

# slippery chicken

Generated with ROBODoc Version 4.99.41 (Jan 14 2012)

January 15, 2014

## **Contents**

## 1 sc/all.lsp

[ Modules ]

**NAME:**

all

File: all.lsp

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Load all the lisp files associated with slippery-chicken  
export of its symbols.  
No public interface envisaged (so no robodoc entries).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 5th December 2000

\$\$ Last modified: 12:38:46 Mon Nov 4 2013 GMT

SVN ID: \$Id: all.lsp 4734 2014-01-15 12:10:40Z medward2 \$

## 2 sc/cm

[ Modules ]

**NAME:**

cm

File: cm.lsp

Class Hierarchy: none (no classes defined)

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Definition of common-music related and other functions  
like transposition of notes/chords, enharmonic  
equivalents etc.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 1st March 2001

\$\$ Last modified: 14:22:20 Sun Dec 29 2013 CIT

SVN ID: \$Id: cm.lsp 4346 2013-12-30 12:46:28Z medward2 \$

## 2.1 cm/degree-to-note

[ *cm* ] [ *Functions* ]

### DESCRIPTION:

Get the specified scale degree number as a note-name pitch symbol within the current scale. An optional argument allows the user to specify that the scale degree number should be used to get the note-name pitch from a different scale.

### ARGUMENTS:

An integer that is a scale degree number.

### OPTIONAL ARGUMENTS:

- The scale from which the note-name pitch symbol associated with the specified scale degree is to be drawn.

### RETURN VALUE:

A note-name pitch symbol.

### EXAMPLE:

```
(degree-to-note 127 'chromatic-scale)
```

```
=> G9
```

```
(degree-to-note 127 'twelfth-tone)
```

```
=> ATS0
```

```
(degree-to-note 127 'quarter-tone)
```

```
=> EQF4
```

**SYNOPSIS:**

```
(defun degree-to-note (degree &optional (scale cm::*scale*))
```

**2.2 cm/degrees-per-octave**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Return the number of scale degrees in the span of one octave within the current tuning system.

**ARGUMENTS:**

- No arguments.

**RETURN VALUE:**

- An integer that is the number of scale degrees in each octave.

**EXAMPLE:**

```
(in-scale :chromatic)
(degrees-per-octave)
```

```
=> 12
```

```
(in-scale :quarter-tone)
(degrees-per-octave)
```

```
=> 24
```

**SYNOPSIS:**

```
(defun degrees-per-octave ())
```

**2.3 cm/degrees-per-semitone**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the number of scale degrees per equal-tempered semitone in the current tuning scale.

**ARGUMENTS:**

- No arguments

**OPTIONAL ARGUMENTS:**

- The scale for which the number of degrees per semitone is to be retrieved.

**RETURN VALUE:**

An integer.

**EXAMPLE:**

```
(degrees-per-semitone 'chromatic-scale)
```

```
=> 1
```

```
(degrees-per-semitone 'twelfth-tone)
```

```
=> 6
```

```
(degrees-per-semitone 'quarter-tone)
```

```
=> 2
```

**SYNOPSIS:**

```
(defun degrees-per-semitone (&optional (scale cm::*scale*))
```

**2.4 cm/degrees-to-notes**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

NB: If the specified scale-degree number within the current scale would result in pitch outside of the maximum MIDI pitch range for that tuning (chromatic: C-1 to B10; quarter-tone: C-1 to BQS10; twelfth-tone: C-1 to CTF11), the function will return an error.

**ARGUMENTS:**

An integer that is a scale degree number in the current tuning.

**RETURN VALUE:**

A list of note-name pitch symbols.

**EXAMPLE:**

```
(in-scale :chromatic)
(degrees-to-notes '(0 143 116 127 38))
```

```
=> (C-1 B10 AF8 G9 D2)
```

```
(in-scale :twelfth-tone)
(degrees-to-notes '(0 144 116 127 38 287 863))
```

```
=> (C-1 C1 GSS0 ATSO FSSS-1 CTF3 CTF11)
```

```
(in-scale :quarter-tone)
(degrees-to-notes '(0 144 116 127 38 287))
```

```
=> (C-1 C5 BF3 EQF4 G0 BQS10)
```

**SYNOPSIS:**

```
(defun degrees-to-notes (degrees)
```

**2.5 cm/freq-to-degree**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the scale degree of the specified frequency in Hertz within the current scale.

NB: This method will return fractional scale degrees.

**ARGUMENTS:**

A frequency in Hertz.

**OPTIONAL ARGUMENTS:**

- The scale in which to find the corresponding scale degree.

**RETURN VALUE:**

A scale degree number. This may be a decimal number.

**EXAMPLE:**

```
(freq-to-degree 423 'chromatic-scale)
```

```
=> 68.317856
```

```
(freq-to-degree 423 'twelfth-tone)
```

```
=> 409.9071
```

```
(freq-to-degree 423 'quarter-tone)
```

```
=> 136.63571
```

**SYNOPSIS:**

```
(defun freq-to-degree (degree &optional (scale cm::*scale*))
```

## 2.6 cm/freq-to-note

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the note-name pitch equivalent of the specified frequency, rounded to the nearest scale degree of the current scale.

**ARGUMENTS:**

A number that is a frequency in Hertz.

**OPTIONAL ARGUMENTS:**

- The scale in which the note-name pitch equivalent is to be sought.

**RETURN VALUE:**

A note-name pitch symbol.

**EXAMPLE:**

```
(freq-to-note 423 'chromatic-scale)
```

```
=> AF4
```

```
(freq-to-note 423 'twelfth-tone)
```

```
=> GSSS4
```

```
(freq-to-note 423 'quarter-tone)
```

```
=> AQF4
```

### SYNOPSIS:

```
(defun freq-to-note (freq &optional (scale cm::*scale*))
```

## 2.7 cm/get-pitch-bend

[ *cm* ] [ *Functions* ]

### DESCRIPTION:

Get the MIDI pitch-bend value necessary for application to a MIDI pitch in order to achieve the specified frequency.

NB: This will always return a positive value between 0.0 and 1.0, as slippery-chicken always applies pitch-bends upwards from the nearest chromatic note below the specified frequency.

NB: This value will be the same in all tuning scales.

### ARGUMENTS:

A frequency in Hertz.

### RETURN VALUE:

A two-digit decimal number that is the pitch-bend value required to achieve the specified frequency in MIDI.

### EXAMPLE:

```
(get-pitch-bend 423)
```

```
=> 0.32
```



**SYNOPSIS:**

```
(defun get-pitch-bend (freq)
```

**2.8 cm/in-scale**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Set the global scale (tuning) for the current slippery-chicken environment. Current options are :chromatic, :quarter-tone or :twelfth-tone. See the file cm-load.lsp for specifications and the html manual page "More about note-names and scales" for more details on use.

**ARGUMENTS:**

- A scale (tuning) designation.

**RETURN VALUE:**

Lisp REPL feedback on the tuning now set.

**EXAMPLE:**

```
(in-scale :chromatic)
```

```
=> #<tuning "chromatic-scale">
```

```
(in-scale :quarter-tone)
```

```
=> #<tuning "quarter-tone">
```

```
(in-scale :twelfth-tone)
```

```
=> #<tuning "twelfth-tone">
```

**SYNOPSIS:**

```
(defun in-scale (scale)
```

**2.9 cm/midi-file-high-low**

[ *cm* ] [ *Functions* ]

**DATE:**

30-Dec-2010

### DESCRIPTION:

Print the highest and lowest pitch in a specified MIDI file as a MIDI note number.

NB: This is a Common Music function and as such must be called with the package qualifier `cm::` if used within `slippery chicken`.

### ARGUMENTS:

- The path (including the name) to the MIDI file.

### OPTIONAL ARGUMENTS:

- An integer or `NIL` to indicate which track in the specified MIDI file is to be accessed. If `NIL`, all tracks will be accessed. NB: `CM` (and therefore `slippery-chicken` too) generates some MIDI files by writing each channel to a different track, so the "track" would seem synonymous with "channel" here.

### RETURN VALUE:

Two integer values (using the `values` function) that are the highest and lowest pitches in the specified MIDI file.

### EXAMPLE:

```
(cm::midi-file-high-low "/tmp/multi-ps.mid")
```

```
=> 72, 60
```

### SYNOPSIS:

```
(defun midi-file-high-low (file &optional track)
```

## 2.10 cm/midi-file-one-note

[ *cm* ] [ *Functions* ]

### DESCRIPTION:

Write all midi notes in the file out to a new one-channel file using the single pitch `<note>` and channel number `<channel>`.

**ARGUMENTS:**

- A string that is the file path, including file-name and extension.
- A note-name symbol or MIDI-note integer that is the pitch to write.
- An integer that is the channel to which the output should be written (1-based)

**OPTIONAL ARGUMENTS:**

- An integer that is the an existing MIDI channel in the original file. If this argument is given, only notes on this channel of the original file will be written (1-based).

**RETURN VALUE:**

The path to the new file.

**EXAMPLE:**

```
(cm::midi-file-one-note "/tmp/multi-ps.mid" 'c4 1)
```

**SYNOPSIS:**

```
(defun midi-file-one-note (file note channel &optional old-channel)
```

**2.11 cm/midi-to-degree**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Convert the specified MIDI note number to the degree number of the current scale.

**ARGUMENTS:**

- A MIDI note number.

**RETURN VALUE:**

- An integer that is the scale-degree equivalent of the specified MIDI note number in the current scale.

**EXAMPLE:**

```
(in-scale :chromatic)
(midi-to-degree 64)
```

```
=> 64
```

```
(in-scale :twelfth-tone)
(midi-to-degree 64)
```

```
=> 384
```

```
(in-scale :quarter-tone)
(midi-to-degree 64)
```

```
=> 128
```

**SYNOPSIS:**

```
(defun midi-to-degree (midi-note)
```

**2.12 cm/midi-to-freq**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the frequency equivalent in Hertz to the specified MIDI note number.

**ARGUMENTS:**

- A number (can be a decimal) that is a MIDI note number.

**RETURN VALUE:**

A decimal number that is a frequency in Hertz.

**EXAMPLE:**

```
(midi-to-freq 67)
```

```
=> 391.99542
```

```
(midi-to-freq 67.9)
```

```
=> 412.91272
```

**SYNOPSIS:**

```
(defun midi-to-freq (midi-note)
```

**2.13 cm/midi-to-note**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the note-name pitch symbol equivalent of the specified MIDI note number.

**ARGUMENTS:**

- An integer that is a MIDI note number.

**RETURN VALUE:**

A note-name pitch symbol.

**EXAMPLE:**

```
(midi-to-note 67)
```

```
=> G4
```

**SYNOPSIS:**

```
(defun midi-to-note (midi-note)
```

**2.14 cm/note-to-degree**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the scale degree number of the specified note-name pitch symbol within the current scale.

**ARGUMENTS:**

- A note-name pitch symbol.

**OPTIONAL ARGUMENTS:**

- The scale in which to find the scale-degree of the specified pitch.

**RETURN VALUE:**

An integer that is a scale degree in the current scale.

**EXAMPLE:**

```
(note-to-degree 'AF4 'chromatic-scale)
```

```
=> 68
```

```
(note-to-degree 'AF4 'twelfth-tone)
```

```
=> 408
```

```
(note-to-degree 'AF4 'quarter-tone)
```

```
=> 136
```

**SYNOPSIS:**

```
(defun note-to-degree (note &optional (scale cm::*scale*))
```

**2.15 cm/note-to-freq**

[ *cm* ] [ *Functions* ]

**DESCRIPTION:**

Get the frequency in Hertz of the specified note-name pitch symbol.

**ARGUMENTS:**

- A note-name pitch symbol.

**RETURN VALUE:**

A frequency in Hertz.

**EXAMPLE:**

```
(in-scale :chromatic)
(note-to-freq 'AF4)
```

```
=> 415.3047
```

```
(in-scale :twelfth-tone)
(note-to-freq 'GSSS4)
```

```
=> 423.37845
```

```
(in-scale :quarter-tone)
(note-to-freq 'AQF4)
```

```
=> 427.47403
```

#### SYNOPSIS:

```
(defun note-to-freq (note)
```

### 2.16 cm/note-to-midi

[ *cm* ] [ *Functions* ]

#### DESCRIPTION:

Get the MIDI note number equivalent for a chromatic note-name pitch symbol.

#### ARGUMENTS:

- A chromatic note-name pitch symbol.

#### RETURN VALUE:

An integer.

#### EXAMPLE:

```
(note-to-midi 'g4)
```

```
=> 67
```

#### SYNOPSIS:

```
(defun note-to-midi (midi-note)
```

## 2.17 cm/parse-midi-file

[ cm ] [ Functions ]

### DESCRIPTION:

Print the MIDI event slots in the specified file to the Lisp listener.

NB: This is a Common Music function and as such must be called with the package qualifier `cm::` if used within `slippery chicken`.

### ARGUMENTS:

- The path (including the file name) to the MIDI file.

### OPTIONAL ARGUMENTS:

- An integer or NIL to indicate which track in the specified MIDI file is to be accessed. If NIL, all tracks will be accessed. NB: CM (and therefore `slippery-chicken` too) generates some MIDI files by writing each channel to a different track, so the "track" would seem synonymous with "channel" here.

### RETURN VALUE:

The CM data for the MIDI events in the specified file, and the number of events.

### EXAMPLE:

```
(cm::parse-midi-file "/tmp/multi-ps.mid")
```

```
=>
```

```
(#i(midi-tempo-change time 0.0 usecs 357142)
 #i(midi-time-signature time 0.0 numerator 2 denominator 4 clocks 24 32nds 8)
 #i(midi time 0.0 keynum 36 duration 0.357142 amplitude 0.09448819 channel 15)
 #i(midi-tempo-change time 0.0 usecs 357142)
 #i(midi-time-signature time 0.0 numerator 2 denominator 4 clocks 24 32nds 8)
 #i(midi-tempo-change time 0.0 usecs 357142)
 #i(midi time 0.178571 keynum 66 duration 0.178571 amplitude 0.09448819 channel 15)
 #i(midi time 0.357142 keynum 68 duration 0.0892855 amplitude 0.09448819 channel 15)
 #i(midi time 0.357142 keynum 40 duration 0.357142 amplitude 0.09448819 channel 15)
 #i(midi time 0.6249985 keynum 66 duration 0.0892855 amplitude 0.09448819 channel 15)
 #i(midi-time-signature time 0.714284 numerator 3 denominator 4 clocks 24 32nds 8))
```

### SYNOPSIS:

```
(defun parse-midi-file (file &optional track)
```



### 3 sc/cm-load

[ Modules ]

**NAME:**

cm-load

File: cm-load.lsp

Class Hierarchy: none (no classes defined)

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Definition of the common-music quarter-tone scale and twelfth-tone scale which should be loaded and not compiled. The quarter tone scale is our default No public interface envisaged (so no robodoc entries).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 7th February 2003

\$\$ Last modified: 21:11:47 Thu Aug 22 2013 BST

SVN ID: \$Id: cm-load.lsp 4168 2013-08-22 20:37:07Z medward2 \$

### 4 sc/cmn

[ Modules ]

**NAME:**

cmn

File: cmn.lsp

Class Hierarchy: None: no classes defined.

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Interface from complete-set to Bill's CMN package for displaying of sets in musical notation.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 11th February 2002

\$\$ Last modified: 11:39:48 Sat Dec 28 2013 WIT

SVN ID: \$Id: cmn.lsp 4345 2013-12-28 13:11:39Z medward2 \$

## 5 sc/cmn-glyphs

[ Modules ]

**NAME:**

cmn-glyphs

File: cmn-glyphs.lsp

Class Hierarchy: none, no classes defined

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Definition of various postscript glyphs (accidentals etc.) for cmn.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 10th November 2002

\$\$ Last modified: 09:01:19 Mon Dec 12 2011 ICT

SVN ID: \$Id: cmn-glyphs.lsp 4223 2013-10-29 10:57:09Z medward2 \$

## 6 sc/globals.lsp

[ Modules ]

**NAME:**

globals

File: globals.lsp

Class Hierarchy: None: no classes defined.

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Definition of the user-changeable configuration data and  
globals for internal programme use.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 30th May 2013

\$\$ Last modified: 16:04:44 Thu Nov 14 2013 GMT

SVN ID: \$Id: sclist.lsp 963 2010-04-08 20:58:32Z medward2 \$

## 7 sc/instruments

[ Modules ]

NAME:

instrument

File: instruments.lsp

Class Hierarchy: none (no classes defined)

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Definition of various standard instruments and other  
data/functions useful to slippery-chicken users.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 30th December 2010

\$\$ Last modified: 18:27:02 Fri Dec 27 2013 WIT

SVN ID: \$Id: instruments.lsp 4345 2013-12-28 13:11:39Z medward2 \$

## 7.1 instruments/+slippery-chicken-standard-instrument-palette+

[ *instruments* ] [ *Global Parameters* ]

### DESCRIPTION:

A palette of standard instruments (by no means exhaustive...) for use directly in projects or for combining with user palettes e.g.

```
(combine
+slippery-chicken-standard-instrument-palette+
(make-instrument-palette
'esoteric-stuff
'((toy-piano
(:staff-name "toy piano" ....
```

### SYNOPSIS:

```
(defparameter +slippery-chicken-standard-instrument-palette+
(make-instrument-palette
'slippery-chicken-standard-instrument-palette
;; SAR Fri Jan 20 11:43:32 GMT 2012: Re-ordering these to Adler's "standard"
;; score order for easier look-up
'((piccolo
(:staff-name "piccolo" :staff-short-name "picc"
:lowest-written d4 :highest-written c7 :transposition-semitones 12
:missing-notes nil
:largest-fast-leap 19
:starting-clef treble
:chords nil
:microtones t
:midi-program 73))
(flute
(:staff-name "flute" :staff-short-name "fl"
:lowest-written c4 :highest-written d7
:missing-notes (cqs4 dqf4)
:largest-fast-leap 19
:starting-clef treble
:chords nil
:microtones t
:midi-program 74))
(alto-flute
```

```

(:staff-name "alto flute" :staff-short-name "alt fl"
 :lowest-written c4 :highest-written c7 :transposition-semitones -5
 :missing-notes (cqs4 dqf4)
 :largest-fast-leap 17
 :starting-clef treble
 :chords nil
 :microtones t
 :midi-program 74))
;; SAR Fri Jan 20 11:46:45 GMT 2012: Modified bass flute range to that
;; stated by Adler.
(bass-flute
 (:staff-name "bass flute" :staff-short-name "bass fl"
 :lowest-written c4 :highest-written c7 :transposition-semitones -12
 :missing-notes (cqs4 dqf4)
 :largest-fast-leap 15
 :clefs-in-c (treble bass) :starting-clef treble
 :chords nil
 :microtones t
 :midi-program 74))
;; SAR Fri Jan 20 12:01:37 GMT 2012: Added oboe. Conservative range taken
;; from the Adler
(oboe
 (:staff-name "oboe" :staff-short-name "ob"
 :lowest-written bf3 :highest-written a6
 :largest-fast-leap 19
 :starting-clef treble
 :chords nil
 :midi-program 69))
(e-flat-clarinet
 (:staff-name "E-flat clarinet" :staff-short-name "E-flat cl"
 :lowest-written e3 :highest-written a6 :transposition-semitones 3
 :missing-notes (aqs4 bqf4 bqs4 cqs5 dqf5 gqf3 fqs3 fqf3)
 :largest-fast-leap 15
 :starting-clef treble
 :chords nil
 :microtones t
 :midi-program 72))
(b-flat-clarinet
 (:staff-name "B-flat clarinet" :staff-short-name "B-flat cl"
 :lowest-written e3 :highest-written a6 :transposition-semitones -2
 :missing-notes (aqs4 bqf4 bqs4 cqs5 dqf5 gqf3 fqs3 fqf3)
 :largest-fast-leap 15
 :starting-clef treble
 :chords nil
 :microtones t
 :midi-program 72))

```

```

(a-clarinet
  (:staff-name "A clarinet" :staff-short-name "A cl"
    :lowest-written e3 :highest-written a6 :transposition-semitones -3
    :missing-notes (aqs4 bqf4 bqs4 cqs5 dqf5 gqf3 fqs3 fqf3)
    :largest-fast-leap 15
    :starting-clef treble
    :chords nil
    :microtones t
    :midi-program 72))
(bass-clarinet
  (:staff-name "bass clarinet" :staff-short-name "bass cl"
    :lowest-written c3 :highest-written g6 :transposition-semitones -14
    :missing-notes (aqs4 bqf4 bqs4 cqs5 dqf5 gqf3 fqs3 fqf3 eqf3 dqs3 dqf3
      cqs3)
    :largest-fast-leap 13
    :prefers-notes low
    :clefs (treble) :clefs-in-c (treble bass) :starting-clef treble
    :chords nil
    :microtones t
    :midi-program 72))
(soprano-sax
  (:staff-name "soprano saxophone" :staff-short-name "sop sax"
    :lowest-written bf3 :highest-written fs6 :transposition-semitones -2
    :missing-notes (gqs4 gqs5)
    :largest-fast-leap 15
    :starting-clef treble
    :chords nil
    :microtones t
    :midi-program 65))
(alto-sax
  (:staff-name "alto saxophone" :staff-short-name "alt sax"
    ;; altissimo extra...by hand...
    :lowest-written bf3 :highest-written fs6 :transposition-semitones -9
    :missing-notes (gqs4 gqs5)
    :largest-fast-leap 15
    :starting-clef treble
    :chords nil
    :microtones t
    :midi-program 66))
(tenor-sax
  (:staff-name "tenor sax" :staff-short-name "ten sax"
    :lowest-written bf3 :highest-written fs6 :transposition-semitones -14
    :missing-notes (gqs4 gqs5)
    :largest-fast-leap 13
    :starting-clef treble :clefs-in-c (treble bass)
    :chords nil

```

```

      :microtones t
      :midi-program 67))
(baritone-sax
 (:staff-name "baritone sax" :staff-short-name "bar sax"
  :lowest-written bf3 :highest-written fs6 :transposition-semitones -21
  :missing-notes (gqs4 gqs5)
  :largest-fast-leap 11
  :clefs-in-c (treble bass) :starting-clef treble
  :chords nil
  :microtones t
  :midi-program 68))
(bassoon
 (:staff-name "bassoon" :staff-short-name "bsn"
  ;; of course it can go higher but best not to algorithmically select
  ;; these
  :lowest-written bf1 :highest-written c5
  ;; Wolfgang Ruediger says all 1/4 tones are OK above low E
  :missing-notes (bqf1 bqs1 cqs2 dqf2 dqs2 eqf2)
  :largest-fast-leap 13
  :clefs (bass tenor) :starting-clef bass
  :chords nil
  :microtones t
  :midi-program 71))
(french-horn
 (:staff-name "french horn" :staff-short-name "hn"
  :lowest-written c3 :highest-written c6 :transposition-semitones -7
  :largest-fast-leap 9
  :clefs (treble bass) :starting-clef treble
  :chords nil
  :microtones t
  :midi-program 61))
(c-trumpet
 (:staff-name "trumpet in c" :staff-short-name "c tpt"
  :lowest-written fs3 :highest-written c6
  :largest-fast-leap 9
  :clefs (treble) :starting-clef treble
  :chords nil
  :microtones t
  :midi-program 57))
;; SAR Fri Jan 20 12:09:41 GMT 2012: Added b-flat-trumpet from Adler
;; MDE Mon Feb 20 20:02:55 2012 -- modified to keep in line with clarinet
(b-flat-trumpet
 (:staff-name "B-flat trumpet" :staff-short-name "b-flat tpt"
  ;; the -flat should be converted in CMN and LilyPond to the flat sign
  :lowest-written fs3 :highest-written d6 :transposition-semitones -2
  :largest-fast-leap 9

```

```

      :starting-clef treble
      :chords nil
      :midi-program 57))
;; SAR Fri Jan 20 12:17:24 GMT 2012: Added tenor trombone from Adler
(tenor-trombone
 (:staff-name "trombone" :staff-short-name "tbn"
  :lowest-written e2 :highest-written bf4
  :largest-fast-leap 7
  :clefs (bass tenor) :starting-clef bass
  :chords nil
  :midi-program 58))
;;; SAR Fri Jul 13 12:35:35 BST 2012
(tuba
 (:staff-name "tuba" :staff-short-name "tba"
  :lowest-written d1 :highest-written g4
  :largest-fast-leap 5
  :clefs (bass) :starting-clef bass
  :chords nil
  :midi-program 59))
(marimba
 (:staff-name "marimba" :staff-short-name "mba"
  :lowest-written c3 :highest-written c7
  :starting-clef treble :clefs (treble) ; (treble bass)
  :chords t
  :microtones nil
  :midi-program 13))
(vibraphone
 (:staff-name "vibraphone" :staff-short-name "vib"
  :lowest-written f3 :highest-written f6
  :starting-clef treble
  :chords t
  :microtones nil
  :midi-program 12))
(piano
 (:staff-name "piano" :staff-short-name "pno"
  :lowest-written a0 :highest-written c8
  :largest-fast-leap 9
  :clefs (treble bass double-treble double-bass) :starting-clef treble
  :chords t :chord-function piano-chord-fun
  :microtones nil
  :midi-program 1))
;; We generally treat the piano as two instruments (LH, RH), generating
;; lines separately. So this is the same as the piano instrument but has
;; no staff-name and starts with bass clef. Use set-limits to change the
;; range of the two hands, as they're both set to be full piano range
;; here.

```



```

(piano-lh
  (:lowest-written a0 :highest-written c8
    ;; MDE Tue Aug 21 17:47:07 2012 -- to avoid the NIL ins name in CMN
    :staff-name "" :staff-short-name ""
    :largest-fast-leap 9
    :chords t :chord-function piano-chord-fun
    :clefs (treble bass double-treble double-bass) :starting-clef bass
    :microtones nil
    :midi-program 1))
(tambourine
  (:staff-name "tambourine" :staff-short-name "tmb"
    :lowest-written c4 :highest-written c4
    :starting-clef percussion
    :midi-program 1))
(guitar
  (:staff-name "guitar" :staff-short-name "gtr"
    :lowest-written e3 :highest-written b6 :transposition-semitones -12
    :largest-fast-leap 31
    :starting-clef treble
    :chords t :chord-function guitar-chord-selection-fun
    :microtones nil
    :midi-program 25))
;; MDE Wed Oct 9 12:21:22 2013
(mandolin
  (:staff-name "mandolin" :staff-short-name "mln"
    :lowest-written g3 :highest-written c7
    :largest-fast-leap 25
    :starting-clef treble
    ;; mandolin has same tuning as the violin
    :chords t :chord-function violin-chord-selection-fun
    ;; there is no GM programme for mandolin so use either steel string
    ;; guitar (26) or banjo 106 perhaps
    :microtones nil :midi-program 26))
(soprano
  (:staff-name "soprano" :staff-short-name "s"
    :lowest-written c4 :highest-written c6
    :starting-clef treble
    :midi-program 54))
(violin
  (:staff-name "violin" :staff-short-name "vln"
    :lowest-written g3 :highest-written c7
    :largest-fast-leap 13
    :starting-clef treble
    :chords t :chord-function violin-chord-selection-fun
    :microtones t
    :midi-program 41))

```

```

(viola
  (:staff-name "viola" :staff-short-name "vla"
    :lowest-written c3 :highest-written f6
    :largest-fast-leap 13
    :clefs (alto treble) :starting-clef alto
    :chords t :chord-function viola-chord-selection-fun
    :microtones t
    :midi-program 42))
(viola-d-amore
  (:staff-name "viola d'amore" :staff-short-name "vla d'am"
    :lowest-written a2 :highest-written f7
    :largest-fast-leap 13
    :clefs (alto treble) :starting-clef alto
    :chords t :chord-function nil
    :microtones t
    :midi-program 41))
(cello
  (:staff-name "cello" :staff-short-name "vc"
    ;; of course it can go higher but best not to algorithmically select
    ;; these
    :lowest-written c2 :highest-written a5
    :largest-fast-leap 12
    :clefs (bass tenor treble) :starting-clef bass
    :chords t :chord-function cello-chord-selection-fun
    :microtones t
    :midi-program 43))
(double-bass
  (:staff-name "double bass" :staff-short-name "db"
    :lowest-written e2 :highest-written g5 :transposition-semitones -12
    :prefers-notes low
    :largest-fast-leap 10
    :clefs (bass tenor treble) :starting-clef bass
    :chords nil
    :microtones t
    :midi-program 44))
(bass-guitar
  (:staff-name "bass guitar" :staff-short-name "b. gtr"
    :lowest-written e2 :highest-written g4 :transposition-semitones -12
    :prefers-notes low
    :largest-fast-leap 10
    :clefs (bass treble) :starting-clef bass
    :chords t
    :microtones nil
    :midi-program 33))
;; SAR Thu Apr 12 18:19:21 BST 2012: Added "computer" part for "silent"
;; parts in case the user would like to create rhythmically independent

```

```
;; computer parts.
;; MDE Jul 2012 -- changed to reflect more clefs (and removed percussion)
(computer
  (:staff-name "computer" :staff-short-name "comp"
    :lowest-sounding C-1 :highest-sounding bf8
    :clefs (treble bass double-treble double-bass)
    :starting-clef treble))))
```

## 7.2 instruments/cello-chord-selection-fun

[ *instruments* ] [ *Functions* ]

### DESCRIPTION:

Create a double-stop chord object using the core string-chord-selection-fun and a value of 'G2 for the open III string.

### SYNOPSIS:

```
(let ((vc-III (make-pitch 'g2)))
  (defun cello-chord-selection-fun (curve-num index pitch-list pitch-seq
                                   instrument set)
```

## 7.3 instruments/chord-fun-aux

[ *instruments* ] [ *Functions* ]

### DESCRIPTION:

An auxiliary function that allows users to create moderately tailored chord functions by setting values for the number of notes in the current set to skip, the number of desired notes in the resulting chord, and the maximum span of the resulting chord in semitones.

This function must be called within a call to the defun macro to create a new chord function, as demonstrated below.

### ARGUMENTS:

The first six arguments -- curve-num, index, pitch-list, pitch-seq, instrument, and set -- are inherited and not required to be directly accessed by the user.

- An integer that is the step by which the function skips through the subset of currently available pitches. A value of 2, for example, will

instruct the method to build chords from every second pitch in that subset.

- An integer that is the number of pitches that should be in each resulting chord. If the list of pitches available to an instrument is too short to make a chord with x notes, a chord with fewer pitches may be made instead.
- An integer that is the largest interval in semitones allowed between the bottom and top notes of the chord. If a chord made with the specified number of notes surpasses this span, a chord with fewer pitches may be made instead.

#### EXAMPLE:

```
(defun new-chord-function (curve-num index pitch-list pitch-seq instrument set)
  (chord-fun-aux curve-num index pitch-list pitch-seq instrument set 4 3 14))
```

=> NEW-CHORD-FUNCTION

#### SYNOPSIS:

```
(defun chord-fun-aux (curve-num index pitch-list pitch-seq instrument set
  skip num-notes max-span)
```

### 7.4 instruments/chord-fun1

[ *instruments* ] [ *Functions* ]

#### DESCRIPTION:

Generate three-note chords where possible, using every second pitch from the list of pitches currently available to the given instrument from the current set, and ensuring that none of the chords it makes span more than an octave.

#### SYNOPSIS:

```
(defun chord-fun1 (curve-num index pitch-list pitch-seq instrument set)
```

### 7.5 instruments/chord-fun2

[ *instruments* ] [ *Functions* ]

#### DESCRIPTION:

Generates 4-note chords where possible, using every third pitch from the list of pitches currently available to the given instrument from the current set, with (almost) no limit on the total span of the chord.

#### SYNOPSIS:

```
(defun chord-fun2 (curve-num index pitch-list pitch-seq instrument set)
```

### 7.6 instruments/guitar-chord-selection-fun

[ *instruments* ] [ *Functions* ]

#### DESCRIPTION:

Create chord objects with differing numbers of pitches, drawing the pitches from set-palette object subsets with the ID 'guitar.

This function was written for the composition "Cheat Sheet", in which the pitch sets were defined explicitly such that all of the pitches available to the guitar at any moment were playable as a guitar chord. As such, this function always assumes that the pitch-list it is drawing from contains pitches that are already playable as a guitar chord. It also adds the fingering as mark above each chord when outputting to CMN, which may or may not be desirable.

#### SYNOPSIS:

```
(let ((last-chord '()))
  (defun guitar-chord-selection-fun (curve-num index pitch-list pitch-seq
                                     instrument set)
```

### 7.7 instruments/natural-harmonic

[ *instruments* ] [ *Functions* ]

#### DATE:

December 24th 2013

#### DESCRIPTION:

Determine whether a pitch can be played as a natural harmonic on a string instrument (with the guitar as default).

#### ARGUMENTS:

- the pitch (symbol or pitch object)

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :tuning. a list of the fundamentals of the open strings, as pitch objects or symbols. These should descend from the highest string. Default: guitar tuning.
- :highest-partial. Integer. What we consider the highest harmonic possible (counting the fundamental as 1).
- :tolerance. The deviation in cents that we can accept for the frequency comparison. Default = 10.
- :debug. Print data for debugging/testing purposes. Default = NIL.

**RETURN VALUE:**

The string number and partial number as a list if possible as a harmonic, or NIL if not.

**EXAMPLE:**

```
(NATURAL-HARMONIC 'b5) ; octave harmonic of B string
=> (2 2)
SC> (NATURAL-HARMONIC 'b6) ; octave + 5th of high E string
=> (1 3)
```

**SYNOPSIS:**

```
(defun natural-harmonic (pitch &key (tuning '(e5 b4 g4 d4 a3 e3))
                        (highest-partial 6) (tolerance 15) debug)
```

**7.8 instruments/piano-chord-fun**

[ *instruments* ] [ *Functions* ]

**DESCRIPTION:**

Generate four-note chords, where possible, from consecutive notes in the current set, with the number enclosed in parentheses in the pitch-seq being the top note of that chord, where possible.

**SYNOPSIS:**

```
(defun piano-chord-fun (curve-num index pitch-list pitch-seq instrument set)
```

## 7.9 instruments/string-chord-selection-fun

[ *instruments* ] [ *Functions* ]

### DESCRIPTION:

This is the core function for creating instances of double-stop chords for strings, ensuring that the highest note of the double-stop is not lower than the open III string. The pitch of the open III string is passed as an argument in the chord-selection functions for the individual stringed instruments.

This function uses the best-string-diad function. If no double-stops instances can be created using best-string-diad, two-note chords will be created using the default-chord-function. If neither of these are possible, a chord of a single pitch will be returned instead.

### SYNOPSIS:

```
(defun string-chord-selection-fun (curve-num index pitch-list pitch-seq
                                  instrument set string-III)
```

## 7.10 instruments/viola-chord-selection-fun

[ *instruments* ] [ *Functions* ]

### DESCRIPTION:

Create a double-stop chord object using the core string-chord-selection-fun and a value of 'G3 for the open III string.

### SYNOPSIS:

```
(let ((vla-III (make-pitch 'g3)))
  (defun viola-chord-selection-fun (curve-num index pitch-list pitch-seq
                                    instrument set)
```

## 7.11 instruments/violin-chord-selection-fun

[ *instruments* ] [ *Functions* ]

### DESCRIPTION:

Create a double-stop chord object using the core string-chord-selection-fun and a value of 'D4 for the open III string.

**SYNOPSIS:**

```
(let ((vln-III (make-pitch 'd4)))
  (defun violin-chord-selection-fun (curve-num index pitch-list pitch-seq
                                     instrument set)
```

## 8 sc/lilypond

[ Modules ]

### 8.1 lilypond/lp-get-mark

[ lilypond ] [ Functions ]

**DESCRIPTION:**

lp-get-mark:

Translation function for LilyPond marks (dynamics, accents, etc.). Not generally called by the user but the list of symbols that can be used will be useful. If <silent> then non-existing marks will not produce warnings/errors (but we'll return nil).

**SYNOPSIS:**

```
(a "-> " ; accent
(lhp "--+ "
;; see p229 of lilypond.pdf: need to define this command in file
;; this is done for us in lilypond.ly, which will be included if we
;; call write-lp-data-for-all with :use-custom-markup T
(bartok "^\\snapPizzicato ")
(pizz "^\\pizz\\.\" ")
(ord "^\\ord\\.\" ")
(pizzp "^\\(pizz.)\\.\" ")
(clb "^\\clb\\.\" ")
(cl "^\\cl\\.\" ")
(col-legno "^\\col legno\\.\" ")
(clt "^\\clt\\.\" ")
(arco "^\\arco\\.\" ")
(batt "^\\batt\\.\" ")
(spe "^\\spe\\.\" ")
(sp "^\\sul pont\\.\" ")
(mv "^\\molto vib\\.\" ")
(sv "^\\senza vib\\.\" ")
(poco-crini "^\\poco crini\\.\" ")
```



```

(s "-. ")
(nail (no-lp-mark 'nail))
(stopped (no-lp-mark 'stopped))
(as "->-. ")
(at "->-- ")
(ts "-_ ")
(te "-- ")
;; so unmeasured is implicit
(t3 (format nil "~a " (* 32 (expt 2 num-flags))))
(flag "\\flageolet ")
(niente "^\\markup { niente } ")
(pppp "\\pppp ")
(ppp "\\ppp ")
(pp "\\pp ")
(p "\\p ")
(mp "\\mp ")
(mf "\\mf ")
(f "\\f ")
(ff "\\ff ")
(fff "\\fff ")
(ffff "\\ffff ")
;; MDE Sat Aug 11 15:51:16 2012 -- dynamics in parentheses
(ffff-p "\\parenFFFF ")
(fff-p "\\parenFFF ")
(ff-p "\\parenFF ")
(f-p "\\parenF ")
(mf-p "\\parenMF ")
(mp-p "\\parenMP ")
(p-p "\\parenP ")
(pp-p "\\parenPP ")
(ppp-p "\\parenPPP ")
(pppp-p "\\parenPPPP ")
(sfz "\\sfz ")
(downbow "\\downbow ")
(upbow "\\upbow ")
(open "\\open ")
(I "^\\markup { \\teeny \\\"I\\\" } ")
(II "^\\markup { \\teeny \\\"II\\\" } ")
(III "^\\markup { \\teeny \\\"III\\\" } ")
(IV "^\\markup { \\teeny \\\"IV\\\" } ")
;; MDE Thu Dec 26 14:14:34 2013 -- guitar string numbers
(c1 "\\1 ")
(c2 "\\2 ")
(c3 "\\3 ")
(c4 "\\4 ")
(c5 "\\5 ")

```

```

(c6 "\\6 ")
(beg-sl "( ")
(end-sl ") ")
;; MDE Fri Apr 6 21:57:59 2012 -- apparently LP can't have nested
;; slurs but it does have phrase marks:
(beg-phrase "\\( ")
(end-phrase "\\) ")
;; there's no start gliss / end gliss in lilypond
(beg-gliss "\\glissando ")
(end-gliss "")
;; 13.4.11
(beg-8va "\\ottava #1 ")
(end-8va "\\ottava #0 ")
(beg-8vb "\\ottava #-1 ")
(end-8vb "\\ottava #0 ")
;; NB note heads should be added via (add-mark-before ... so if
;; adding new, add the mark symbol to the move-elements call in
;; event::get-lp-data
(circled-x "\\once \\override NoteHead #'style = #'xcircle ")
;; (x-head "\\once \\override NoteHead #'style = #'cross ")
(x-head " \\xNote ")
(triangle "\\once \\override NoteHead #'style = #'triangle ")
(triangle-up "\\once \\override NoteHead #'style = #'do ")
(airy-head (no-lp-mark 'airy-head))
;; this has to be added to the event _before_ the one which needs to
;; start with these noteheads.
(improvOn "\\improvisationOn ")
(improvOff "\\improvisationOff ")
;; MDE Sat Nov 9 20:21:19 2013 -- in CMN it's :breath-in: a
;; triangle on its side (pointing left)
(wedge "\\once \\override NoteHead #'style = #'fa ")
(square "\\once \\override NoteHead #'style = #'la ")
;; (mensural "\\once \\override NoteHead #'style = #'slash ")
;; (flag-head "\\once \\override NoteHead #'style = #'harmonic-mixed
;;")
;; MDE Mon Apr 30 20:46:06 2012 -- see event::get-lp-data for how
;; this is handled
(flag-head "\\harmonic ")
;; MDE Mon Apr 30 20:46:31 2012 -- flag-heads by default don't
;; display dots so we need to add-mark-before to get these to
;; display or turn them off again
(flag-dots-on "\\set harmonicDots = ##t ")
(flag-dots-off "\\set harmonicDots = ##f ")
;; circle head but stem extends through it like a vertical slash
(none (no-lp-mark 'none))
(trill-f (no-lp-mark 'trill-f))

```

```

(trill-n (no-lp-mark 'trill-n))
(trill-s (no-lp-mark 'trill-s))
(beg-trill-a "\\pitchedTrill ") ; must be before note
;; we'll also need e.g. (trill-note g5) to give the note in ()
(end-trill-a "\\stopTrillSpan ") ; after note
;; (no-lp-mark 'square))
(slash (no-lp-mark 'slash))
;; MDE Sat Dec 28 11:37:22 2013 -- up and down arrows on arpeggio
;; lines will need more complex treatment (need a note-before mark
;; :/ )
(arp "\\arpeggio ")
(arrow-up (no-lp-mark 'arrow-up))
(arrow-down (no-lp-mark 'arrow-down))
(cresc-beg "\\< ")
(cresc-end "\\! ")
(dim-beg "\\> ")
(dim-end "\\! ")
(<< "<< ")
(>> ">> ")
;; NB this override has to come exactly before the note/dynamic it
;; applies to
(hairpin0 "\\once \\override Hairpin #'circled-tip = ##t ")
;; (dim0-beg "\\once \\override Hairpin #'circled-tip = ##t \\> ")
(pause "\\fermata ")
(short-pause
  "\\markup { \\musicglyph #\"scripts.ushortfermata\" } ")
;; MDE Thu Apr 5 16:17:11 2012 -- these need the graphics files in
;; lilypond-graphics.zip to be in the same directory as the
;; generated lilypond files
(aeolian-light "\\aeolianLight ")
(aeolian-dark "\\aeolianDark ")
;; this one uses the graphic for close bracket
(bracket-end "\\bracketEnd ")
(mphonic "\\mphonic ")
(mphonic-arr "\\mphonicArr ")
(mphonic-cons "\\mphonicCons ")
(mphonic-diss "\\mphonicDiss ")
(mphonic-cluster "\\mphonicCluster ")
(sing "\\sing ")
(high-sine "\\high-sine ")
(noise "\\noise ")
(sing-arr "\\singArr ")
(arrow-up-down "\\arrowUpDown ")
;;; end lilypond-graphics.zip files
;; these must have been set up with the event::add-arrow method
(start-arrow "\\startTextSpan ")

```

```

(end-arrow "\\stopTextSpan ")
(harm "^\\flageolet ")
;; 2.3.11
;; write sost. pedal as text (usually held for long time so brackets
;; not a good idea)
(ped "\\sustainOn ")
(ped^ "\\sustainOff\\sustainOn ")
(ped-up "\\sustainOff ")
(uc "\\unaCorda ")
(tc "\\treCorde ")

```

## 9 sc/package

[ Modules ]

## 10 sc/permutations

[ Modules ]

**NAME:**

permutations

File: permutations.lsp

Class Hierarchy: none, no classes defined.

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Various permutation functions.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 10th November 2002

\$\$ Last modified: 12:15:10 Sat Nov 16 2013 GMT

SVN ID: \$Id: permutations.lsp 4264 2013-11-16 12:26:43Z medward2 \$

## 10.1 permutations/permutations

[ *permutations* ] [ *Functions* ]

### DESCRIPTION:

Systematically produce a list of all possible permutations of a set of consecutive integers beginning with zero. The function's only argument, <level>, is an integer that determines how many consecutive integers from 0 are to be used for the process.

This is a more efficient permutation algorithm, but the results will always be in a certain order, with the same number at the end until that permutation is exhausted, then the number below that etc.

### ARGUMENTS:

An integer that indicates how many consecutive integers from 0 are to be used for the process.

### RETURN VALUE:

A list of sequences (lists), each of which is a permutation of the original.

### EXAMPLE:

```
;; Produce a list consisting of all permutations that can be made of 4
;; consecutive integers starting with 0 (i.e., (0 1 2 3))
(permutations 4)
```

=>

```
((0 1 2 3) (1 0 2 3) (0 2 1 3) (2 0 1 3) (1 2 0 3) (2 1 0 3) (0 1 3 2)
 (1 0 3 2) (0 3 1 2) (3 0 1 2) (1 3 0 2) (3 1 0 2) (0 2 3 1) (2 0 3 1)
 (0 3 2 1) (3 0 2 1) (2 3 0 1) (3 2 0 1) (1 2 3 0) (2 1 3 0) (1 3 2 0)
 (3 1 2 0) (2 3 1 0) (3 2 1 0))
```

### SYNOPSIS:

```
(defun permutations (level)
```

#### 10.1.1 permutations/inefficient-permutations

[ *permutations* ] [ *Functions* ]

### DESCRIPTION:

Return a shuffled, non-systematic list of all possible permutations of a set of consecutive integers beginning with zero.

The function's first argument, `<level>`, is an integer that determines how many consecutive integers from 0 are to be used for the process. An optional keyword argument `<max>` allows the user to specify the maximum number of permutations to return.

This function differs from the "permutations" function in that its result is not ordered systematically.

The function simply returns a list of `<max>` permutations of the numbers less than `<level>`; it does not permute a given list.

The function is inefficient in so far as it simply shuffles the numbers and so always has to check whether the new list already contains the shuffled before storing it.

The order of the permutations returned will always be the same unless `<fix>` is set to `NIL`.

Keyword argument `<skip>` allows the user to skip a number of permutations, which is only sensible if `:fix` is set to `T`.

#### ARGUMENTS:

An integer that indicates how many consecutive integers from 0 are to be used for the process.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- `:max`. An integer that indicates the maximum number of permutations to be returned.
- `:skip`. An integer that indicates a number of permutations to skip.
- `:fix`. `T` or `NIL` to indicate whether the given sequence should always be shuffled with the same (fixed) random seed (thus always producing the same result). `T` = fixed seed. Default = `T`.
- `:if-not-enough`. A function object (or `NIL`) to call when `:max` was requested but we can't return that many results. Default = `#'error`.

#### RETURN VALUE:

A list.

#### EXAMPLE:

```
;; Creating a shuffled, non-systematic list of all permutations of consecutive
;; integers 0 to 4
(inefficient-permutations 4)

=> ((2 3 0 1) (3 1 2 0) (2 0 3 1) (1 0 2 3) (1 2 3 0) (0 2 3 1) (2 1 0 3)
    (0 1 2 3) (2 3 1 0) (1 2 0 3) (3 0 1 2) (3 1 0 2) (1 3 2 0) (1 0 3 2)
    (2 0 1 3) (3 2 1 0) (2 1 3 0) (3 2 0 1) (1 3 0 2) (0 2 1 3) (3 0 2 1)
    (0 1 3 2) (0 3 2 1) (0 3 1 2))

;; Using 0 to 4 again, but limiting the number of results returned to a maximum
;; of 7
(inefficient-permutations 4 :max 7)

=> ((2 3 0 1) (3 1 2 0) (2 0 3 1) (1 0 2 3) (1 2 3 0) (0 2 3 1) (2 1 0 3))

;; The same call will return the same "random" results each time by default
(loop repeat 4 do (print (inefficient-permutations 3 :max 5)))

=>
((2 0 1) (2 1 0) (0 2 1) (1 0 2) (1 2 0))
((2 0 1) (2 1 0) (0 2 1) (1 0 2) (1 2 0))
((2 0 1) (2 1 0) (0 2 1) (1 0 2) (1 2 0))
((2 0 1) (2 1 0) (0 2 1) (1 0 2) (1 2 0))

;; Setting the :fix argument to NIL will result in different returns
(loop repeat 4 do (print (inefficient-permutations 3 :max 5 :fix nil)))

=>
((1 0 2) (0 1 2) (1 2 0) (2 1 0) (0 2 1))
((1 2 0) (2 0 1) (2 1 0) (1 0 2) (0 1 2))
((0 1 2) (1 0 2) (2 0 1) (1 2 0) (2 1 0))
((0 2 1) (1 2 0) (0 1 2) (2 0 1) (1 0 2))
```

**SYNOPSIS:**

```
(defun inefficient-permutations (level &key (max nil) (skip 0) (fix t)
                                (if-not-enough #'error))
```

**10.1.2 permutations/inefficiently-permutate**

[ *permutations* ] [ *Functions* ]

**DESCRIPTION:**

Return a shuffled, non-systematically ordered list of all possible

permutations of an original list of elements of any type. An optional keyword argument <max> allows the user to specify the maximum number of permutations to return.

As opposed to the function "permutate", inefficiently-permutate returns the elements of the specified <list> as a flat list, unless the keyword argument <sublists> is set to T, whereupon the function returns the result as a list of lists, each one being a permutation of <list>.

The function is inefficient in so far as it simply shuffles the numbers and so always has to check whether the new list already contains the shuffled sublist before storing it.

The order of the permutations returned will always be the same unless <fix> is set to NIL.

#### ARGUMENTS:

- A list.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :max. An integer that indicates the maximum number of permutations to be returned.
- :skip. An integer that indicates a number of permutations to skip.
- :fix. T or NIL to indicate whether the given sequence should always be shuffled with the same (fixed) random seed (thus always producing the same result). T = fixed seed. Default = T.
- :sublists. T or NIL to indicate whether the returned result should be flattened into a one-dimensional list or should be left as a list of lists. T = leave as list of lists. Default = NIL.
- :clone. T or NIL to indicate whether objects in the list should be cloned as they are permuted (so that they are unique objects rather than shared data space). Useful perhaps if e.g. you're cloning chords which will then have their own marks. etc. If T then the list must contain slippery-chicken named-objects or types subclassed from them (as is every slippery-chicken class).
- :if-not-enough. A function object (or NIL) to call when :max was requested but we can't return that many results. Default = #'error.

#### RETURN VALUE:

- A list.

#### EXAMPLE:



```
;; By default the function returns a flattened list of all possible
;; permutations in a shuffled (random) order
(inefficiently-permutate '(a b c))

=> (C A B C B A A C B B A C B C A A B C)

;; The length of the list returned can be potentially shortened using the :max
;; keyword argument. Note here that the value given here refers to the number
;; of permutations before the list is flattened, not to the number of
;; individual items in the flattened list.
(inefficiently-permutate '(a b c) :max 3)

=> (C A B C B A A C B)

;; By default the function is set to using a fixed random seed, causing it to
;; return the same result each time
(loop repeat 4 do (print (inefficiently-permutate '(a b c))))

=>
(C A B C B A A C B B A C B C A A B C)
(C A B C B A A C B B A C B C A A B C)
(C A B C B A A C B B A C B C A A B C)
(C A B C B A A C B B A C B C A A B C)

;; Setting the :fix keyword argument to NIL allows the function to produce
;; different output each time
(loop repeat 4 do (print (inefficiently-permutate '(a b c) :fix nil)))

=>
(B A C A C B B C A A B C C B A C A B)
(A C B B A C C B A C A B B C A A B C)
(A C B B A C B C A A B C C A B C B A)
(B A C A B C C A B C B A B C A A C B)

;; Setting the :sublists keyword argument to T causes the function to return a
;; list of lists instead
(inefficiently-permutate '(a b c) :sublists t)

=> ((C A B) (C B A) (A C B) (B A C) (B C A) (A B C))
```

**SYNOPSIS:**

```
(defun inefficiently-permutate (list &key (max nil) (skip 0) (fix t)
                               clone (sublists nil) (if-not-enough #'error))
```

**10.1.3 permutations/move-repeats***[ permutations ] [ Functions ]***DESCRIPTION:**

Move, when possible, any elements within a given list that are repeated consecutively.

When two consecutive elements repeat, such as the c in '(a b c c b a)', the function moves the repeated element to the next place in the given list that won't produce a repetition. When no such place can be found in the remainder of the list, the offending element is moved to the end of the given list and a warning is printed.

This function can be applied to simple lists and lists with sublists. However, due to this function being designed for--but not limited to--use with the results of permutations, if the list has sublists, then instead of repeating sublists being moved, the last element of a sublist is checked for repetition with the first element of the next sublist. See the first example below.

NB: This function only move elements further along the list; it won't place them earlier than their original position. Thus:

```
(move-repeats '(3 3 1))
```

will return (3 1 3), while

```
(move-repeats '(1 3 3))
```

will leave the list untouched and print a warning.

**ARGUMENTS:**

- A list.

**OPTIONAL ARGUMENTS:**

- A function that serves as the comparison test. Default = #'eq.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;;; Used with a list of lists. Note that the repeating C, end of sublist 1,
;;; beginning of sublist 2, is moved, not the whole repeating sublist (c a b).
(move-repeats '((a b c) (c a b) (c a b) (d e f) (a b c) (g h i)))
```

```
=> ((A B C) (D E F) (C A B) (C A B) (A B C) (G H I))
```

```
;;; Works with simple lists too:
(move-repeats '(1 2 3 3 4 5 6 7 8 8 9 10))
```

```
=> (1 2 3 4 3 5 6 7 8 9 8 10)
```

```
;; Moves the offending element to the end of the list and prints a warning when
;; no solution can be found
(move-repeats '((a b c d) (d c b a) (b c a d) (c a b d)))
```

```
=> ((A B C D) (B C A D) (C A B D) (D C B A))
WARNING:
  move-repeats: can't find non-repeating place!
  present element: (D C B A), elements left: 1
```

## SYNOPSIS:

```
(defun move-repeats (list &optional (test #'eq))
```

### 10.1.4 permutations/multi-shuffle

[ *permutations* ] [ *Functions* ]

## DESCRIPTION:

Applies the shuffle function a specified number of times to a specified list.

NB: As with the plain shuffle function, the order of the permutations returned will always be the same unless the keyword argument `:fix` is set to `NIL`.

## ARGUMENTS:

- A sequence.

## OPTIONAL ARGUMENTS:

keyword arguments:

- `:start`. A zero-based index integer indicating the first element of a

- subsequence to be shuffled. Default = 0.
- :end. A zero-based index integer indicating the last element of a subsequence to be shuffled. Default = the length of the given sequence.
- :copy. T or NIL to indicate whether the given sequence should be copied before it is modified or should be destructively shuffled.  
T = copy. Default = T.
- :fix. T or NIL to indicate whether the given sequence should always be shuffled with the same (fixed) random seed (thus always producing the same result). T = fixed seed. Default = T.
- :reset. T or NIL to indicate whether the random state should be reset before the function is performed. T = reset. Default = T.

**RETURN VALUE:**

- A sequence.

**EXAMPLE:**

```
;; Simple multi-shuffle with default keywords.
(multi-shuffle '(a b c d e f g) 3)
```

```
=> (B A C E D G F)
```

```
;; Always returns the same result by default.
(loop repeat 4 do (print (multi-shuffle '(a b c d e f g) 3)))
```

```
=>
(B A C E D G F)
(B A C E D G F)
(B A C E D G F)
(B A C E D G F)
```

```
;; Set keyword argument :fix to NIL to return different results each time
(loop repeat 4 do (print (multi-shuffle '(a b c d e f g) 3 :fix nil)))
```

```
=>
(G C F B D E A)
(A G F B D C E)
(A B D G C F E)
(G C A D E F B)
```

```
;; Set keyword arguments :start and :end to shuffle just a subsequence of the
;; given sequence
(loop repeat 4
  do (print (multi-shuffle '(a b c d e f g) 3
                           :fix nil
```

```

                                :start 2
                                :end 5)))

=>
(A B D E C F G)
(A B E C D F G)
(A B E D C F G)
(A B D C E F G)

```

**SYNOPSIS:**

```

(defun multi-shuffle (seq num-shuffles &key
                    (start 0)
                    (end (length seq))
                    (copy t)
                    (fix t)
                    (reset t))

```

**10.1.5 permutations/multi-shuffle-with-perms**

[ *permutations* ] [ *Functions* ]

**DESCRIPTION:**

Return one permutation from a shuffled list of permutations of the specified list. The second argument determines how many shuffled permutations will be in the list from which the resulting permutation is selected. Similar to the "multi-shuffle" function, but uses the function "inefficient-permutations" as part of the process.

The <num-shuffles> argument allows the user to always return the same specific permutation.

NB: This function always uses a fixed random seed and has no optional arguments to allow the user to alter that setting.

**ARGUMENTS:**

- A list.
- An integer that is the number of consecutive shuffles to be collected in the list from which the resulting permutation is selected.

**RETURN VALUE:**

- A list that is a single permutation of the specified list.

**EXAMPLE:**

```
;; Returns a permutation of a shuffled version of the specified list
(let ((l '(0 1 2 3 4)))
  (multi-shuffle-with-perms l 7))
```

```
=> (3 1 4 2 0)
```

```
;; Always returns the same result
(loop repeat 4 do (print (multi-shuffle-with-perms '(0 1 2 3 4) 7)))
```

```
=>
(3 1 4 2 0)
(3 1 4 2 0)
(3 1 4 2 0)
(3 1 4 2 0)
```

```
;; Different <num-shuffles> values return different permutations
(loop for i from 0 to 5
  do (print (multi-shuffle-with-perms '(0 1 2 3 4) i)))
```

```
=>
(0 1 2 3 4)
(1 4 2 0 3)
(0 3 1 4 2)
(4 0 2 1 3)
(1 2 3 4 0)
(2 1 3 0 4)
```

**SYNOPSIS:**

```
(defun multi-shuffle-with-perms (seq num-shuffles)
```

**10.1.6 permutations/permutate**

[ *permutations* ] [ *Functions* ]

**DESCRIPTION:**

Systematically produce a list of all possible permutations of an original list of elements of any type.

NB: Such lists can quickly become very long, so *slippery-chicken* automatically defaults to outputting the resulting list to a file and printing a warning when the results exceed a certain length.

**ARGUMENTS:**

- A list with elements of any type.

**RETURN VALUE:**

A list of lists that are all possible permutations of the original, specified list.

Interrupts with an error if the method is passed anything but a list.

**EXAMPLE:**

```
;; Simple usage
(permutate '(a b c))
```

```
=> ((A B C) (B A C) (A C B) (C A B) (B C A) (C B A))
```

```
;; When the list is more than 8 elements long, the resulting permutations are
;; written to a file due to the very high number of results
(permutate '(1 2 3 4 5 6 7 8 9))
```

```
=>
```

```
WARNING: permutations::permutations: This call will return 362880
results so they are being written to the file
'/tmp/permutations.txt'.
```

**SYNOPSIS:**

```
(defun permutate (list)
```

**10.1.7 permutations/random-rep**

```
[ permutations ] [ Functions ]
```

**DESCRIPTION:**

Return a random non-negative number that is less than the specified value. An optional argument allows for the random state to be reset.

**ARGUMENTS:**

- A number.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the random state should be reset before the function is performed. T = reset. Default = NIL.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
;; By default returns a different value each time
(loop repeat 10 do (print (random-rep 5)))
```

```
=>
```

```
1
3
4
4
3
4
2
0
2
0
```

```
;; Setting the optional argument to T resets the random state before
;; performing the function
(loop repeat 10 do (print (random-rep 5 t)))
```

```
=>
```

```
3
3
3
3
3
3
3
3
3
3
```

**SYNOPSIS:**

```
(defun random-rep (below &optional (reset nil))
```



**10.1.8 permutations/shuffle***[ permutations ] [ Functions ]***DESCRIPTION:**

Create a random ordering of a given sequence or a subsequence of a given sequence. By default we used fixed-seed randomness so we can guarantee the same results each time (perhaps counter-intuitively). So the order of the permutations returned will always be the same unless keyword argument `:fix` is set to `NIL`.

NB: This function is a modified form of Common Music's shuffle function.

**ARGUMENTS:**

- A sequence (list, vector (string)).

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:start`. A zero-based index integer indicating the first element of a subsequence to be shuffled. Default = 0.
- `:end`. A zero-based index integer indicating the last element of a subsequence to be shuffled. Default = the length of the given sequence.
- `:copy`. T or NIL to indicate whether the given sequence should be copied before it is modified or should be destructively shuffled.  
T = copy. Default = T.
- `:fix`. T or NIL to indicate whether the given sequence should always be shuffled with the same (fixed) random seed (thus always producing the same result). T = fixed seed. Default = T.
- `:reset`. T or NIL to indicate whether the random state should be reset before the function is performed. T = reset. Default = T.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; Simple shuffle with default keywords.
(shuffle '(1 2 3 4 5 6 7))
```

```
=> (5 4 3 6 7 1 2)
```

```
;; Always returns the same result by default.
(loop repeat 4 do (print (shuffle '(1 2 3 4 5 6 7))))
```

```
=>
(5 4 3 6 7 1 2)
(5 4 3 6 7 1 2)
(5 4 3 6 7 1 2)
(5 4 3 6 7 1 2)
```

```
;; Set keyword argument :fix to NIL to return different results each time
(loop repeat 4 do (print (shuffle '(1 2 3 4 5 6 7) :fix nil)))
```

```
=>
(1 2 6 3 5 4 7)
(1 3 5 2 7 4 6)
(4 7 2 5 1 6 3)
(1 5 3 7 4 2 6)
```

```
;; Set the keyword argument :reset to t only at the beginning so we get the
;; same result that time but different (but repeatable) results thereafter.
(loop repeat 3 do
  (print 'start)
  (loop for i below 4
    do (print (shuffle '(1 2 3 4 5 6 7) :reset (zerop i)))))
```

```
=>
START
(5 4 3 6 7 1 2)
(4 6 5 2 3 1 7)
(3 4 1 6 5 7 2)
(3 2 7 4 1 6 5)
START
(5 4 3 6 7 1 2)
(4 6 5 2 3 1 7)
(3 4 1 6 5 7 2)
(3 2 7 4 1 6 5)
START
(5 4 3 6 7 1 2)
(4 6 5 2 3 1 7)
(3 4 1 6 5 7 2)
(3 2 7 4 1 6 5)
```

```
;; Set keyword arguments :start and :end to shuffle just a subsequence of the
;; given sequence
(loop repeat 4
```

```

do (print (shuffle '(1 2 3 4 5 6 7)
                    :fix nil
                    :start 2
                    :end 5)))

=>
(1 2 5 4 3 6 7)
(1 2 3 5 4 6 7)
(1 2 4 5 3 6 7)
(1 2 3 4 5 6 7)

```

**SYNOPSIS:**

```

(defun shuffle (seq &key
                (start 0)
                (end (length seq))
                (copy t)
                (fix t)
                (reset t)
                &aux (width (- end start)))

```

**11 sc/samp5**

[ Modules ]

**NAME:**

samp5

File: samp5.lsp

Class Hierarchy: none, no classes defined

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: clm instrument for sample processing; called by  
slippery-chicken::clm-play

Author: Michael Edwards: m@michael-edwards.org

Creation date: 12th June 2004

\$\$ Last modified: 11:32:09 Mon Nov 4 2013 GMT

SVN ID: \$Id: samp5.lsp 4229 2013-11-04 14:08:06Z medward2 \$

## 12 sc/sine

[ Modules ]

**NAME:**

samp5

File: sine.lsp

Class Hierarchy: none, no classes defined

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: clm instrument for simple sine wave generation. This is used mainly as an example to show how user instruments can be used in clm-play but it may also be useful for a quick sinewave rendition of a piece.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 12th June 2004

\$\$ Last modified: 11:23:12 Tue Dec 3 2013 GMT

SVN ID: \$Id: samp5.lsp 4223 2013-10-29 10:57:09Z medward2 \$

## 13 sc/slippy-chicken-edit

[ Modules ]

**NAME:**

slippery-chicken-edit

File: slippery-chicken-edit.lsp

Class Hierarchy: named-object -> slippery-chicken

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Post-generation editing methods for the slippery-chicken class.

Author: Michael Edwards: m@michael-edwards.org

Creation date: April 7th 2012

\$\$ Last modified: 09:07:23 Thu Jan 9 2014 GMT

SVN ID: \$Id: slippery-chicken-edit.lsp 4351 2014-01-09 09:35:31Z medward2 \$

### 13.1 slippery-chicken-edit/add-arrow-to-events

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DATE:

April 9th 2012

#### DESCRIPTION:

Adds an arrow above the specified notes of a slippery-chicken object, coupled with text to be printed in the score at the start and end of the arrow. Can be used, for example, for transitions from one playing state to another.

If no text is desired, this must be indicated by a space in quotes (" ") rather than empty quotes ("").

See also the add-arrow method in the event class.

#### ARGUMENTS:

- A slippery-chicken object.
- A text string for the beginning of the arrow.
- A text string for the end of the arrow.
- A list that is the starting event reference, in the form (bar-number event-number). Event numbers count from 1 and include rests and tied notes.
- A list that is the end event reference, in the form (bar-number event-number).
- The ID of the player to whose part the arrow should be attached.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not to print a warning when trying to attach an arrow and accompanying marks to a rest.  
T = print warning. Default = NIL.

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :title "mini"
        :ensemble '(((pno (piano :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6)))
                        (2 ((cs4 ds4 fs4 gs4 as4 cs5 ds5 fs5 gs5 as5))))
        :set-map '((1 (1 1 1 1 1 1)))
        :rthm-seq-palette '((1 (((2 4) q q))
                                :pitch-seq-palette ((1 (2))))))
      :rthm-seq-map '((1 ((pno (1 1 1 1 1 1))))))
      (add-arrow-to-events mini "here" "there" '(1 1) '(5 1) 'pno)
      (write-lp-data-for-all mini)))
```

**SYNOPSIS:**

```
(defmethod add-arrow-to-events ((sc slippery-chicken) start-text end-text
                                event1-ref event2-ref player
                                &optional warn-rest)
```

**13.2 slippery-chicken-edit/add-clef**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Attach a specified clef symbol to a specified clef object within a given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player to whose part the clef symbol is to be added.

NB: The optional arguments are actually required.

#### OPTIONAL ARGUMENTS:

- An integer that is the bar number in which the clef symbol is to be placed.
- An integer that is the event number within the given bar to which the clef symbol is to be attached.
- A symbol that is the clef type to be attached. See the documentation for the make-instrument function of the instrument class for a list of possible clef types.

#### RETURN VALUE:

Returns the new value of the MARKS-BEFORE slot of the given event object.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :title "mini"
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6)))
                    (2 ((cs4 ds4 fs4 gs4 as4 cs5 ds5 fs5 gs5 as5))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '(1 (((2 4) q e s s)
                             :pitch-seq-palette ((1 2 3 4))))
      :rthm-seq-map '(1 ((vn (1 1 1 1 1 1))))))
  (add-clef mini 'vn 3 2 'alto))

=> ((CLEF ALTO))
```

#### SYNOPSIS:

```
(defmethod add-clef ((sc slippery-chicken) player &optional
                    bar-num event-num clef)
```

### 13.3 slippery-chicken-edit/add-event-to-bar

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Add an event object to a specified bar either at the end of that bar or at a specified position within that bar.

**ARGUMENTS:**

- A slippery-chicken object.
- An event object.
- An integer that is the bar number or a list that is the reference to the bar in the form '(section sequence bar)', where sequence and bar are numbers counting from 1)
- The ID of the player to whose part the event should be added.

**OPTIONAL ARGUMENTS:**

keyword argument:

- :position. NIL or an integer indicating the position in the bar (0-based) where the event should be added. If NIL, the new event is place at the end of the bar. Default = NIL.

**RETURN VALUE:**

T

**EXAMPLE:**

```
;;; Adding two events to separate bars, once using a bar number with
;;; :position's default to NIL, and once using a bar number reference list with
;;; :position specified as 2. Print the bars after adding to see the changes.
```

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6)))
                       (2 ((cs4 ds4 fs4 gs4 as4 cs5 ds5 fs5 gs5 as5 cs6))))
       :set-map '((1 (1 1 1 1 1 1))
                  (2 (2 2 2 2 2 2)))
       :rthm-seq-palette '(1 (((2 4) q e s s)
                               :pitch-seq-palette ((1 2 3 4))))
                     (2 (((2 4) e s s q)
                          :pitch-seq-palette ((1 2 3 4)))))
       :rthm-seq-map '(1 ((vn (1 1 1 1 1 1)))))
```



```

                (2 ((vn (2 2 2 2 2 2)))))))))
(add-event-to-bar mini (make-event 'cs4 'e) 2 'vn)
(print-simple (first (get-bar mini 2)))
(add-event-to-bar mini (make-event 'c4 'q) '(2 2 1) 'vn :position 2)
(print-simple (first (get-bar mini '(2 2 1)))))

=>
(2 4): C4 Q, D4 E, F4 S, G4 S, CS4 E
(2 4): CS4 E, DS4 S, C4 Q, FS4 S, GS4 Q

```

**SYNOPSIS:**

```

(defmethod add-event-to-bar ((sc slippery-chicken) event bar-num-or-ref player
                             &key (position nil))

```

**13.4 slippery-chicken-edit/add-mark-all-players**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Add a specified mark to a specified even in the parts of all players. The event can either be specified as a 1-based integer, in which case the mark will be attached to the same event in all parts, or as a list of integers, in which the mark is attached to different events in the same bar for each player, passing from the top of the ensemble downwards.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the bar number or a list of integers that is a reference to the bar number in the form (section sequence bar).
- An integer that is the event to which to attach the specified mark in all parts, or a list of integers that are the individual events to which to attach the mark in the consecutive players.
- The mark to be added.

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```

;;; Apply the method twice: Once using an integer to attach the mark to the
;;; same event in all players, and once using a list to attach the mark to

```

;;; different events in the consecutive players. Print the corresponding marks  
 ;;; slots to see the results.

```
(let (mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                          (hn (french-horn :midi-channel 2))
                          (vc (cello :midi-channel 3))))
        :tempo-map '(1 (q 60))
        :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
        :set-map '(1 (1 1 1 1 1))
                  (2 (1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) h q e s s))
                              :pitch-seq-palette ((1 2 3 4 5)))))
      :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                              (hn (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                      (2 ((cl (1 1 1 1 1))
                              (hn (1 1 1 1 1))
                              (vc (1 1 1 1 1)))))))
  (add-mark-all-players mini 3 1 'ppp)
  (add-mark-all-players mini '(2 2 1) '(1 2 3) 'fff)
  (loop for i in '(cl hn vc)
        do (print (marks (get-event mini 3 1 i))))
  (loop for i in '(cl hn vc)
        for e in '(1 2 3)
        do (print (marks (get-event mini '(2 2 1) e i)))))
```

=>

```
(PPP)
(PPP)
(PPP)
(FFF)
(FFF)
(FFF)
```

#### SYNOPSIS:

```
(defmethod add-mark-all-players ((sc slippery-chicken)
                                   bar-num event-num mark)
```

### 13.5 slippery-chicken-edit/add-mark-before-note

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Add the specified mark to the MARKS-BEFORE slot of the specified note object within the given slippery-chicken object.

NB: This method counts notes, not events; i.e., rests are not counted.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the bar number in which the mark is to be added.
- An integer that is the NOTE number to which the mark is to be added (not the event number; i.e., rests are not counted).
- The ID of the player to which the mark is to be added.
- The mark to be added.

**RETURN VALUE:**

Returns the new value of the MARKS-BEFORE slot of the given event object.

**EXAMPLE:**

```
;; The method adds the mark to the specified note, not event. Add the mark to
;; note 2, print the MARKS-BEFORE slots of events 2 (which is a rest) and 3.
```

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vn (violin :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '(((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6)))
        :set-map '(((1 (1 1 1 1 1 1))))
        :rthm-seq-palette '(((2 4) q (e) s s)
                               :pitch-seq-palette ((1 2 3))))
      :rthm-seq-map '(((vn (1 1 1 1 1 1))))))
  (add-mark-before-note mini 3 2 'vn 'ppp)
  (print (marks-before (get-event mini 3 2 'vn)))
  (print (marks-before (get-event mini 3 3 'vn))))
```

 $\Rightarrow$ 

NIL

(PPP)

**SYNOPSIS:**

[illegible]

## 13.6 slippery-chicken-edit/add-mark-to-event

[ *slippery-chicken-edit* ] [ *Methods* ]

### DESCRIPTION:

Add the specified mark to the MARKS slot of the specified event within the given slippery-chicken object.

### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the bar number to which the mark is to be added.
- An integer that is the event number in the specified bar to which the mark is to be added.
- The ID of the player to which to add the mark.
- The mark to add.

### RETURN VALUE:

Returns T.

### EXAMPLE:

```
;;; Add a mark to an event object then read the value of the MARKS slot of that
;;; event to see the result
```

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6))))
       :set-map '((1 (1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s s))
                               :pitch-seq-palette ((1 2 3)))))
       :rthm-seq-map '(((1 ((vn (1 1 1 1 1 1)))))))
      (add-mark-to-event mini 3 2 'vn 'ppp)
      (marks (get-event mini 3 2 'vn)))
```

```
=> (PPP)
```

### SYNOPSIS:

```
(defmethod add-mark-to-event ((sc slippery-chicken) bar-num event-num player
                              mark)
```

### 13.7 slippery-chicken-edit/add-mark-to-note

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Add the specified mark to the specified note of a given slippery-chicken object.

NB: This method counts notes, not events; i.e., not rests.

#### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the bar number to which to add the mark
- An integer that is the note number two which to add the mark. This is 1-based, and counts notes not events; i.e., not rests.
- The ID of the player to whose part the mark is to be added.
- The mark to add.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

;;; Add a mark to a note in a bar with a rest. Print the corresponding event  
;;; object to see the result.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '(((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6))))
      :set-map '((1 (1 1 1 1 1 1)))
      :rthm-seq-palette '(((1 (((2 4) q (e) s s))
                                :pitch-seq-palette ((1 2 3))))))
      :rthm-seq-map '(((1 ((vn (1 1 1 1 1 1)))))))
  (add-mark-to-note mini 3 2 'vn 'ppp)
  (print (marks (get-event mini 3 2 'vn)))
  (print (marks (get-event mini 3 3 'vn))))
```

=>

NIL

(PPP)

**SYNOPSIS:**

```
(defmethod add-mark-to-note ((sc slippery-chicken)
                             bar-num note-num player mark)
```

**13.8 slippery-chicken-edit/add-marks-sh**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

27-Jun-2011

**DESCRIPTION:**

Add marks in a somewhat more free list form, with the option of implementing a user-defined shorthand.

**ARGUMENTS:**

- A slippery-chicken object.
- A list of lists containing the players, bar and note refs, and marks to be added. The first element of each contained list will be the ID of the player to whose part the marks are to be added followed by a pattern of <mark bar-number note-number> triplets, or if a mark is to be added repeatedly then <mark bar note bar note... >. A mark can be a string or a symbol.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- For marks given as symbols, the user can supply a shorthand table that will expand an abbreviation, such as sp, to the full mark name, such as short-pause. This table takes the form of a simple Lisp association list, e.g.: 

```
'((al aeolian-light)
      (ad aeolian-dark)
      (wt "WT")
      (h harm))
```
- :warn. T or NIL to indicate whether to print a warning for unrecognized marks. T = print warning. Default = T.
- :verbose. T or NIL to indicate whether the method is to print verbose feedback about each mark added to the Listener. T = print feedback. Default = NIL.

**RETURN VALUE:**

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vn (violin :midi-channel 1))
                          (va (viola :midi-channel 2))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((c4 d4 f4 g4 a4 c5 d5 f5))))
        :set-map '((1 (1 1 1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                   :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vn (1 1 1 1 1 1))
                           (va (1 1 1 1 1 1))))))
      (add-marks-sh mini
        '(vn a 1 1 1 2 3 1 s 2 1 2 2 2 5)
        (va pizz 1 3 2 3 sp 3 1))
        :shorthand '((sp short-pause))
        :verbose t))
```

=> NIL

#### SYNOPSIS:

```
(defmethod add-marks-sh ((sc slippery-chicken) player-data
                          &key shorthand (warn t) verbose)
```

### 13.9 slippery-chicken-edit/add-marks-to-note

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Add one or more specified marks to a specified note within a given slippery-chicken object.

NB: This method counts notes, not events; i.e., rests are not counted.

#### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the bar number to which the mark or marks should to be added.

- An integer that is the note within the specified bar to which the mark or marks should be added.
- The ID of the player to whose part the mark or marks should be added.
- The mark or marks to add.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

;;; Add several marks to one note, then print the corresponding MARKS slot to  
 ;;; see the difference.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (va (viola :midi-channel 2))))
       :tempo-map '(1 (q 60)))
      :set-palette '((1 ((c4 d4 f4 g4 a4 c5 d5 f5))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) e (e) e e (e) e e e))
                               :pitch-seq-palette ((1 2 3 4 5 6))))
      :rthm-seq-map '((1 ((vn (1 1 1 1 1 1))
                              (va (1 1 1 1 1 1))))))
  (add-marks-to-note mini 2 3 'va 'a 's 'lhp 'pizz)
  (print (marks (get-note mini 2 3 'va))))
```

=> (PIZZ LHP S A)

**SYNOPSIS:**

```
(defmethod add-marks-to-note ((sc slippery-chicken) bar-num note-num
                              player &rest marks)
```

**13.10 slippery-chicken-edit/add-marks-to-notes**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Add the specified mark or marks to a consecutive sequence of multiple notes within the given slippery-chicken object.

**ARGUMENTS:**



- A slippery-chicken object.
- An integer or a list consisting of two numbers to indicate the start bar/note. If this is an integer, all notes in this bar will receive the specified mark or marks. If this is a two-number list, the first number determines the bar, the second the note within that bar.
- An integer or a list consisting of two numbers to indicate the end bar/note. If this is an integer, all notes in this bar will receive the specified mark or marks. If this is a two-number list, the first number determines the bar, the second the note within that bar.
- The ID of the player or players to whose parts the mark or marks should be attached. This can be a single symbol or a list.
- T or NIL to indicate whether the mark should be added to the MARKS slot or the MARKS-BEFORE slot of the given events objects.
- The mark or marks to be added.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

;;; This example calls the method twice: Once using the single-integer  
 ;;; indication for full bars, with one instrument and one mark; and once using  
 ;;; the bar/note reference lists for more specific placement, a list of several  
 ;;; players that should all receive the marks, and multiple marks to add.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                     (va (viola :midi-channel 2))))
       :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c4 d4 f4 g4 a4 c5 d5 f5))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '(1 (((4 4) e e e e e e e e))
                             :pitch-seq-palette ((1 2 3 4 5 6 7 8))))
      :rthm-seq-map '(1 ((vn (1 1 1 1 1 1))
                          (va (1 1 1 1 1 1))))))
  (add-marks-to-notes mini 2 3 'vn nil 'lhp)
  (add-marks-to-notes mini '(1 3) '(2 2) '(vn va) nil 's 'a))
```

=> T

**SYNOPSIS:**

```
(defmethod add-marks-to-notes ((sc slippery-chicken) start end players before
                               &rest marks)
```

### 13.11 slippery-chicken-edit/add-pitches-to-chord

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Add specified pitches to an existing chord object.

#### ARGUMENTS:

- The slippery-chicken object which contains the given chord object.
- The ID of the player whose part is to be affected.
- An integer that is the number of the bar that contains the chord object that is to be modified.
- An integer that is the number of the note that is the chord object to be modified.
- The pitches to be added. These can be pitch objects or any data that can be passed to make-pitch, or indeed lists of these, as they will be flattened.

#### RETURN VALUE:

The chord object that has been changed.

#### EXAMPLE:

```
(let* ((ip-clone (clone +slippery-chicken-standard-instrument-palette+)))
  (set-slot 'chord-function 'chord-fun1 'guitar ip-clone)
  (let* ((mini
    (make-slippery-chicken
      '+mini+
      :instrument-palette ip-clone
      :ensemble '(((gtr (guitar :midi-channel 1))))
      :set-palette '((1 ((e3 f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5 d5 e5 f5
        g5 a5 b5 c6 d6 e6))))
      :set-map '((1 (1)))
      :rthm-seq-palette
      '((1 (((4 4) e e e e e e e e)
        :pitch-seq-palette ((1 (2) 3 (4) 5 (6) 7 (8))))))
      :rthm-seq-map '((1 ((gtr (1)))))))
    (print (get-pitch-symbols
      (pitch-or-chord (get-event mini 1 2 'gtr))))
    (add-pitches-to-chord mini 'gtr 1 2 'cs4 'ds4)
    (print (get-pitch-symbols
      (pitch-or-chord (get-event mini 1 2 'gtr))))))
```

```
=>
(E3 G3 B3)
(E3 G3 B3 CS4 DS4)
```

**SYNOPSIS:**

```
(defmethod add-pitches-to-chord ((sc slippery-chicken) player bar-num note-num
                                &rest pitches)
```

**13.12 slippery-chicken-edit/add-tuplet-bracket-to-bar**

```
[ slippery-chicken-edit ] [ Methods ]
```

**DESCRIPTION:**

Add a tuplet bracket (with number) to a specified bar in a slippery-chicken object. This method adds only one tuplet bracket of one tuplet type (triplet, quintuplet etc.) at a time.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar to which the tuplet bracket is to be added.
- The ID of the player to whose part the tuplet bracket is to be added.
- The bracket info defining the tuplet bracket to be added. This takes the form of a three-element list specifying tuplet value, number of the event (zero-based) on which the bracket is to begin, and number of the event on which the bracket is to end, e.g. '(3 0 2).

**OPTIONAL ARGUMENTS:**

T or NIL to indicate whether all existing tuplet brackets in the given bar are to be deleted first. T = delete. Default = NIL>

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+sc-object+
```

```

:ensemble '(((va (viola :midi-channel 2))))
:set-palette '((1 ((c3 d3 e3 f3 g3 a3 b3 c4 d4))))
:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((3 4) (te) - te te - { 3 te ts+ts te }
                        - fs fs fs fs fs -))
                    :pitch-seq-palette ((1 2 3 4 5 6 7 8 9 8))))
:rthm-seq-map '(((1 ((va (1 1 1)))))))
(add-tuplet-bracket-to-bar mini 1 'va '(3 0 2))
(add-tuplet-bracket-to-bar mini 2 'va '(5 7 11))
(add-tuplet-bracket-to-bar mini 3 'va '(3 3 4) t)
(add-tuplet-bracket-to-bar mini 3 'va '(3 5 6)))

=> T

```

**SYNOPSIS:**

```

(defmethod add-tuplet-bracket-to-bar ((sc slippery-chicken) bar-num player
                                     bracket-info
                                     &optional (delete-all-tuplets-first nil))

```

**13.13 slippery-chicken-edit/add-tuplet-brackets-to-beats**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Add the specified tuplet brackets (and numbers) to the specified event objects in the specified bars within the given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player to whose part the tuplet brackets are to be added.
- A list of 4-element sublists that is the bracket info. Each sublist must consist of: the number of the bar to which the bracket is to be added; the number that is the tuplet type (3 = triplet, 5 = quintuplet etc.); the zero-based number of the event where the bracket is to begin; the zero-based number that is the number of the event where the bracket is to end; e.g. '((2 3 0 5) (3 3 0 3) (5 5 0 4))

**OPTIONAL ARGUMENTS:**

T or NIL to indicate whether all existing tuplet bracket info in the given bars is to first be deleted. T = delete. Default = NIL.

**RETURN VALUE:**

NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+sc-object+
        :ensemble '(((va (viola :midi-channel 2))))
        :set-palette '((1 ((c3 e3 g3 c4))))
        :set-map '((1 (1 1 1)))
        :rthm-seq-palette '((1 (((3 4) - te te te - - fs fs fs fs fs -
                                   - 28 28 28 28 28 28 28 -))
                               :pitch-seq-palette ((1 2 3 4 1 2 3 4 1 2 3 4 1
                                                       2 3))))))
      :rthm-seq-map '(((1 ((va (1 1 1)))))))
  (add-tuplet-brackets-to-beats mini 'va '(((1 3 0 2) (2 5 3 7) (3 7 8 14)))))

=> NIL
```

**SYNOPSIS:**

```
(defmethod add-tuplet-brackets-to-beats
  ((sc slippery-chicken) player bracket-info
   &optional (delete-all-tuplets-first nil))
```

**13.14 slippery-chicken-edit/auto-accidentals**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Automatically determine which notes in each bar need accidentals and which don't.

This method also places cautionary accidentals (in parentheses) based on how many notes back the last occurrence of that note/accidental combination appeared in the bar. The first optional argument to the method allows the user to specify how many notes back to look.

NB: As both `cmn-display` and `write-lp-data-for-all` call `respell-notes` by default, that option must be set to NIL for this method to be effective (see below).

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

- An integer that is the number of notes back to look when placing cautionary accidentals in parentheses. If the last occurrence of a given repeated note/accidental combination was farther back than this number, the accidental will be placed in the score in parentheses.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((fs4 gs4 as4))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e)))
                           :pitch-seq-palette ((1 2 3 2 1 2 3 2))))
      :rthm-seq-map '((1 ((vn (1 1 1 1))))))
      (auto-accidentals mini 4)
      (cmn-display mini :respell-notes nil))

=> NIL
```

**SYNOPSIS:**

```
(defmethod auto-accidentals ((sc slippery-chicken) &optional
                             (cautionary-distance 3)
                             ignore1 ignore2)
```

**13.15 slippery-chicken-edit/auto-beam**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Automatically places indications for beam start- and end-points (1 and 0)

in the BEAMS slot of the corresponding event objects.

By default, this method determines the start and end indications for beams on the basis of the beat found in the time signature, but the user can specify a different beat basis using the first optional argument.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

- NIL, an integer that is a power-of-two rhythmic duration, or the alphabetic representation of such a rhythm to specify the beat basis for setting beams (e.g. 4 or 'h).
- T or NIL to indicate whether the method is to check whether an exact beat of rhythms can be found for each beat of the bar. If T, a warning will be printed when an exact beat cannot be found for each beat of the bar.  
Default = T.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```
;; Auto-beam the events of the given slippery-chicken object on the basis of a
;; half note:
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((fs4 gs4 as4))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 2 1 2 3 2))))
       :rthm-seq-map '((1 ((vn (1 1 1 1))))))
      (auto-beam mini 'h))

=> NIL
```

#### SYNOPSIS:

```
(defmethod auto-beam ((sc slippery-chicken) &optional (beat nil) (check-dur t))
```

**13.16 slippery-chicken-edit/auto-clefs***[ slippery-chicken-edit ] [ Methods ]***DESCRIPTION:**

Automatically create clef changes in the specified player's or players' part or parts by adding the appropriate clef symbol to the MARKS-BEFORE slot of the corresponding event object.

This routine will only place clef symbols that are present in the given instrument object's CLEFS slot.

This method is called automatically by `cmn-display` and `write-lp-data-for-all`, with the `delete-clefs` option set to T.

NB: While this routine generally does a good job of putting the proper clefs in place, it will get confused if the pitches in a given player's part jump from very high to very low (e.g. over the complete range of the piano).

**ARGUMENTS:**

- A `slippery-chicken` object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:verbose`. T or NIL to indicate whether the method is to print feedback about its operations to the Listener. T = print feedback. Default = NIL.
- `:in-c`. T or NIL to indicate whether the pitches processed are to be handled as sounding or written pitches. T = sounding. Default = T.
- `:players`. A list containing the IDs of the players whose parts are to be to have clefs automatically added.
- `:delete-clefs`. T or NIL to indicate whether the method should first delete all clef symbols from the MARKS-BEFORE slots of all event objects it is processing before setting the automatic clef changes.
- `:delete-marks-before`. T or NIL to indicate whether the MARKS-BEFORE slot of all event objects processed should first be set to NIL. T = set to NIL. Default = NIL.

**RETURN VALUE:**

Returns T

**EXAMPLE:**



```
;;; Straightforward usage applied to just the VC player
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8))))
       :rthm-seq-map '((1 ((vn (1 1 1 1))
                               (vc (1 1 1 1))))))
      (auto-clefs mini :players '(vc)))

=> T
```

**SYNOPSIS:**

```
(defmethod auto-clefs ((sc slippery-chicken)
                      &key verbose in-c players
                      (delete-clefs t)
                      (delete-marks-before nil))
```

**13.17 slippery-chicken-edit/auto-slur**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Automatically add slurs to note groups in the specified measure range of a given player's part.

This method places slurs above all consecutive notes between rests. If a value is specified for `:end-bar` and the last event in the end bar is not a rest, the final sequence of attacked notes in that bar will not be slurred.

NB: Slurs will automatically stop at repeated pitches. Staccato marks will not stop the auto-slurring process but staccatos can be removed (see below).

**ARGUMENTS:**

- A `slippery-chicken` object.

- A player ID or list of player IDs for the parts in which the slurs are to be placed.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :start-bar. An integer that is the first bar in which to automatically place slurs.
- :end-bar. An integer that is the last bar in which to automatically place slurs.
- :rm-slurs-first. T or NIL to indicate whether to first remove existing slurs from the specified region. NB: If you already have slur marks attached to events, setting this to NIL can produce unwanted results caused by orphaned beg-slur or end-slur marks. T = remove existing slurs first. Default = T.
- :rm-staccatos. T or NIL to indicate whether to first remove existing staccato, tenuto, and accented staccato marks from the specified region. T = remove staccatos. Default = NIL.
- :over-accents. T or NIL. Default = T.
- :verbose. T or NIL to indicate whether to print feedback from the process to the Lisp listener. T = print. Default = NIL.

### RETURN VALUE:

A list of sublists, each of which contains the start and end event, plus the number of notes under the slur, for each slur added.

### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vn (violin :midi-channel 1))))
        :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c3 d3 e3 f3 g4 a3 b3
                        c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(1 (1 1 1)))
      :rthm-seq-palette '(1 (((4 4) - e e - (s) e.
                              - s s e - - s (s) s s -))
                          :pitch-seq-palette ((1 2 3 4 5 6 7 8 9))
                          :marks (a 4))))
      :rthm-seq-map '(1 ((vn (1 1 1))))))
(auto-slur mini 'vn
  :start-bar 1
  :end-bar 2))
```

**SYNOPSIS:**

```
(defmethod auto-slur ((sc slippery-chicken) players
  &key start-bar end-bar
  (rm-slurs-first t)
  (rm-staccatos t)
  ;; 5.4.11
  (over-accents t)
  verbose)
```

**13.18 slippery-chicken-edit/bars-to-sc**

[ *slippery-chicken-edit* ] [ *Functions* ]

**DESCRIPTION:**

Take a list of `rthm-seq-bars` and add them to a new or existing `slippery-chicken` object. If already existing, we assume it's one you're creating part by part with this function, as it's not currently possible to add a part like this in the middle of the score--the new part will be added to the end of the last group of the ensemble (bottom of score) so make sure to add parts in the order you want them.

NB Bear in mind that if you want to use `midi-play`, then the events in the bars will need to have their `midi-channel` set (e.g. via `make-event`). It's the caller's responsibility that any parts added have the same `time-signature` structure as any existing part.

**ARGUMENTS:**

- A list of `rthm-seq-bars`

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:sc`. Either an existing `slippery-chicken` object or `nil` if one should be created automatically. If `nil`, the following three arguments must be specified, otherwise they will be ignored. Default = `NIL`.
- `:sc-name`. The name (symbol) for the `slippery-chicken` object to be created. This will become a global variable. Default = `'*auto*`.
- `:player`. The name (symbol) of the player to create. Default = `'player-one`. (Remember that Lilypond has problems with player names with numbers in them `:/` )
- `:instrument`. The id (symbol) of an already existing instrument in the `instrument-palette`. Default = `'flute`.

- :update. Whether to call update-slots on the new slippery-chicken object. Default = t.
- :section-id. The section id. Default = 1.

**RETURN VALUE:**

A slippery-chicken object.

**EXAMPLE: SYNOPSIS:**

```
(defun bars-to-sc (bars &key sc (sc-name '*auto*) (player 'player-one)
                  (instrument-palette
                   +slippery-chicken-standard-instrument-palette+)
                  (instrument 'flute) (section-id 1) (update t))
```

**13.19 slippery-chicken-edit/change-pitch**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Change the pitch of a specified event to a new specified pitch. The new pitch is not required to be a member of the current set.

NB The new pitch is the sounding pitch if a transposing instrument.

NB This doesn't update following tied-to notes.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the bar number in which the pitch is to be changed.
- An integer that is the number of the note in the specified bar whose pitch is to be changed.
- The ID of the player for whom the pitch is to be changed.
- A note-name symbol that is the new pitch.

**OPTIONAL ARGUMENTS:**

T or NIL to indicate whether the written or sounding pitch should be changed. Default = NIL (sounding).

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
        :set-map '((1 (1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vc (1 1 1 1)))))))
  (change-pitch mini 1 3 'vc 'fs3))

=> T
```

**SYNOPSIS:**

```
(defmethod change-pitch ((sc slippery-chicken) bar-num note-num player
                        new-pitch &optional written)
```

**13.20 slippery-chicken-edit/change-pitches**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Change the pitches of the specified event objects for a given player to the specified new pitches.

If the new pitches are passed as a simple flat list, the method will just change the pitch of each consecutive event object (with NIL indicating no change), moving from bar to bar as necessary, until all of the specified new pitches are used up. Also, if a flat list is passed, each new pitch specified will be applied to each consecutive attacked note; i.e., ties don't count as new pitches.

Also see the documentation in the bar-holder class for the method of the same name.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player whose part is to be modified.
- An integer that is the number of the first bar whose pitches are to be

modified.

- A list note-name symbols and NILs, or a list of lists of note-name symbols and NILs, which are the new pitches. If a simple flat list, see the comment in the description above. If a list of lists, each sub-list will represent a full bar; e.g., (change-pitches bh 'vla 5 '((g3 gs4) nil (nil nil aqf5))) will change the pitches in bars 5 and 7 (for the player 'vla), whereas bar six, indicated by nil, wouldn't be changed; similarly the first two notes of bar 7, being nil, will also not be changed, but note 3 will.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :use-last-octave. T or NIL to indicate whether or not each consecutive new pitch listed will automatically take the most recent octave number specified; e.g. '((a3 b g cs4)). T = use last octave number. Default = T.
- :marks. A list of marks to be added to the events objects. This option can only be used in conjunction with the simple flat list of pitches. In this case the list of pitches and list of marks must be the same length and correspond to each other item by item. Sub-lists can be used to add several marks to a single event. NB: See cmn.lsp:get-cmn-marks for the list of recognised marks. If NIL, no marks will be added. Default = NIL.
- :written. T or NIL to indicate whether these are the written or sounding notes for a transposing instrument. Default = NIL.
- :warn. If there are more pitches in the given list than there are events in the slippery-chicken structure, issue a warning, unless NIL. Default = T.

### RETURN VALUE:

If a the new pitches are passed as a simple flat list, the method returns the number of the bar in which the pitches were changed; otherwise returns T.

### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
        :set-map '((1 (1 1 1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
```

```

      :rthm-seq-map '((1 ((vc (1 1 1 1 1))))))
    (change-pitches mini 'vc 2 '((fs3 gs3 as3)))
    (change-pitches mini 'vc 3 '((nil nil fs3 gs as ds fs gs)
                                   nil
                                   (cs4 ds fs))))

```

=> T

## SYNOPSIS:

```

(defmethod change-pitches ((sc slippery-chicken) player start-bar new-pitches
  &key (use-last-octave t) marks written
  (warn t))

```

## 13.21 slippery-chicken-edit/change-time-sig

[ *slippery-chicken-edit* ] [ *Methods* ]

### DESCRIPTION:

Force a change of the time-sig associated with a specified bar.

NB: This method does not check to see if the rhythms in the bar add up to a complete bar in the new time-sig.

Also see `rthm-seq-bar` (`setf time-sig`).

### ARGUMENTS:

- A `slippery-chicken` object.
- An integer that is the number of the bar whose time signature should be changed or a list that is a reference to the bar whose time signature is to be changed in the format (section sequence bar).
- The new signature in the format (number-of-beats beat-unit).

### RETURN VALUE:

Returns T.

### EXAMPLE:

```

;;; Changing two time signatures; once using the integer bar reference, the
;;; second time using the list reference to the bar number.
(let ((mini
      (make-slippery-chicken

```

```

'+mini+
:ensemble '(((vc (cello :midi-channel 1))))
:tempo-map '((1 (q 60)))
:set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
:set-map '((1 (1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                        :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
:rthm-seq-map '((1 ((vc (1 1 1 1))))))
(change-time-sig mini 2 '(3 8))
(change-time-sig mini '(1 1 1) '(5 8))

```

=> T

## SYNOPSIS:

```
(defmethod change-time-sig ((sc slippery-chicken) bar-num-or-ref new-time-sig)
```

## 13.22 slippery-chicken-edit/delete-bars

[ *slippery-chicken-edit* ] [ *Methods* ]

### DESCRIPTION:

Delete a sequence of consecutive bars from the given slippery-chicken object.

NB This might delete rehearsal letters, instrument changes (and maybe other things) attached to a bar/event.

### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the first bar to delete.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :num-bars. An integer that is the number of consecutive bars, including the start-bar, to delete. This argument cannot be used simultaneously with :end-bar
- :end-bar. An integer that is the number of the last of the consecutive bars to delete. This argument cannot be used simultaneously with :num-bars.
- :print. Print feedback of the process to the Listener, including a print-simple of the bars deleted.



**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
        :set-map '((1 (1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vc (1 1 1 1)))))))
  (delete-bars mini 2 :end-bar 3)
  (delete-bars mini 2 :num-bars 1))

=> T
```

**SYNOPSIS:**

```
(defmethod delete-bars ((sc slippery-chicken) start-bar
                        &key num-bars end-bar print)
```

**13.23 slippery-chicken-edit/delete-clefs**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Delete the clef symbol held in the MARKS-BEFORE slot of the specified event object within the given slippery-chicken object.

**ARGUMENTS:**

NB: The optional arguments are actually required.

- A slippery-chicken object.
- The ID of the player from whose part the clef symbol is to be deleted.
- An integer that is the number of the bar from which the clef symbol is to be deleted.
- An integer that is the number of the event object within the specified from whose MARKS-BEFORE slot the clef symbol is to be deleted. This is a 1-based index but counts rests and ties.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
        :set-map '((1 (1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vc (1 1 1 1))))))
  (auto-clefs mini)
  (delete-clefs mini 'vc 1 3))

=> NIL
```

**SYNOPSIS:**

```
(defmethod delete-clefs ((sc slippery-chicken) &optional
  player bar-num event-num)
```

**13.24 slippery-chicken-edit/delete-events**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

21-Jul-2011 (Pula)

**DESCRIPTION:**

Turn notes into rests by setting the IS-REST slots of the specified consecutive event objects within the given slippery-chicken object to T.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the first bar for which the notes are to be changed to rests.

- An integer that is the index of the first event object within the specified start bar for which the IS-REST slot is to be changed to T. This number is 1-based and counts rests and ties.
- An integer that is the number of the last bar for which the notes are to be changed to rests.
- An integer that is the index of the last event object within the specified end bar for which the IS-REST slot is to be changed to T. This number is 1-based and counts rests and ties. If NIL, apply the change to all events in the given bar.

**OPTIONAL ARGUMENTS:**

- A list of the IDs of the players whose parts are to be modified. If NIL, apply the method to the parts of all players.
- T or NIL to indicate whether to consolidate resulting consecutive rests into one longer rest each. T = consolidate. Default = T.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vc (1 1 1 1))))))
      (delete-events mini 2 2 3 nil 'vc))
```

=> T

**SYNOPSIS:**

```
(defmethod delete-events ((sc slippery-chicken) start-bar start-event end-bar
                          end-event &optional players (consolidate-rests t))
```

**13.25 slippery-chicken-edit/delete-rehearsal-letter**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Delete the rehearsal letter from a specified bar of on or more specified players' parts by setting the REHEARSAL-LETTER slot of the corresponding rthm-seq-bar object to NIL.

NB: This deletes the given rehearsal letter without resetting and re-ordering the remaining rehearsal letters.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar from which the rehearsal letter is to be deleted. NB: The rehearsal letter for a given bar is internally actually attached to the previous bar. The number given here is the number from the user's perspective, but the change will be reflected in the bar with the number specified -1.

**OPTIONAL ARGUMENTS:**

- A list consisting of the IDs of the players from whose parts the rehearsal letter is to be deleted.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '(1 (((4 4) e e e e e e e e))
                             :pitch-seq-palette ((1 2 3 4 5 6 7 8))))
      :rthm-seq-map '(1 ((vc (1 1 1 1 1 1))))
      :rehearsal-letters '(2 4 6)))
  (delete-rehearsal-letter mini 2 '(vc)))

=> NIL
```

**SYNOPSIS:**

```
(defmethod delete-rehearsal-letter ((sc slippery-chicken) bar-num
                                     &optional players)
```

### 13.26 slippery-chicken-edit/delete-slur

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Delete a slur mark that starts on a specified note within a specified bar of a specified player's part by deleting the BEG-SL and END-SL marks from the corresponding event objects.

#### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the number of the bar from which the slur is to be deleted.
- An integer that is the number of the note on which the slur to be deleted starts within the given bar. This number counts tied-notes but not rests.
- The ID of the player from whose part the slur is to be deleted.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8))
                                :marks (slur 1 8))))
      :rthm-seq-map '((1 ((vc (1 1 1 1 1 1))))))
  (delete-slur mini 1 1 'vc)
  (delete-slur mini 3 1 'vc))
```

=> NIL

**SYNOPSIS:**

```
(defmethod delete-slur ((sc slippery-chicken) bar-num note-num player)
```

**13.27 slippery-chicken-edit/double-events**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

20-Jul-2011 (Pula)

**DESCRIPTION:**

Copy the specified events from one player to the corresponding bars of one or more other players.

NB: Although partial bars can be copied from the source player, the entire bars of the target players are always overwritten, resulting in rests in those segments of the target players' bars that do not contain the copied material. This method thus best lends itself to copying into target players parts that have rests in the corresponding bars.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player from whose part the events are to be copied.
- The ID or a list of IDs of the player or players into whose parts the copied events are to be placed.
- An integer that is the number of the first bar from which the events are to be copied.
- An integer that is the number of the first event to be copied from the specified start bar. This number is 1-based and counts rests and ties.
- An integer that is the number of the last bar from which the events are to be copied.
- NIL or an integer that is the number of the last event to be copied from the specified end bar. This number is 1-based and counts rests and ties. If NIL, all event from the given bar will be copied.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :transposition. A positive or negative number that is the number of semitones by which the copied material is to be first transposed. This number can be a decimal number, in which case the resulting pitches will

be rounded to the nearest microtone (if the current tuning environment is capable of microtones).

- :consolidate-rests. T or NIL to indicate whether resulting consecutive rests should be consolidated each into one longer rest.  
T = consolidate. Default = T.
- :update. T or NIL to indicate whether to update the slots of the given slippery-chicken object after copying. T = update. Default = T.

#### RETURN VALUE:

Returns T

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((bsn (bassoon :midi-channel 1))
                        (tbn (tenor-trombone :midi-channel 2))
                        (vlc (cello :midi-channel 3)))))
      :tempo-map '(1 (q 60)))
      :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) (w)))))
                        (2 (((4 4) e e e e e e e e)))
                        :pitch-seq-palette ((1 2 3 4 5 6 7 8))))
      :rthm-seq-map '((1 ((bsn (1 1 1 1 1 1))
                          (tbn (1 1 1 1 1 1))
                          (vlc (2 2 2 2 2 2))))))
  (double-events mini 'vlc '(bsn tbn) 2 3 4 2)
  (double-events mini 'vlc 'bsn 5 1 5 nil :transposition 3.5))

=> T
```

#### SYNOPSIS:

```
(defmethod double-events ((sc slippery-chicken) master-player doubling-players
                          start-bar start-event end-bar end-event
                          &key transposition (consolidate-rests t) (update t))
```

### 13.28 slippery-chicken-edit/enharmonic-spellings

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Change the pitch of specified event objects to their enharmonic equivalents.

This takes as its second argument a list of lists, each of which consists of the ID of the player whose part is to be altered and a series of bar-number/event-number pairs, where (2 3) indicates that the pitch of the third event of the second bar is to be changed to its enharmonic equivalent.

Pitches within chords are specified by following the bar number with a 2-item list consisting of the event number and the number of the pitch within the chord, counting from low to high, where (2 (2 4)) indicates that the fourth pitch from the bottom of the chord located in the second event object of bar 2 should be changed to its enharmonic equivalent.

An optional T can be included to indicate that the written pitch is to be changed, but not the sounding pitch, as in (cl (3 4 t)).

NB: In order for this method to work, the :respell-notes option of cmn-display and write-lp-data-for-all must be set to NIL.

#### ARGUMENTS:

- A slippery-chicken object.
- The list of changes to be made, in the format '((player changes...)), e.g.:

```
'((cl (3 3 t) (3 4 t))
  (pn (2 (2 4)))
  (vc (1 1) (1 3) (1 4) (1 6)))
```

#### RETURN VALUE:

Returns T.

#### EXAMPLE: SYNOPSIS:

```
(defmethod enharmonic-spellings ((sc slippery-chicken) corrections)
```

### 13.29 slippery-chicken-edit/enharmonics

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:



Change the sharp/flat pitches of a specified region of a specified player's part to their enharmonic equivalent.

NB: This method only affects pitches that already have sharp/flat accidentals. It does not affect "white-key" notes (e.g. C-natural = B-sharp etc.)

NB: As the `cmn-display` and `write-lp-data-for-all` methods call `:respell-notes` by default, this option must be explicitly set to `NIL` for this method to be effective.

#### ARGUMENTS:

- A slippery-chicken object.
- An integer or a 2-item list of integers that indicates the first bar in which the enharmonics are to be changed. If an integer, the method will be applied to all sharp/flat pitches in the bar of that number. If a 2-item list of integers, these represent '(bar-number note-number). The note number is 1-based and counts ties.
- An integer or a 2-item list of integers that indicates the last bar in which the enharmonics are to be changed. If an integer, the method will be applied to all sharp/flat pitches in the bar of that number. If a 2-item list of integers, these represent '(bar-number note-number). The note number is 1-based and counts ties.
- The ID of the player whose part is to be changed.

#### OPTIONAL ARGUMENTS:

keyword arguments

- `:written`. T or NIL to indicate whether to change written-only pitches or sounding-only pitches. T = written-only. Default = T.
- `:pitches`. NIL or a list of note-name symbols. If NIL, all sharp/flat pitches in the specified region will be changed to their enharmonic equivalents. If a list of one or more note-name symbols, only those pitches will be affected.
- `:force-naturals`. T or NIL to indicate whether to force "natural" note names that contain no F or S in their name to convert to their enharmonic equivalent (ie, B3 = CF4). NB double-flats/sharps are not implemented so this will only work on F/E B/C.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (pn (piano :midi-channel 2))
                        (vn (violin :midi-channel 3))))
       :set-palette '((1 ((cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) - e e e e - - e e e e -))
                                :pitch-seq-palette ((1 (2) 3 4 (5) 6 (7) 8)))))
      :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                           (pn (1 1 1 1 1))
                           (vn (1 1 1 1 1)))))))
  (enharmonics mini 1 2 'vn)
  (enharmonics mini 2 3 'pn :pitches '(cs4 ds4))
  (enharmonics mini 3 4 'cl :written nil))

=> T

```

**SYNOPSIS:**

```

(defmethod enharmonics ((sc slippery-chicken) start end player
                        &key (written t) pitches force-naturals)

```

**13.30 slippery-chicken-edit/force-artificial-harmonics**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

For string scoring purposes only: Transpose the pitch of the given event object down two octaves and add the harmonic symbol at the perfect fourth.

If this results in a fingered pitch (or even a touched perfect fourth) that is out of the range of the instrument, a warning will be printed to the Listener, the pitch will not be transposed, and the harmonic diamond will not be added.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player whose part is to be changed.
- An integer that is the number of the first bar in which artificial harmonics are to be created.
- An integer that is the number of the first event in that bar that is to

be changed into an artificial harmonic.

- An integer that is the number of the last bar in which artificial harmonics are to be created.

#### OPTIONAL ARGUMENTS:

- An integer that is the number of the first event in that bar that is to be changed into an artificial harmonic. If no end-event is specified, all event objects in the last bar will be changed to artificial harmonics.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c4 f4 b4 e5 a5 d6 g7 c8))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vn (1 1 1))))))
      (force-artificial-harmonics mini 'vn 2 3 3 2))
```

=> T

#### SYNOPSIS:

```
(defmethod force-artificial-harmonics ((sc slippery-chicken) player start-bar
                                       start-event end-bar &optional end-event)
```

### 13.31 slippery-chicken-edit/force-rest-bars

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Delete all notes from the specified bars and replace them with full-bar rests.

NB: The start-bar and end-bar index numbers are inclusive

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the first bar to change to a full bar of rest.
- An integer that is the number of the last bar to change to a full bar of rest.
- A list containing the IDs of the players in whose parts the full-bar rests are to be forced.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                       (va (viola :midi-channel 2))
                       (vc (cello :midi-channel 3)))))
      :tempo-map '(1 (q 60)))
      :set-palette '((1 ((c4 e4 g4 b4 d5 f5 a5 c6))))
      :set-map '(1 (1 1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                               :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vn (1 1 1 1 1 1))
                           (va (1 1 1 1 1 1))
                           (vc (1 1 1 1 1 1))))))
      (force-rest-bars mini 3 5 '(vn vc)))

=> NIL
```

**SYNOPSIS:**

```
(defmethod force-rest-bars ((sc slippery-chicken) start-bar end-bar players)
```

**13.32 slippery-chicken-edit/map-over-bars**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Apply the specified method/function to the bars (all rthm-seq-bar objects) of one or more players' parts in the given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- A number that is the first bar to which the function should be applied.
- A number that is the last bar to which the function should be applied.
- A list of the IDs of the players to whose parts the function should be applied. Can also be a single symbol.
- The method or function itself. This can be a user-defined function or the name of an existing method or function. It should take at least one argument, a rthm-seq-bar, and any other arguments as supplied.

**OPTIONAL ARGUMENTS:**

- Any additional argument values the specified method/function may take or require.

**RETURN VALUE:**

- A list of the rthm-seq-bar objects that were modified. NB This might be a long list, and, depending on your Lisp implementation, formatting of the bars might cause Lisp to appear to 'hang'.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))))
       :instrument-change-map '(((1 ((sax ((1 alto-sax) (3 tenor-sax))))
                                     (2 ((sax ((2 alto-sax) (5 tenor-sax))))
                                     (3 ((sax ((3 alto-sax) (4 tenor-sax))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h e (s) (s) e+s+s))
                              :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '(((1 ((sax (1 1 1 1 1)))
                           (2 ((sax (1 1 1 1 1)))
                           (3 ((sax (1 1 1 1 1)))))))
      (print (map-over-bars mini 1 nil nil #'consolidate-notes nil 'q)))

=>
(
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: T, bar-num: 1,
```

```
[...]
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: T, bar-num: 2,
[...]
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: T, bar-num: 3,
[...]
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: T, bar-num: 4,
[...]
)
```

**SYNOPSIS:**

```
(defmethod map-over-bars ((sc slippery-chicken) start-bar end-bar players
                          function &rest further-args)
```

**13.33 slippery-chicken-edit/move-clef**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Move a specified clef from a specified event object to another.

NB: As the :auto-clefs option of cmn-display and write-lp-data-for all first deletes all clefs before automatically placing them, this argument must be set to NIL. The auto-clefs method can be called outside of the cmn-display or write-lp-data-for-all methods instead.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the given clef is located.
- An integer that is the number of the event object in the given bar to which the given clef is attached.
- An integer that is the number of the bar to which the given clef is to be moved (this can be the same bar).
- An integer that is the number of the event object in the new bar to which the given clef is to be attached.
- The ID of the player in whose part the clef is to be moved.

**RETURN VALUE:**

Returns the value of the MARKS-BEFORE slot of the event object to which the clef is moved.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
        :set-map '((1 (1 1 1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8)))))
      :rthm-seq-map '((1 ((vc (1 1 1 1)))))))
  (auto-clefs mini)
  (move-clef mini 1 6 1 8 'vc)
  (cmn-display mini :auto-clefs nil))
```

**SYNOPSIS:**

```
(defmethod move-clef ((sc slippery-chicken) from-bar from-event
                     to-bar to-event player)
```

**13.34 slippery-chicken-edit/move-events**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

20-Jul-2011 (Pula)

**DESCRIPTION:**

Move a specified sequence of consecutive event objects from one player to another, deleting the events from the source player.

NB: Although partial bars can be moved from the source player, the entire bars of the target players are always overwritten, resulting in rests in those segments of the target players' bars that do not contain the moved material. This method thus best lends itself to moving into target players parts that have rests in the corresponding bars.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the source player.
- The ID of the target player.

- A number that is the first bar from which events are to be moved.
- A number that is the first event within the start-bar that is to be moved.
- A number that is the last bar from which events are to be moved.
- A number that is the last event within the end-bar that is to be moved.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :transposition. A positive or negative number that is the number of semitones by which the copied material is to be first transposed. This number can be a decimal number, in which case the resulting pitches will be rounded to the nearest microtone (if the current tuning environment is capable of microtones).
- :consolidate-rests. T or NIL to indicate whether resulting consecutive rests should be consolidated each into one longer rest.  
T = consolidate. Default = T.

### RETURN VALUE:

Returns T.

### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((bn (bassoon :midi-channel 1))
                        (vc (cello :midi-channel 2)))))
      :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
      :set-map '(1 (1 1 1 1)))
      :rthm-seq-palette '(1((((4 4) e e e e e e e))
                             :pitch-seq-palette ((1 2 3 4 5 6 7 8)))
                             (2((((4 4) (w)))))
      :rthm-seq-map '(1 ((bn (1 1 1 1))
                          (vc (2 2 2 2))))))
  (move-events mini 'bn 'vc 2 3 3 2)
  (move-events mini 'bn 'vc 4 1 4 2 :transposition 4.5))

=> T
```

### SYNOPSIS:



```
(defmethod move-events ((sc slippery-chicken) from-player to-player
                        start-bar start-event end-bar end-event
                        &key transposition (consolidate-rests t))
```

### 13.35 slippery-chicken-edit/note-add-bracket-offset

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

For CMN only: Adjust the position, lengths, and angles of the tuplet bracket attached to a specified event object.

NB: The bracket data is stored in the BRACKET slot of the first event object of a given tuplet figure.

#### ARGUMENTS:

- A slippery-chicken object.
- An integer that is the number of the bar in which the tuplet bracket is located.
- An integer that is the event to which the tuplet bracket is attached. Tuplet brackets are attached to the first event object of a given tuplet figure.
- The ID of the player in whose part the tuplet bracket is located.

#### OPTIONAL ARGUMENTS:

keyword arguments:

NB: At least one of these arguments must be set in order to create a change.

- :dx. A positive or negative decimal number to indicate the horizontal offset of the entire bracket.
- :dy. A positive or negative decimal number to indicate the vertical offset of the entire bracket.
- :dx0. A positive or negative decimal number to indicate the horizontal offset of the left corner of the bracket.
- :dy0. A positive or negative decimal number to indicate the vertical offset of the left corner of the bracket.
- :dx1. A positive or negative decimal number to indicate the horizontal offset of the right corner of the bracket.
- :dy1. A positive or negative decimal number to indicate the vertical offset of the right corner of the bracket.
- :index. An integer that indicates which bracket of a nested bracket on the same event is to be affected. 0 = outermost bracket, 1 = first nested bracket, etc. Default = 0.

**RETURN VALUE:**

Returns a list of the bracket start/end indicator and the tuplet value followed by the offset values passed to the keyword arguments.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((f3 g3 a3 b3))))
        :set-map '((1 (1)))
        :rthm-seq-palette '((1 (((2 4) { 3 te te te } q ))
                                :pitch-seq-palette ((1 2 3 4)))))
      :rthm-seq-map '((1 ((vc (1)))))))
      (note-add-bracket-offset mini 1 1 'vc
        :dx -.1 :dy -.3
        :dx0 -.1 :dy0 -.4
        :dx1 .3 :dy1 -.1))

=> (1 3 -0.1 -0.3 -0.1 -0.4 0.3 -0.1)
```

**SYNOPSIS:**

```
(defmethod note-add-bracket-offset ((sc slippery-chicken)
                                     bar-num note-num player
                                     &key (dx nil) (dy nil)
                                     (dx0 nil) (dy0 nil)
                                     (dx1 nil) (dy1 nil)
                                     (index 0))
```

**13.36 slippery-chicken-edit/process-events-by-time**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Apply the given function to all event objects within the given measure range in order of their chronological occurrence. The function can take one argument only: the current event object. NB If the time of the event is needed it can be accessed in the given function via the event's start-time slot.

**ARGUMENTS:**

- A slippery-chicken object.
- A function (or variable to which a function has been assigned).

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :start-bar. An integer that is the first bar in which the function is to be applied to event objects. Default = 1.
- :end-bar. NIL or an integer that is the last bar in which the function is to be applied to event objects. If NIL, the function will be applied to all event objects of all bars in the given slippery-chicken object. Default = NIL.

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((marks (make-cscl '(a s as te ts at))))
  (defun add-random-marks (event)
    (unless (is-rest event)
      (setf (marks event) (list (get-next marks))))))

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                       (va (viola :midi-channel 2))
                       (vc (cello :midi-channel 3))))
      :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4))))
      :set-map '((1 (1 1 1)))
      :rthm-seq-palette '((1 (((3 4) s (e.) (s) s (e) (e) s (s)))
                              :pitch-seq-palette ((1 2 3)))
                          (2 (((3 4) (s) s (e) (e) s (s) s (e.)))
                              :pitch-seq-palette ((1 2 3)))
                          (3 (((3 4) (e) s (s) s (e.) (s) s (e)))
                              :pitch-seq-palette ((1 2 3))))))
      :rthm-seq-map '((1 ((vn (1 2 3))
                          (va (2 3 1))
                          (vc (3 1 2))))))
  (process-events-by-time mini #'add-random-marks))
```

**SYNOPSIS:**

```
(defmethod process-events-by-time ((sc slippery-chicken) function
                                   &key (start-bar 1) end-bar)
```

### 13.37 slippery-chicken-edit/re-bar

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Arrange the events of specified consecutive bars in a given slippery-chicken object into new bars of a different time signature. If the number of beats in the specified series of events does not fit evenly into full measures of the the specified time signature, the method will do its best to create occasional bars of a different time-signature that are as close as possible to the desired length.

This method will only combine existing short bars into longer ones; it won't split up longer bars and recombine them.

NB: This method should not be confused with the rebar method.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

keyword arguments

- :start-bar. An integer that is the number of the first bar whose events are to be re-barred.
- :end-bar. An integer that is the number of the last bar whose events are to be re-barred.
- :min-time-sig. A time signature in the form of a 2-item list containing the number of beats and the beat unit; e.g. '(3 4). This is a target time signature from which the method may occasionally if the number of events does not fit evenly into full bars of the specified time signature.
- :verbose. T or NIL to indicate whether to print feedback on the re-barring process to the Listener. T = print feedback. Default = NIL.
- :check-ties. T or NIL to indicate whether to force the method to ensure that all ties have a beginning and ending. T = check. Default = T.
- :auto-beam. T, NIL, or an integer. If T, the method will automatically attach beam indications to the corresponding events according to the beat unit of the time signature. If an integer, the method will beam in accordance with a beat unit that is equal to that integer. If NIL, the

method will not automatically place beams. Default = T.  
 - :update-slots. T or NIL to indicate whether to update all slots of the given slippery-chicken object after applying the method. This is an internal argument and will generally not be needed by the user.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1 1 1))))))
      (re-bar mini :start-bar 2 :end-bar 5 :min-time-sig '(4 4) :auto-beam 4))

=> T
```

**SYNOPSIS:**

```
(defmethod re-bar ((sc slippery-chicken)
                  &key start-bar
                  end-bar
                  ;; the following is just a list like '(3 8) '(5 8)
                  min-time-sig
                  verbose
                  ;; MDE Thu Feb 9 10:36:02 2012 -- seems if we don't
                  ;; update-slots then the new bar structure isn't displayed
                  (update-slots t)
                  (check-ties t)
                  ;; could also be a beat rhythmic unit
                  (auto-beam t))
```

**13.38 slippery-chicken-edit/remove-extraneous-dynamics**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

A post-generation editing method: If two or more consecutive event objects have the same dynamic, remove that dynamic marking from all but the first of these.

#### ARGUMENTS:

- A slippery-chicken object.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))
                                :marks (f 1 f 2 f 3 f 4))))
      :rthm-seq-map '((1 ((vn (1 1 1 1 1 1 1))))))
      (remove-extraneous-dynamics mini))

=> T
```

#### SYNOPSIS:

```
(defmethod remove-extraneous-dynamics ((sc slippery-chicken))
```

### 13.39 slippery-chicken-edit/replace-events

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Replace one or more consecutive existing event objects with new event objects. All references are 1-based. This method can be applied to only one bar at a time.

One or more new event objects can be specified as a replacement for one single original event object.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player whose part is to be modified.
- An integer that is the number of the bar in which the change is to be made; or a reference to the bar in the format '(section sequence bar).
- An integer that is the number of the first event object in the given bar to replace.
- An integer that is the total number of consecutive original event objects to replace.
- A list of the new event objects, each in turn specified as a 2-item list in the format (pitch rhythm), e.g. '((c4 e)). Rests are indicated with NIL or 'r, e.g. (nil s) (r h). Chords are indicated by enclosing the pitches of the chord in a list, e.g. ((c4 e4) e).

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to automatically re-beam the given bar after replacing the events. T = beam. Default = NIL.
- A list of integers to indicate tuplet bracket placement, in the format '(tuplet-value start-event end-event). These numbers are 0-based and inclusive and count rests.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c2 e2 d4 e4 f4 g4 a4 f5))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s s))
                                :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vn (1 1 1 1))))))
      (replace-events mini 'vn 1 2 1 '((nil s) ((ds5 fs5) s)) t)
      (replace-events mini 'vn 2 2 1 '((cs5 e)))
      (replace-events mini 'vn '(1 3 1) 3 1 '((df4 s)))
      (replace-events mini 'vn 4 1 1 '((ds4 te) (r te) (b3 te)) t '(3 0 2)))

=> T
```

**SYNOPSIS:**

```
(defmethod replace-events ((sc slippery-chicken) player bar-num start-event
                           replace-num-events new-events
                           &optional (auto-beam nil) tuplet-brackets)
```

**13.40 slippery-chicken-edit/replace-multi-bar-events**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Replace specified consecutive event objects across several bars.

The new rhythms provided must produce full bars for all bars specified; i.e., if only a quarter note is provided as the new event for a 2/4 bar, the method will not automatically fill up the remainder of the bar.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the player whose part is to be modified.
- An integer that is the number of the first bar in which event objects are to be replaced. This can be an absolute bar number or a list in the form '(section sequence bar); or with subsections then e.g. '((3 1) 4 2)).
- An integer that is the number of bars in which event objects will be replaced.
- The list of new event objects. The new event objects can be passed as complete event objects; as a list of 2-item lists that are note-name/rhythm pairs, e.g: '((c4 q) (d4 e)); or as a list with two sub-lists, the first being just the sequence of rhythms and the second being just the sequence of pitches, e.g: '((q e ) (c4 d4)). For the latter, :interleaved must be set to NIL. (see :interleaved below). Pitch data is the usual cs4 or (cs4 cd3) for chords, and NIL or 'r indicate a rest. NB: All pitches are sounding pitches; written pitches will be created for transposing instruments where necessary.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :interleaved. T or NIL to indicate whether the new event data is to be processed as a list of note-name/rhythm pairs (or existing event objects), or if it is to be processed as a list with two sub-lists, the first containing the sequence of rhythms and the second containing the sequence of pitches (see above). T = interleaved, i.e. already existing





```

(replace-multi-bar-events mini 'vn '(2 2 2) '3
      '((h h h) (cs5 (ds5 fs5) nil))
      :interleaved nil)
(replace-multi-bar-events mini 'vn 1 1
      '((nil e) (nil e) (nil e) (cs4 e))
      :consolidate-rests t)
(replace-multi-bar-events mini 'vn 8 1
      '((nil q) (b3 e) (cs4 s) (ds4 s))
      :auto-beam t))

=> 4

```

**SYNOPSIS:**

```

(defmethod replace-multi-bar-events ((sc slippery-chicken)
      player start-bar num-bars new-events
      &key
      ;; 24.3.11: see above.
      (interleaved t)
      ;; MDE Mon Apr 23 12:36:08 2012 -- changed
      ;; default to nil
      (consolidate-rests nil)
      ;; for consolidate rests
      (beat nil)
      ;; MDE Mon Apr 23 12:36:08 2012 -- changed
      ;; default to nil
      (auto-beam nil)
      ;; 31.3.11: if this is t, then rthms > a
      ;; beat will case an error
      (auto-beam-check-dur t)
      (tuplet-bracket nil))

```

**13.41 slippery-chicken-edit/replace-tempo-map**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Replace the tempo data for a given slippery-chicken object with new specified tempo indications.

Calls not only the setf method - which converts bar references like (section-num sequence-num bar-num) to numbers and makes a tempo-map object, but also updates all event objects to reflect new start times etc.

**ARGUMENTS:**

- A slippery-chicken object
- A list that is the new tempo-map.

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((pno (piano :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '(((1 ((c4 d4 f4 g4 a4 c5 d5 f5 g5 a5 c6))))
        :set-map '(((1 (1 1 1 1 1 1 1 1)))
        :rthm-seq-palette '(((1 (((2 4) q q))
                                :pitch-seq-palette ((1 (2))))))
        :rthm-seq-map '(((1 ((pno (1 1 1 1 1 1 1 1)))))))
      (replace-tempo-map mini '((1 (q 60 "Andante")) ((1 3 1) (e 80)))))
```

=&gt; T

**SYNOPSIS:**

```
(defmethod replace-tempo-map ((sc slippery-chicken) tm)
```

**13.42 slippery-chicken-edit/respell-bars**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Look for enharmonically equivalent pitches in the same bar and try to unify their spelling. The method applies this process to every bar in the given slippery-chicken object.

Also see rthm-seq-bar/respell-bar and slippery-chicken/respell-notes.

**ARGUMENTS:**

- A slippery-chicken object.

**RETURN VALUE:**

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vn (violin :midi-channel 1))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((cs4 ds4 df5 ef5))))
        :set-map '((1 (1 1 1 1 1)))
        :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))))
        :rthm-seq-map '((1 ((vn (1 1 1 1 1))))))
      (respell-bars mini))
```

=> T

#### SYNOPSIS:

```
(defmethod respell-bars ((sc slippery-chicken))
```

### 13.43 slippery-chicken-edit/respell-notes

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Pass through the entire given slippery-chicken object and change some of the pitch objects to their enharmonic equivalents to produce more sensible spellings of consecutive pitches in the score.

An optional argument takes a list specifying which pitches to change in the same format found in the method enharmonic-spellings; i.e.

'((player (bar note-num))). These notes are changed after the respelling routine has run.

NB: If a list of corrections is specified, the :respell-notes argument of any subsequent call to cmn-display or write-lp-data-for-all must be set NIL, otherwise the modified pitches may be overwritten. Also, although this algorithm corrects tied notes when respelling, notes referenced in the corrections list will not be followed through to any subsequent ties.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

- A list of specific notes whose pitches are to be enharmonically flipped, in the format, e.g. '((vn (1 1) (1 4)) (vc (2 3) (3 3)))

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

;; An example using respell-notes for the whole slippery-chicken object.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((cs4 ds4 df5 ef5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1)))))))
      (respell-notes mini))
```

;; An example specifying which pitches are to be enharmonically changed.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((cs4 ds4 df5 ef5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1)))))))
      (respell-notes mini '((vn (1 1) (1 4))))
      (cmn-display mini :respell-notes nil))
```

=> T

#### SYNOPSIS:

```
(defmethod respell-notes ((sc slippery-chicken) &optional corrections)
```

### 13.44 slippery-chicken-edit/respell-notes-for-player

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Pass through the pitches of a specified player's part and change some of the pitches to their enharmonic equivalents in order to produce more sensible spellings of consecutive notes.

This is just a very simple attempt to better spell notes by comparing each note to the previous two and making it the same accidental type. It doesn't look further back or ahead as of yet.

If the optional argument is set to T, then look at the written notes instead of the sounding notes.

NB: Since both the `cmn-display` and `write-lp-data-for-all` methods automatically call `respell-notes` for all players of an entire `sc-object`, their `:respell-notes` argument may need to be set to `NIL` for this method to produce the desired results.

#### ARGUMENTS:

- A `slippery-chicken` object.
- The ID of the player whose pitches are to be modified.

#### OPTIONAL ARGUMENTS:

- T or `NIL` to indicate whether to change written pitches only or sounding pitches only. T = change written pitches only. Default = `NIL`.

#### RETURN VALUE:

Returns `NIL`.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vn (violin :midi-channel 2))))
        :tempo-map '((1 (q 60)))
        :set-palette '((1 ((b3 cs4 b4 cs5))))))
```

```

:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) q e s s))
                        :pitch-seq-palette ((1 2 3 4)))))
:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                        (vn (1 1 1 1 1))))))
(respell-notes-for-player mini 'cl t)
(cmn-display mini :respell-notes nil :in-c nil))

=> T

```

**SYNOPSIS:**

```

(defmethod respell-notes-for-player ((sc slippery-chicken) player
                                     &optional written)

```

**13.45 slippery-chicken-edit/rest-to-note**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Change a specified event object from a rest into a note by supplying a pitch or chord (as objects or symbols).

Marks to be attached to the new note can be supplied as a symbol or a list as an optional argument.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the rest is to be changed to a note.
- An integer that is the number of the rest in the given bar that is to be changed. This number counts rests only, not sounding notes or events.
- The ID of the player whose part is to be changed.
- A note-name symbol that is to be the pitch of the new note, or a list of note-name symbols that will make up a chord.

**OPTIONAL ARGUMENTS:**

- A mark or list of marks to be attached to the new note.

**RETURN VALUE:**

Returns the new event object created.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((cs4 ds4 fs4))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s s))
                                :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1)))))))
      (rest-to-note mini 2 1 'vn 'gs5)
      (rest-to-note mini 3 1 'vn '(gs5 b5))
      (rest-to-note mini 4 1 'vn '(gs4 b4) 'ppp)
      (rest-to-note mini 5 1 'vn '(gs4 b4) '(fff pizz)))
```

=&gt;

```
EVENT: start-time: 9.000, end-time: 9.500,
       duration-in-tempo: 0.500,
       compound-duration-in-tempo: 0.500,
       amplitude: 0.900
       bar-num: 5, marks-before: NIL,
       tempo-change: NIL
       instrument-change: NIL
       display-tempo: NIL, start-time-qtrs: 9.000,
       midi-time-sig: NIL, midi-program-changes: NIL,
       8va: 0
       pitch-or-chord:
CHORD: auto-sort: T, marks: NIL, micro-tone: NIL
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
[...]
```

**SYNOPSIS:**

```
(defmethod rest-to-note ((sc slippery-chicken) bar-num rest-num player new-note
                        &rest marks)
```

**13.46 slippery-chicken-edit/rm-marks-from-note**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**



**ARGUMENTS:**

- ### OPTIONAL ARGUMENTS:

- RETURN VALUE:**

**EXAMPLE:**

$$\Rightarrow T$$

**SYNOPSIS:**

```
(defmethod rm-marks-from-note ((sc slippery-chicken) bar-num note-num
                               player &rest marks)
```

**13.47 slippery-chicken-edit/rm-marks-from-notes***[ slippery-chicken-edit ] [ Methods ]***DESCRIPTION:**

Remove only the specified marks from the MARKS slots of specified events in the parts of specified players. If the <players> argument is set to NIL, remove the mark or marks from all players.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer or a 2-item list of integers indicating the first bar and note from which to remove marks. If an integer, this is the bar number and the mark will be removed from all notes in the bar. If a 2-item list, this is a reference to the bar number and number of the first note in the bar from which to start removing marks, in the form e.g. '(3 1).
- An integer or a 2-item list of integers indicating the last bar and note from which to remove marks. If an integer, this is the bar number and the mark will be removed from all notes in the bar. If this is a 2-item list, this is a reference to the bar number and number of the first note in the bar from which to start removing marks, in the form e.g. '(3 1).
- The ID or a list of IDs of the players from whose parts the marks are to be removed.

**OPTIONAL ARGUMENTS:**

NB: The <marks> argument is a required argument for this method.

- The mark or a list of the marks to remove. This method will only remove specified marks.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((fl (flute :midi-channel 1))
                     (hn (french-horn :midi-channel 2))
                     (vn (violin :midi-channel 3))))
      :tempo-map '((1 (q 60)))
```

```

:set-palette '((1 ((cs4 ds4 fs4))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) q e s s))
                        :pitch-seq-palette ((1 2 3 4))
                        :marks (a 2 s 2 fff 2))))
:rthm-seq-map '((1 ((fl (1 1 1 1 1))
                      (hn (1 1 1 1 1))
                      (vn (1 1 1 1 1))))))
(rm-marks-from-notes mini 1 2 'fl 'fff)
(rm-marks-from-notes mini '(1 2) '(2 1) 'hn '(fff a))
(rm-marks-from-notes mini 3 '(4 3) '(hn vn) '(fff s a))
(rm-marks-from-notes mini 5 5 nil 'fff)

=> T

```

**SYNOPSIS:**

```

(defmethod rm-marks-from-notes ((sc slippery-chicken) start end
                                players &rest marks)

```

**13.48 slippery-chicken-edit/rm-pitches-from-chord**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Remove the specified pitches from an existing chord object.

**ARGUMENTS:**

- The slippery-chicken object which contains the given chord object.
- The ID of the player whose part is to be affected.
- An integer that is the number of the bar that contains the chord object that is to be modified.
- An integer that is the number of the note that is the chord object to be modified.
- The pitches to be removed. These can be pitch objects or any data that can be passed to make-pitch, or indeed lists of these, as they will be flattened.

**RETURN VALUE:**

The chord object that has been changed.

**EXAMPLE:**

```

(let* ((ip-clone (clone +slippery-chicken-standard-instrument-palette+)))
  (set-slot 'chord-function 'chord-fun2 'guitar ip-clone)
  (let* ((mini
    (make-slippery-chicken
      '+mini+
      :instrument-palette ip-clone
      :ensemble '(((gtr (guitar :midi-channel 1))))
      :set-palette '((1 ((e3 f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5 d5 e5 f5
                          g5 a5 b5 c6 d6 e6))))
      :set-map '((1 (1)))
      :rthm-seq-palette
      '(1 (((4 4) e e e e e e e e)
            :pitch-seq-palette ((1 (2) 3 (4) 5 (6) 7 (8)))))
      :rthm-seq-map '((1 ((gtr (1)))))))
    (print (get-pitch-symbols
      (pitch-or-chord (get-event mini 1 2 'gtr))))
    (rm-pitches-from-chord mini 'gtr 1 2 'a3 'd4)
    (print (get-pitch-symbols
      (pitch-or-chord (get-event mini 1 2 'gtr))))))
  =>
  (E3 A3 D4 G4)
  (E3 G4)

```

**SYNOPSIS:**

```

(defmethod rm-pitches-from-chord ((sc slippery-chicken) player bar-num note-num
  &rest pitches)

```

**13.49 slippery-chicken-edit/rm-slurs**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Remove the specified slurs from the MARKS slots of specified events in the parts of specified players. If the <players> argument is set to NIL, remove the specified slurs from all players.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer or a 2-item list of integers indicating the first bar and note from which to remove slurs. If an integer, this is the bar number and the slurs will be removed from all notes in the bar. If a 2-item list, this is

- a reference to the bar number and number of the first note in the bar from which to start removing slurs, in the form e.g. '(3 1).
- An integer or a 2-item list of integers indicating the last bar and note from which to remove slurs. If an integer, this is the bar number and the slurs will be removed from all notes in the bar. If this is a 2-item list, this is a reference to the bar number and number of the first note in the bar from which to start removing slurs, in the form e.g. '(3 1).
- The ID or a list of IDs of the players from whose parts the marks are to be removed.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((fl (flute :midi-channel 1))
                       (hn (french-horn :midi-channel 2))
                       (vn (violin :midi-channel 3))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c4 d4 e4 fs4 gs4 as4 c5 d5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8))
                                :marks (slur 1 2 slur 3 4 slur 5 6 slur 7 8))))
      :rthm-seq-map '((1 ((fl (1 1 1 1 1))
                           (hn (1 1 1 1 1))
                           (vn (1 1 1 1 1)))))))

(rm-slurs mini 1 2 'fl)
(rm-slurs mini '(1 3) '(2 1) 'hn)
(rm-slurs mini 3 '(4 3) '(hn vn))
(rm-slurs mini 5 5 nil))
```

=> T

**SYNOPSIS:**

```
(defmethod rm-slurs ((sc slippery-chicken) start end players)
```

**13.50 slippery-chicken-edit/sc-delete-beams**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Delete beam indications from specified notes. If only a bar number is specified, this method deletes all beams in the bar.

NB: If specifying start and end notes, the start notes specified must be the first note of a beamed group of notes (i.e. the BEAMS slot of the corresponding event object must be 1), and the end note must be the last note of a beamed group of notes (i.e., the BEAMS slot of the corresponding event object must be 0), otherwise errors may occur. Also, if specifying one of these arguments, both must be specified.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the beams are to be deleted.
- The ID of the player from whose part the beams are to be deleted.

**OPTIONAL ARGUMENTS:**

- An integer that is the number of the note that currently holds the start-beam information (i.e., the BEAMS slot is 1). This number is 1-based and counts ties.
- An integer that is the number of the note that currently holds the end-beam information (i.e., the BEAMS slot is 0). This number is 1-based and counts ties.

**RETURN VALUE:**

If deleting all beams in a bar, returns T, otherwise returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) - e e - - e e - - e e -))
                                :pitch-seq-palette ((1 2 3 4 5 6 7 8))))
       :rthm-seq-map '((1 ((vc (1 1 1 1))))))
      (sc-delete-beams mini 2 'vc)
```

```
(sc-delete-beams mini 3 'vc 3 4))

=> NIL
```

**SYNOPSIS:**

```
(defmethod sc-delete-beams ((sc slippery-chicken) bar-num player
                             &optional start-note end-note)
```

**13.51 slippery-chicken-edit/sc-delete-marks**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Delete all marks from the MARKS slot of a given note event object and set the slot to NIL.

NB: This method counts notes, not rests, and is 1-based.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the marks are to be deleted.
- An integer that is the number of the note from which the marks are to be deleted.
- The ID of the player from whose part the marks are to be deleted.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((cs4 ds4 fs4))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s s))
                                :pitch-seq-palette ((1 2 3))
                                :marks (a 2 s 2 fff 2 pizz 2))))
      :rthm-seq-map '((1 ((vn (1 1 1 1)))))))
```

```
(sc-delete-marks mini 2 2 'vn))

=> T
```

**SYNOPSIS:**

```
(defmethod sc-delete-marks ((sc slippery-chicken) bar-num note-num player)
```

**13.52 slippery-chicken-edit/sc-delete-marks-before**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Deletes all data from the MARKS-BEFORE slot of a specified event object and replaces it with NIL.

NB: In addition to clef symbol data, the MARKS-BEFORE slot also stores part of the required data for trills and arrows. Deleting just the MARKS-BEFORE components of those markings may result in unwanted results.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the event object is to be modified.
- An integer that is the number of the note within the given bar for which the MARKS-BEFORE slot is to be set to NIL.
- The ID of the player whose part is to be affected.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
```



```

                                :pitch-seq-palette ((1 2 3 4))))))
      :rthm-seq-map '(((1 ((vc (1 1 1)))))))
      (add-mark-before-note mini 2 3 'vc 'fff)
      (add-mark-before-note mini 2 3 'vc 's)
      (add-mark-before-note mini 2 3 'vc 'lhp)
      (sc-delete-marks-before mini 2 3 'vc))

=> NIL

```

**SYNOPSIS:**

```

(defmethod sc-delete-marks-before ((sc slippery-chicken)
                                   bar-num note-num player)

```

**13.53 slippery-chicken-edit/sc-delete-marks-from-event**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Delete all data from the MARKS slot of the specified event object and replace it with NIL.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar from which the marks are to be deleted.
- An integer that is the number of the event within the given bar from which the marks are to be deleted.
- The ID of the player from whose part the marks are to be deleted.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4))))
       :set-map '((1 (1 1 1)))

```

```

      :rthm-seq-palette '(((1 (((2 4) q e s s))
                             :pitch-seq-palette ((1 2 3 4))
                             :marks (a 1 4 lhp 4 s 3 4 slur 1 2))))
      :rthm-seq-map '(((1 ((vc (1 1 1)))))))
      (sc-delete-marks-from-event mini 2 4 'vc))

=> NIL

```

**SYNOPSIS:**

```

(defmethod sc-delete-marks-from-event ((sc slippery-chicken)
                                       bar-num event-num player)

```

**13.54 slippery-chicken-edit/sc-force-rest**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

23-Jul-2011 (Pula)

**DESCRIPTION:**

Change the specified event object to a rest. If events tied from this event should automatically be forced to rests also, use the `sc-force-rest2` method instead.

**ARGUMENTS:**

- A `slippery-chicken` object.
- An integer that is the number of the bar in which the rest is to be forced.
- An integer that is the number of the event within that bar which is to be changed into a rest. This number is 1-based and counts tied notes but not rests.
- The ID of the player whose part is to be modified.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the specified bar should be automatically beamed after the change has been made. NB: In general, calling `auto-beam` is a good idea (esp. when deleting notes under an existing beam); however, `auto-beam` may fail when addressing bars that contain notes longer than one beat. T = automatically beam. Default = NIL.

**RETURN VALUE:**

The new rthm-seq-bar object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vc (cello :midi-channel 1))))
        :set-palette '((1 ((a3 b3 c4 e4))))
        :set-map '((1 (1 1 1)))
        :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))))
        :rthm-seq-map '(((vc (1 1 1))))))
      (sc-force-rest mini 2 3 'vc)
      (sc-force-rest mini 3 3 'vc t))

=>

RTHM-SEQ-BAR: time-sig: 3 (2 4), time-sig-given: T, bar-num: 3,
               old-bar-nums: NIL, write-bar-num: NIL, start-time: 4.000,
               start-time-qtrs: 4.0, is-rest-bar: NIL, multi-bar-rest: NIL,
               show-rest: T, notes-needed: 3,
               tuplets: NIL, nudge-factor: 0.35, beams: ((1 2)),
               current-time-sig: 3, write-time-sig: NIL, num-rests: 1,
               num-rhythms: 4, num-score-notes: 3, parent-start-end: NIL,
               missing-duration: NIL, bar-line-type: 2,
               player-section-ref: (1 VC), nth-seq: 2, nth-bar: 0,
               rehearsal-letter: NIL, all-time-sigs: (too long to print)
               sounding-duration: 1.750,
               rhythms: (
[...]

```

**SYNOPSIS:**

```
(defmethod sc-force-rest ((sc slippery-chicken) bar-num note-num player
                          &optional (auto-beam nil))
```

**13.55 slippery-chicken-edit/sc-force-rest2**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**



**13.56 slippery-chicken-edit/sc-move-dynamic***[ slippery-chicken-edit ] [ Methods ]***DESCRIPTION:**

Move the dynamic attached to a specified event object to another specified event object.

By default the dynamics are moved between events within the same bar. An optional argument allows for dynamics to be moved to events in a different bar.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which to move the dynamic.
- The ID of the player in whose part the dynamic is located.
- An integer that is the number of the event object from which the dynamic is to be moved. This number is 1-based and counts both rests and ties.
- An integer that is the number of the event object to which the dynamic is to be moved. This number is 1-based and counts both rests and ties.

**OPTIONAL ARGUMENTS:**

- An integer that is the number of the bar to which the dynamic should be moved. If this is not specified, the dynamic will be moved to the specified event within the same bar.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :set-palette '((1 ((a3 b3 c4 e4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))
                                :marks (fff 1))))
      :rthm-seq-map '((1 ((vc (1 1 1)))))))
```

```
(sc-move-dynamic mini 1 'vc 1 3)
(sc-move-dynamic mini 2 'vc 1 4 3))
```

=> T

## SYNOPSIS:

```
(defmethod sc-move-dynamic ((sc slippery-chicken) bar-num player
  ;; event numbers 1-based but counting rests and ties
  from to &optional to-bar)
```

## 13.57 slippery-chicken-edit/sc-remove-dynamic

[ *slippery-chicken-edit* ] [ *Methods* ]

## DESCRIPTION:

Remove all dynamics from the MARKS slot of one or more specified event objects.

## ARGUMENTS:

- A slippery-chicken object.
- An integer that is the number of the bar from which the dynamics are to be removed.
- The ID of the player from whose part the dynamics are to be removed.
- An integer or a list of integers that are the numbers of the events from which the dynamics are to be removed. Event numbers include ties and rests.

## RETURN VALUE:

Returns the last dynamic removed.

## EXAMPLE:

```
(let ((mini
  (make-slippery-chicken
    '+mini+
    :ensemble '(((vc (cello :midi-channel 1))))
    :set-palette '((1 ((a3 b3 c4 e4))))
    :set-map '((1 (1 1 1)))
    :rthm-seq-palette '((1 (((2 4) q e s s))
      :pitch-seq-palette ((1 2 3 4))
      :marks (fff 1 ppp 3))))))
```

```

      :rthm-seq-map '(((1 ((vc (1 1 1)))))))
(sc-remove-dynamic mini 2 'vc 1)
(sc-remove-dynamic mini 3 'vc '(1 3)))

=> PPP

```

**SYNOPSIS:**

```

(defmethod sc-remove-dynamic ((sc slippery-chicken) bar-num player
                              &rest event-nums)

```

**13.58 slippery-chicken-edit/sc-remove-dynamics**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

16-Mar-2011

**DESCRIPTION:**

Remove all dynamic marks from the MARKS slots of all consecutive event objects within a specified region of bars.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer or a list of two integers. If a single integer, this is the number of the first bar from which the dynamics will be removed, and all dynamics will be removed from the full bar. If this is a list of two integers, they are the numbers of the first bar and first note within that bar from which the dynamics will be removed, in the form '(bar-num note-num). Note numbers are 1-based and count ties but not rests.
- An integer or a list of two integers. If a single integer, this is the number of the last bar from which the dynamics will be removed, and all dynamics will be removed from the full bar. If this is a list of two integers, they are the numbers of the last bar and last note within that bar from which the dynamics will be removed, in the form '(bar-num note-num). Note numbers are 1-based and count ties but not rests.
- A single ID or a list of IDs of the players from whose parts the dynamics are to be removed.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (va (viola :midi-channel 2))
                        (vc (cello :midi-channel 3))))
       :set-palette '((1 ((d3 e3 f3 g3 a3 b3 c4 e4 f4 g4 a4 b4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 3 4))
                                :marks (fff 1 ppp 3))))
      :rthm-seq-map '((1 ((vn (1 1 1))
                             (va (1 1 1))
                             (vc (1 1 1)))))))
      (sc-remove-dynamics mini '(1 2) '(2 2) 'vn)
      (sc-remove-dynamics mini 2 3 '(va vc)))

=> T
```

**SYNOPSIS:**

```
(defmethod sc-remove-dynamics ((sc slippery-chicken) start end players)
```

**13.59 slippery-chicken-edit/set-cautionary-accidental**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DATE:**

28-Sep-2011

**DESCRIPTION:**

Place a cautionary accidental (sharp/flat/natural sign in parentheses) before a specified note.

NB: Adding cautionary accidentals to pitches within chords is currently only possible in LilyPond output. Adding cautionary accidentals to single pitches is possible in both CMN and LilyPond.

NB: Since the `cmn-display` and `write-lp-data-for-all` methods call `respell-notes` by default, that option must be explicitly set to `NIL` within the calls to those methods in order for this method to be effective.



**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which to add the cautionary accidental.
- An integer or a 2-item list of integers that is the number of the note within that bar to which to add the cautionary accidental. This number is 1-based and counts ties. If a 2-item list such, this indicates that the pitch is within a chord; e.g., '(1 2) indicates that a cautionary accidental should be added to the 2nd pitch up from the bottom of the chord located at the 1st note position in the bar.
- The ID of the player to whose part the cautionary accidental is to be added.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to add the cautionary accidental to only the written pitch or only the sounding pitch. T = written only.  
Default = NIL.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (pn (piano :midi-channel 2))))
       :set-palette '((1 ((ds3 e3 fs3 af3 bf3 c4 ef4 fs4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                                :pitch-seq-palette ((1 2 (3) 4))
                                :marks (fff 1 ppp 3))))
      :rthm-seq-map '((1 ((cl (1 1 1))
                            (pn (1 1 1)))))))
  (respell-notes mini)
  (set-cautionary-accidental mini 3 2 'cl t)
  (set-cautionary-accidental mini 2 1 'pn)
  (set-cautionary-accidental mini 2 2 'pn)
  (set-cautionary-accidental mini 3 '(3 3) 'pn)
  (write-lp-data-for-all mini :respell-notes nil))
```

=> T

**SYNOPSIS:**

```
(defmethod set-cautionary-accidental ((sc slippery-chicken) bar-num note-num
                                     player &optional written)
```

**13.60 slippery-chicken-edit/set-rehearsal-letter**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Add the specified rehearsal letter/number to the specified bar in one or more specified players.

NB: Since internally this method actually attaches the rehearsal letter/number to the REHEARSAL-LETTER slot of the preceding bar (bar-num - 1), no rehearsal letter/number can be attached to the first bar.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar to which the rehearsal letter/number is to be added.
- A symbol that is the rehearsal letter/number to be added (e.g. 'A or '1)

**OPTIONAL ARGUMENTS:**

- The player ID or a list of player IDs to whose parts the rehearsal letter/number is to be added. If no value is given here, the rehearsal letter/number will be added to the first (top) instrument in each group of the ensemble, as specified in staff-groupings.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                       (va (viola :midi-channel 2))
```

```

      (vc (cello :midi-channel 3))))
:~set-palette '~((1 ((ds3 e3 fs3 af3 bf3 c4 ef4 fs4))))
:~set-map '~((1 (1 1 1 1)))
:rthm-seq-palette '~((1 (((2 4) q e s s))
      :pitch-seq-palette ((1 2 3 4))))
:rthm-seq-map '~((1 ((vn (1 1 1 1))
      (va (1 1 1 1))
      (vc (1 1 1 1)))))))
(set-rehearsal-letter mini 2 'A)
(set-rehearsal-letter mini 3 '2 '(va vc))
(set-rehearsal-letter mini 4 'Z3))

```

=> T

## SYNOPSIS:

```

(defmethod set-rehearsal-letter ((sc slippery-chicken) bar-num letter
      &optional players)

```

### 13.61 slippery-chicken-edit/tie

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Add a tie to a specified event object. The new tie will be placed starting from the specified event object and spanning to the next event object. If the next event object does not have the same pitch, its pitch will be changed to that of the first event object.

An optional argument allows the user to adjust the steepness of the tie's curvature.

NB: This method will not automatically update ties in MIDI output. To make sure that MIDI ties are also updated, use the *handle-ties* method.

NB: If the next event object is a rest and not a note, an error will be produced.

#### ARGUMENTS:

- A *slippery-chicken* object.
- An integer that is the number of the bar in which the tie is to be placed.
- An integer that is the number of the note to which the tie is to be

attached.

- The ID of the player whose part is to be changed.

#### OPTIONAL ARGUMENTS:

- A positive or negative decimal number to indicate the steepness of the tie's curvature.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4))))
       :set-map '((1 (1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q s s (s) s))
                               :pitch-seq-palette ((1 1 2 3))))
       :rthm-seq-map '((1 ((vn (1 1 1 1)))))))
      (tie mini 2 1 'vn)
      (tie mini 3 2 'vn)
      (tie mini 4 2 'vn -.5))
```

=> T

#### SYNOPSIS:

```
(defmethod tie ((sc slippery-chicken) bar-num note-num player
                &optional curvature)
```

### 13.62 slippery-chicken-edit/tie-all-last-notes-over-rests

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Extend the duration of the last note of any bar that precedes a bar which starts with a rest in the specified region, such that the rest that begins the next measure is changed to a note and the last note of the first measure is tied to it.

NB: This method will not automatically update ties in MIDI output. To make sure that MIDI ties are also updated, use the `handle-ties` method.

#### ARGUMENTS:

- A `slippery-chicken` object.
- An integer that is the first bar in which changes are to be made.
- An integer that is the last bar in which changes are to be made.
- A player ID or list of player IDs.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- `:to-next-attack`. T or NIL to indicate whether ties are to extend over only full bars of rest or also over partial bars (until the next attacked note). T = until the next attacked note. Default = T.
- `:tie-next-attack`. T or NIL to indicate whether the new tied notes created should also be further extended over the next attacked note if that note has the same pitch as the starting note of the tie. T = also tie next attacked note if same pitch. Default = NIL.
- `:auto-beam`. T or NIL to indicate whether the new events should be automatically beamed after placement. T = automatically beam. Default = NIL.
- `:last-rhythm`. NIL or a rhythmic duration. If a rhythmic duration, the last duration of the tie will be forced to this length. Useful, for example, when tying into a rest bar without filling that whole bar. NIL = fill the bar with a tied note. Default = NIL.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                     (va (viola :midi-channel 2))
                     (vc (cello :midi-channel 3))))
      :set-palette '((1 ((f3 g3 a3 b3 c4 d4 f4 g4 a4 c5 d5 f5))))
      :set-map '((1 (1 1 1)))
      :rthm-seq-palette '((1 (((4 4) e (e) e e (e) (e) e e)
                               ((w))
                               ((h.) q))
```

```

((w))
((w))
((e) e h.))
:pitch-seq-palette ((1 2 3 4 5 6 7 7))))))
:rthm-seq-map '((1 ((vn (1 1 1))
                     (va (1 1 1))
                     (vc (1 1 1)))))))))
(tie-all-last-notes-over-rests mini 2 6 'vn)
(tie-all-last-notes-over-rests mini 9 12 'vn :auto-beam t)
(tie-all-last-notes-over-rests mini 3 5 '(va vc) :to-next-attack nil)
(tie-all-last-notes-over-rests mini 9 12 'vc :tie-next-attack t)
(tie-all-last-notes-over-rests mini 13 15 'vn :last-rhythm 'e))

=> NIL

```

**SYNOPSIS:**

```

(defmethod tie-all-last-notes-over-rests ((sc slippery-chicken)
      start-bar end-bar players
      &key
      ;; use up all rests until next attack or (if nil)
      ;; just the rest bars?
      (to-next-attack t)
      ;; if the next attack is the same note/chord as
      ;; the previous, tie to it too?
      (tie-next-attack nil)
      (last-rhythm nil)
      (auto-beam nil))

```

**13.63 slippery-chicken-edit/tie-over-all-rests**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Extend the durations of all notes that immediately precede rests in the specified region by changing the rests to notes and tying the previous notes to them.

NB: This method will not automatically update ties in MIDI output. To make sure that MIDI ties are also updated, use the `handle-ties` method.

**ARGUMENTS:**

- A `slippery-chicken` object.

- The ID of the player whose part is to be changed.
- An integer that is the number of the first bar in which notes are to be tied over rests.
- An integer that is the number of the last bar in which notes are to be tied over rests. NB: This argument does not necessarily indicate the bar in which the ties will stop, but rather the last bar in which a tie will be begun; the ties created may extend into the next bar.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :start-note. An integer that is the number of the first attacked note (not counting rests) in the given start-bar for which ties can be placed.
- :end-note. An integer that is the number of the last attacked note (not counting rests) in the given end-bar for which ties can be placed.  
NB: This argument does not necessarily indicate the note on which the ties will stop, but rather the last note on which a tie can begin; the ties created may extend to the next note.
- :auto-beam. T or NIL to indicate whether the method should automatically place beams for the notes of the affected measure after the ties over rests have been created. T = automatically beam. Default = NIL.
- :consolidate-notes. T or NIL to indicate whether the tied notes are to be consolidated into single rhythmic units of longer durations after the ties over rests have been created. T = consolidate notes. Default = NIL.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4))))
       :set-map '((1 (1 1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) (q) e (s) s))
                               :pitch-seq-palette ((1 2))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1 1 1))))))
      (tie-over-all-rests mini 'vn 2 3 :start-note 2 :auto-beam t)
      (tie-over-all-rests mini 'vn 5 6 :end-note 1 :consolidate-notes t))
```

=> NIL

#### SYNOPSIS:

```
(defmethod tie-over-all-rests ((sc slippery-chicken) player
                               start-bar end-bar
                               &key
                               (start-note 1)
                               (end-note 9999999)
                               (auto-beam nil)
                               (consolidate-notes nil))
```

### 13.64 slippery-chicken-edit/tie-over-rest-bars

[ *slippery-chicken-edit* ] [ *Methods* ]

#### DESCRIPTION:

Extend the duration of the last note in a specified bar by changing immediately subsequent full-rest bars to notes of the same pitch and tying them to that note.

NB: This method will not automatically update ties in MIDI output. To make sure that MIDI ties are also updated, use the *handle-ties* method.

#### ARGUMENTS:

- A *slippery-chicken* object.
- An integer that is the number of the bar in which the last note is to be tied.
- An ID or list of IDs of the players whose parts are to be modified.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- *:end-bar*. An integer or NIL. If an integer, this is the number of the last bar of full-rests that is to be changed to a note. This can be helpful for tying into passages of multiple bars of full-rest.
- *:tie-next-attack*. T or NIL to indicate whether the new tied notes created should also be further extended over the next attacked note if that note has the same pitch as the starting note of the tie. T = also tie next attacked note if same pitch. Default = NIL.
- *:to-next-attack*. T or NIL to indicate whether ties are to extend over only full bars of rest or also over partial bars (until the next attacked note). T = until the next attacked note. Default = T.
- *:auto-beam*. T or NIL to indicate whether the method should automatically place beams for the notes of the affected measure after the ties over rests have been created. T = automatically beam. Default = NIL.
- *:last-rhythm*. NIL or a rhythmic duration. If a rhythmic duration, the



last duration of the tie will be forced to this length. Useful, for example, when tying into a rest bar without filling that whole bar. NIL = fill the bar with a tied note. Default = NIL.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                       (va (viola :midi-channel 2))
                       (vc (cello :midi-channel 3))))
       :set-palette '((1 ((c4 d4 e4))))
       :set-map '((1 (1 1)))
       :rthm-seq-palette '((1 (((2 4) (q) e (s) s)
                                ((h))
                                ((s) e. e e)
                                ((h))
                                ((h))
                                ((e) q s (s))))
                           :pitch-seq-palette ((1 2 2 1 3 3 1))))
      :rthm-seq-map '((1 ((vn (1 1))
                          (va (1 1))
                          (vc (1 1))))))
  (tie-over-rest-bars mini 1 'vn :end-bar 2)
  (tie-over-rest-bars mini 3 'va :end-bar 5)
  (tie-over-rest-bars mini 3 '(vn vc) :end-bar 6 :tie-next-attack t)
  (tie-over-rest-bars mini 7 'vc
    :end-bar 9
    :to-next-attack t
    :auto-beam t)
  (tie-over-rest-bars mini 9 'vn :end-bar 11 :last-rhythm 'e))

=> NIL
```

#### SYNOPSIS:

```
(defmethod tie-over-rest-bars ((sc slippery-chicken) bar-num players
                               &key (end-bar nil) ;; num of empty bars
                                     (tie-next-attack nil)
                                     (to-next-attack t)
                                     (last-rhythm nil)
                                     (auto-beam nil))
```

**13.65 slippery-chicken-edit/tie-over-rests***[ slippery-chicken-edit ] [ Methods ]***DESCRIPTION:**

Extend the duration of a specified note that precedes a rest by changing the rest to a note with the same pitch and adding a tie between them.

NB: This method will not automatically update ties in MIDI output. To make sure that MIDI ties are also updated, use the `handle-ties` method.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the note is located.
- An integer that is the number of the note within that bar which is to be extended. This number is 1-based and also counts already tied notes. If NIL, then the last note in the bar will be used.
- The ID of the player whose part is to be modified.

**OPTIONAL ARGUMENTS:**

keyword arguments

- `:end-bar`. An integer that is the number of the last bar into which the tie is to extend. This can be helpful if the user wants to tie into only the first of several consecutive full-rest bars.
- `:auto-beam`. T or NIL to indicate whether the method should automatically beam the beats of the modified bars after the ties have been added.  
T = automatically beam. Default = NIL.
- `:consolidate-notes`. T or NIL to indicate whether the method should consolidate tied notes into single rhythm units of longer duration.  
T = consolidate. Default = T.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4)))))
```

```

:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((2 4) (q) e (s) s)
                        ((h))
                        ((s) e. (e) e)
                        ((h))
                        ((h))
                        ((e) q s (s))))
                  :pitch-seq-palette ((1 2 2 3 3 1))))
:rthm-seq-map '((1 ((vn (1 1 1))))))
(tie-over-rests mini 1 2 'vn)
(tie-over-rests mini 7 1 'vn)
(tie-over-rests mini 9 2 'vn :end-bar 10)
(tie-over-rests mini 13 1 'vn :auto-beam t :consolidate-notes nil))

=> NIL

```

**SYNOPSIS:**

```

(defmethod tie-over-rests ((sc slippery-chicken) bar-num note-num player
                          &key end-bar auto-beam (consolidate-notes t))

```

**13.66 slippery-chicken-edit/trill**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Attach a trill mark to a specified event object by adding 'BEG-TRILL-A to the MARKS-BEFORE slot and TRILL-NOTE with the pitch to the MARKS slot. This method requires a specified trill pitch.

By default trills are set to span from the specified note to the next note, though the length of the span can be specified using the optional arguments.

NB: This is a LilyPond-only method and will not affect CMN output.

**ARGUMENTS:**

- A slippery-chicken object.
- The player to whose part the trill is to be added.
- An integer that is the number of the bar in which the trill is to start.
- An integer that is the number of the event object in that bar on which the trill is to be placed.
- A note-name symbol that is the pitch of the trill note.

**OPTIONAL ARGUMENTS:**

- An integer that is the number of the event object on which the trill span is to stop.
- An integer that is the number of the bar in which the trill span is to stop.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q. s s))
                                :pitch-seq-palette ((1 3 2))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1)))))))
      (trill mini 'vn 2 1 'e4)
      (trill mini 'vn 3 1 'e4 3)
      (trill mini 'vn 4 1 'e4 3 5))
```

=> T

**SYNOPSIS:**

```
(defmethod trill ((sc slippery-chicken) player start-bar start-event trill-note
                  &optional end-event end-bar)
```

**13.67 slippery-chicken-edit/unset-cautionary-accidental**

[ *slippery-chicken-edit* ] [ *Methods* ]

**DESCRIPTION:**

Remove the parentheses from a cautionary accidental (leaving the accidental itself) by setting the ACCIDENTAL-IN-PARENTHESES slot of the contained pitch object to NIL.

NB: Since respell-notes is called by default within cmn-display and write-lp-data-for-all, that option must be explicitly set to NIL for this method to be effective.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar in which the cautionary accidental is to be unset.
- An integer that is the number of the note in that bar for which the cautionary accidental is to be unset.
- The ID of the player whose part is to be changed.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to unset the cautionary accidental for the written part only (for transposing instruments).  
T = written only. Default = NIL.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vn (violin :midi-channel 2))))
        :set-palette '((1 ((cs4 ds4 fs4))))
        :set-map '((1 (1 1)))
        :rthm-seq-palette '((1 (((4 4) e e e e e e e e))
                                :pitch-seq-palette ((1 2 3 2 1 2 3 2)))))
        :rthm-seq-map '((1 ((cl (1 1))
                             (vn (1 1)))))))
      (respell-notes mini)
      (unset-cautionary-accidental mini 2 5 'vn)
      (unset-cautionary-accidental mini 2 7 'cl t)
      (cmn-display mini :respell-notes nil))
```

**SYNOPSIS:**

```
(defmethod unset-cautionary-accidental ((sc slippery-chicken) bar-num note-num
                                         player &optional written)
```

**14 sc/utilities**

[ Modules ]

**NAME:**

utilities

File: utilities.lsp

Class Hierarchy: none: no classes defined

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Various helper functions of a general nature.

Author: Michael Edwards: m@michael-edwards.org

Creation date: June 24th 2002

\$\$ Last modified: 09:05:33 Tue Jan 14 2014 GMT

SVN ID: \$Id: utilities.lsp 4353 2014-01-14 09:50:34Z medward2 \$

**14.1 utilities/a-weighting**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Implementation of A-weighting loudness compensation. Formula taken from <http://en.wikipedia.org/wiki/A-weighting>. This doesn't take 1000Hz loudness into account, rather it implements the 40-phon Fletcher-Munson curve only.

**ARGUMENTS:**

The frequency in Hertz for which to find the loudness weighting.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :expt. A power (exponent) to raise the result to in order to tame/exaggerate the curve (make the db weightings less/more extreme). This only really makes sense if :linear t though will work with db values also of course. Values < 1 result in linear values closer to 1 (less extreme). Values > 1 are further from 1. Default = NIL

- i.e. no exponential function.
- :linear. If T return amplitude values as linear scalers rather than logarithmic decibel values. NB If this is NIL then returned values are likely to be negative (db) values. Default = T.
  - :invert. As the weighting routine tries to tell us what relative loudness we'll perceive given constant amplitudes, low and high frequencies will return negative values as we perceive them Xdb less than our most sensitive frequency area. If :invert t, just flip this negatives to positives so that if :linear T you get a scaler to make lower/higher frequencies equally loud as the most sensitive frequencies.

**RETURN VALUE:**

The linear or db weighting value for the given frequency.

**EXAMPLE:**

```
;;; Decibels:
(a-weighting 50 :invert nil :linear nil) => -30.274979
(a-weighting 50 :invert t :linear nil) => 30.274979
;;; Linear amplitude scalers:
(a-weighting 50) => 32.639904
(a-weighting 50 :invert nil) => 0.030637344
;;; Exaggeration:
(a-weighting 50 :expt 1.1) => 46.251286
;;; Smoothing:
(a-weighting 50 :expt .5) => 5.7131343

;;; Looping through the MIDI note range by tritones returning decibel values:
(loop for midi from 0 to 127 by 6
  for freq = (midi-to-freq midi)
  collect (list (midi-to-note midi)
    (a-weighting freq :linear nil :invert nil)))
=>
((C-1 -76.85258) (FS-1 -65.94491) (C0 -55.819363) (FS0 -46.71565)
 (C1 -38.714867) (FS1 -31.724197) (C2 -25.598646) (FS2 -20.247103)
 (C3 -15.622625) (FS3 -11.657975) (C4 -8.258142) (FS4 -5.358156)
 (C5 -2.9644737) (FS5 -1.1277018) (C6 0.13445985) (FS6 0.8842882) (C7 1.226917)
 (FS7 1.2351798) (C8 0.89729404) (FS8 0.09495151) (C9 -1.3861179)
 (FS9 -3.7814288))

;;; Similar but returning linear amplitude scalers:
(loop for midi from 0 to 127 by 6
  for freq = (midi-to-freq midi)
  collect (list (midi-to-note midi) (a-weighting freq)))
=>
```

```
((C-1 6960.316) (FS-1 1982.6475) (C0 617.9711) (FS0 216.6619) (C1 86.246864)
 (FS1 38.56647) (C2 19.051636) (FS2 10.288571) (C3 6.041312) (FS3 3.827355)
 (C4 2.5876594) (FS4 1.8531382) (C5 1.4067719) (FS5 1.1386365) (C6 0.9846389)
 (FS6 0.9032034) (C7 0.8682687) (FS7 0.86744314) (C8 0.9018521) (FS8 0.9891278)
 (C9 1.1730213) (FS9 1.5455086))
```

**SYNOPSIS:**

```
(defun a-weighting (f &key expt (linear t) (invert t))
```

**14.2 utilities/all-members**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Find out whether the members of the list given as the second argument are all present in the list given as the first argument.

**ARGUMENTS:**

- A list in which the members of the second argument will be sought.
- A list whose members will be sought in the first argument.

**OPTIONAL ARGUMENT**

- A comparison function.

**RETURN VALUE:**

T or NIL.

**EXAMPLE:**

```
(all-members '(1 2 3 4 5 6 7) '(1 2 3 7))
```

```
=> T
```

**SYNOPSIS:**

```
(defun all-members (list test-list &optional (test #'equal))
```

**14.3 utilities/almost-flatten**

[ *utilities* ] [ *Functions* ]

**DATE:**



September 4th 2013

**DESCRIPTION:**

Similar to flatten but allows one level of nesting

**ARGUMENTS:**

A list with an arbitrary level of nesting.

**RETURN VALUE:**

A list with a maximum of one level of nesting

**EXAMPLE:**

```
(almost-flatten '((1 (2 3 4) (5 (6 7) (8 9 10 (11) 12)) 13) 14 15 (16 17)))
```

**SYNOPSIS:**

```
(defun almost-flatten (nested-list)
```

## 14.4 utilities/almost-zero

[ utilities ] [ Functions ]

**DESCRIPTION:**

Return T if a given decimal is within 0.000001 of 0.0.

**ARGUMENTS:**

- A number.

**OPTIONAL ARGUMENTS:**

- A number that is a user-specified difference for the comparison test.

**RETURN VALUE:**

T if the number is within the tolerance difference to zero, otherwise NIL.

**EXAMPLE:**

```
(almost-zero 0.0000007)
```

```
=> T
```

**SYNOPSIS:**

```
(defun almost-zero (num &optional (tolerance 0.000001))
```

**14.5 utilities/amp2db**

[ *utilities* ] [ *Methods* ]

**DESCRIPTION:**

Convert a standard digital amplitude value (>0.0 to 1.0) to a corresponding decibel value.

**ARGUMENTS:**

- A decimal number between >0.0 and 1.0.

**RETURN VALUE:**

A decimal number that is a value in decibel.

**EXAMPLE:**

```
(amp2db 0.3)
```

```
=> -10.457575
```

**SYNOPSIS:**

```
(defmacro amp2db (amp)
```

**14.6 utilities/amplitude-to-dynamic**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Convert a specified digital amplitude between 0.0 and 1.0 to a corresponding dynamic between niente and ffff.

**ARGUMENTS:**

- A decimal number between 0.0 and 1.0.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to print a warning if the specified amplitude is <0.0 or >1.0. T = warn. Default = T.

**RETURN VALUE:**

A symbol that is a dynamic level.

**EXAMPLE:**

```
(amplitude-to-dynamic 0.3)
```

```
=> PP
```

**SYNOPSIS:**

```
(defun amplitude-to-dynamic (amp &optional (warn t))
```

**14.7 utilities/auto-scale-env**

[ utilities ] [ Functions ]

**DATE:**

August 29th 2013

**DESCRIPTION:**

Automatically scale both the x and y values of an envelope to fit within the given ranges.

**ARGUMENTS:**

- The envelope: a list of x y pairs

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :x-min: The new minimum (starting) x value
- :x-max: The new maximum (last) x value
- :y-min: The new minimum (not necessarily starting!) y value
- :y-max: The new maximum (not necessarily starting!) y value

**RETURN VALUE:**

The new envelope (list).

**EXAMPLE:**

```
(AUTO-SCALE-ENV '(0 0 10 1))
```

```
=>
```

```
(0.0 0.0 100.0 10.0)
```

```
(AUTO-SCALE-ENV '(-1 0 .3 -3 1 1) :y-min 5 :y-max 6 :x-min 2)
```

```
=>
```

```
(2.0 5.75 65.7 5.0 100.0 6.0))
```

```
(AUTO-SCALE-ENV '(0 1 5 1.5 7 0 10 1) :y-min -15 :y-max -4)
```

```
=>
```

```
(0.0 -7.6666665 50.0 -4.0 70.0 -15.0 100.0 -7.6666665))
```

**SYNOPSIS:**

```
(defun auto-scale-env (env &key
                        (x-min 0.0) (x-max 100.0)
                        (y-min 0.0) (y-max 10.0))
```

**14.8 utilities/between**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Return a random number between two specified numbers. If the two numbers are integers, the random selection is inclusive. If either are floating-point (decimal) numbers, the result will be a float between the first (inclusive) and just less than the second (i.e. exclusive).

**ARGUMENTS:**

- A first, lower, number.
- A second, higher, number.

NB: The first number must always be lower than the second.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the random seed should be fixed.
- T or NIL to indicate whether, when fixed-random is set to T, we should reset the random number generator (to guarantee the same random sequences). This would generally only be called once, perhaps at the start of a generation procedure.

**RETURN VALUE:**

An integer if both numbers are integers, or a float if one or both are decimal numbers.

**EXAMPLE:**

```
;;; Using the defaults. This will produce a different result each time.
(loop repeat 10 collect (between 1 100))
```

```
=> (43 63 26 47 28 2 99 93 66 23)
```

```
;;; Setting fixed-random to T and using zerop to reset the random when i is 0
(loop repeat 5
  collect (loop for i from 0 to 9 collect (between 1 100 t (zerop i))))
```

```
=> ((93 2 38 81 43 19 70 18 44 26) (93 2 38 81 43 19 70 18 44 26)
    (93 2 38 81 43 19 70 18 44 26) (93 2 38 81 43 19 70 18 44 26)
    (93 2 38 81 43 19 70 18 44 26))
```

**SYNOPSIS:**

```
(defun between (low high &optional fixed-random restart)
```

**14.9 utilities/combine-into-symbol**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Combine a sequence of elements of any combination of type string, number, or symbol into a symbol.

**ARGUMENTS:**

- A sequence of elements.

**RETURN VALUE:**

A symbol as the primary value, with the length of that symbol as a secondary value.

**EXAMPLE:**

```
(combine-into-symbol "test" 1 'a)
```

```
=> TEST1A, 6
```

**SYNOPSIS:**

```
(defun combine-into-symbol (&rest params)
```

**14.10 utilities/db2amp**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Convert a decibel value to a standard digital amplitude value (>0.0 to 1.0), whereby 0dB = 1.0.

**ARGUMENTS:**

- A number that is a value in decibel.

**RETURN VALUE:**

A decimal number between >0.0 and 1.0.

**EXAMPLE:**

```
(db2amp -3)
```

```
=> 0.70794576
```

**SYNOPSIS:**

```
(defmacro db2amp (db)
```

**14.11 utilities/decimal-places**

[ *utilities* ] [ *Functions* ]

**DATE:**

19-Mar-2012

#### DESCRIPTION:

Round the given number to the specified number of decimal places.

#### ARGUMENTS:

- A number.
- An integer that is the number of decimal places to which to round the given number.

#### RETURN VALUE:

A decimal number.

#### EXAMPLE:

```
(decimal-places 1.1478349092347 2)
```

```
=> 1.15
```

#### SYNOPSIS:

```
(defun decimal-places (num places)
```

### 14.12 utilities/decimate-env

[ utilities ] [ Functions ]

#### DESCRIPTION:

Reduce the number of x,y pairs in an envelope. In all three, the envelope is first stretched along the x-axis to fit the new number of points required. Then we proceed by one of three methods:

- 1) average: for every new output x value, interpolate 100 times from -0.5 to +0.5 around the point, then average the y value. This will catch clustering but round out spikes caused by them
- 2) points: also an averaging method but only using the existing points in the original envelope (unless none is present for a new x value, whereupon interpolation is used): Take an average of the (several) points nearest the new output point. This might not recreate the extremes of the original envelope but clustering is captured, albeit averaged.
- 3) interpolate: for each new output point, interpolate the new y value from

the original envelope. This will leave out details in the case of clustering, but accurately catch peaks if there are enough output points. In each case we create an even spread of x values, rather than clustering where clusters exist in the original.

#### ARGUMENTS:

- the original envelope (list of x,y values on any scales).
- the number of points required in the output list.

#### OPTIONAL ARGUMENTS:

- the method to be applied (symbol): 'points, 'average, 'interpolate.  
Default = 'points.

#### RETURN VALUE:

A list representing the x,y values of the new envelope

#### EXAMPLE:

```
(decimate-env '(0 0 4 4 5 5 5.1 5.1 5.3 1 5.6 5.6 6 6 10 10) 6)
=>
(0.0 0.0 1 2.0 2 4.5 3 4.425 4 8.0 5.0 10.0)
```

#### SYNOPSIS:

```
(defun decimate-env (env num-points &optional (method 'points))
```

### 14.13 utilities/dynamic-to-amplitude

[ utilities ] [ Functions ]

#### DESCRIPTION:

Convert a symbol that is a dynamic level between niente and ffff to a corresponding digital amplitude value between 0.0 and 1.0.

#### ARGUMENTS:

- A symbol that is a dynamic level between niente and fff.

#### OPTIONAL ARGUMENTS:



- T or NIL to indicate whether to print a warning when the symbol specified is not recognized as a dynamic. T = warn. Default = T.

**RETURN VALUE:**

A decimal number between 0.0 and 1.0.

**EXAMPLE:**

```
(dynamic-to-amplitude 'fff)
```

```
=> 0.9
```

**SYNOPSIS:**

```
(defun dynamic-to-amplitude (dynamic &optional (warn t))
```

**14.14 utilities/econs**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Add a specified element to the end of an existing list.

**ARGUMENTS:**

- A list.
- An element to add to the end of the list.

**RETURN VALUE:**

A new list.

**EXAMPLE:**

```
(econs '(1 2 3 4) 5)
```

```
=> '(1 2 3 4 5)
```

**SYNOPSIS:**

```
(defun econs (list new-back)
```

### 14.15 utilities/env-plus

[ utilities ] [ Functions ]

#### DESCRIPTION:

Increase all y values of a given list of break-point pairs by a specified amount.

#### ARGUMENTS:

- An envelope in the form of a list of break-point pairs.
- A number that is the amount by which all y values of the given envelope are to be increased.

#### RETURN VALUE:

A list of break-point pairs.

#### EXAMPLE:

```
(env-plus '(0 0 25 11 50 13 75 19 100 23) 7.1)
=> (0 7.1 25 18.1 50 20.1 75 26.1 100 30.1)
```

#### SYNOPSIS:

```
(defun env-plus (env add)
```

### 14.16 utilities/env-symmetrical

[ utilities ] [ Functions ]

#### DESCRIPTION:

Create a new list of break-point pairs that is symmetrical to the original around a specified center. If no center is specified, the center value defaults to 0.5

#### ARGUMENTS:

- An envelope in the form of a list of break-point pairs.

#### OPTIONAL ARGUMENTS:

- A number that is the center value around which the values of the new list are to be symmetrical.
- A number that is to be the minimum value for the y values returned.
- A number that is to be the maximum value for the y values returned.

**RETURN VALUE:**

An envelope in the form of a list of break-point pairs.

**EXAMPLE:**

```
;;; Default center is 0.5
(env-symmetrical '(0 0 25 11 50 13 75 19 100 23))

=> (0 1.0 25 -10.0 50 -12.0 75 -18.0 100 -22.0)

;;; Specifying a center of 0
(env-symmetrical '(0 0 25 11 50 13 75 19 100 23) 0)

=> (0 0.0 25 -11.0 50 -13.0 75 -19.0 100 -23.0)

;;; Specifying minimum and maximum y values for the envelope returned
(env-symmetrical '(0 0 25 11 50 13 75 19 100 23) 0 -20 -7)

=> (0 -7 25 -11.0 50 -13.0 75 -19.0 100 -20)
```

**SYNOPSIS:**

```
(defun env-symmetrical (env &optional (centre .5)
                       (min most-negative-double-float)
                       (max most-positive-double-float))
```

**14.17 utilities/env2gnuplot**

[ utilities ] [ Functions ]

**DATE:**

24th December 2013

**DESCRIPTION:**

Write a data file of x,y envelope values for use with gnuplot. Once called start gnuplot and issue a command such as gnuplot> plot '/tmp/env.txt' with lines.

**ARGUMENTS:**

- The envelope as the usual list of x y pairs

**OPTIONAL ARGUMENTS:**

- The pathname of the data file to write. Default = "/tmp/env.txt".

**RETURN VALUE:**

Always T

**SYNOPSIS:**

```
(defun env2gnuplot (env &optional (file "/tmp/env.txt"))
```

**14.18 utilities/equal-within-tolerance**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Test whether the difference between two decimal numbers falls within a specified tolerance.

This test is designed to compensate for calculation discrepancies caused by floating-point errors (such as 2.0 vs. 1.9999997), in which the equations should yield equal numbers. It is intended to be used in place of = in such circumstances.

**ARGUMENTS:**

- A first number.
- A second number.

**OPTIONAL ARGUMENTS:**

- A decimal value that is the maximum difference allowed between the two numbers that will still return T. Default = 0.000001d0.

**RETURN VALUE:**

T if the two tested numbers are equal within the specified tolerance, otherwise NIL.

**EXAMPLE:**

```
;; An example of floating-point error
(loop for i from 0.0 below 1.1 by 0.1 collect i)

=> (0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.70000005 0.8000001 0.9000001 1.0000001)

;; Using =
(loop for i from 0.0 below 1.1 by 0.1
      for j in '(0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0)
      collect (= i j))

=> (T T T T T T T NIL NIL NIL NIL)

;; Using equal-within-tolerance
(loop for i from 0.0 below 1.1 by 0.1
      for j in '(0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0)
      collect (equal-within-tolerance i j))

=> (T T T T T T T T T T)
```

**SYNOPSIS:**

```
(defun equal-within-tolerance (a b &optional (tolerance 0.000001d0))
```

**14.19 utilities/factor**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Boolean test to check if a specified number is a multiple of a second specified number.

**ARGUMENTS:**

- A number that will be tested to see if it is a multiple of the second number.
- A second number that is the base number for the factor test.

**RETURN VALUE:**

T if the first number is a multiple of the second number, otherwise NIL.

**EXAMPLE:**

```
(factor 14 7)
```

```
=> T
```

**SYNOPSIS:**

```
(defun factor (num fac)
```

**14.20 utilities/flatten**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Return a list of nested lists of any depth as a flat list.

**ARGUMENTS:**

- A list of nested lists.

**RETURN VALUE:**

A flat list.

**EXAMPLE:**

```
(flatten '((1 (2 3 4) (5 (6 7) (8 9 10 (11) 12))) 13) 14 15 (16 17)))
```

```
=> (1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17)
```

**SYNOPSIS:**

```
(defun flatten (nested-list)
```

**14.21 utilities/force-length**

[ *utilities* ] [ *Functions* ]

**DATE:**

03-FEB-2011

**DESCRIPTION:**

Create a new a list of a specified new length by adding or removing items at regular intervals from the original list. If adding items and the list contains numbers, linear interpolation will be used, but only between two adjacent items; i.e. not with a partial increment.

NB: The function can only create new lists that have a length between 1 and 1 less than double the length of the original list.

#### ARGUMENTS:

- A flat list.
- A number that is the new length of the new list to be derived from the original list. This number must be a value between 1 and 1 less than double the length of the original list.

#### RETURN VALUE: EXAMPLE:

```
;;; Shortening a list
(force-length (loop for i from 1 to 100 collect i) 17)
```

```
=> (1 7 13 20 26 32 39 45 51 57 63 70 76 82 89 95 100)
```

```
;;; Lengthening a list
(force-length (loop for i from 1 to 100 collect i) 199)
```

```
=> (1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12
    12.5 13 13.5 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 19 19.5 20 20.5 21
    21.5 22 22.5 23 23.5 24 24.5 25 25.5 26 26.5 27 27.5 28 28.5 29 29.5 30
    30.5 31 31.5 32 32.5 33 33.5 34 34.5 35 35.5 36 36.5 37 37.5 38 38.5 39
    39.5 40 40.5 41 41.5 42 42.5 43 43.5 44 44.5 45 45.5 46 46.5 47 47.5 48
    48.5 49 49.5 50 50.5 51 51.5 52 52.5 53 53.5 54 54.5 55 55.5 56 56.5 57
    57.5 58 58.5 59 59.5 60 60.5 61 61.5 62 62.5 63 63.5 64 64.5 65 65.5 66
    66.5 67 67.5 68 68.5 69 69.5 70 70.5 71 71.5 72 72.5 73 73.5 74 74.5 75
    75.5 76 76.5 77 77.5 78 78.5 79 79.5 80 80.5 81 81.5 82 82.5 83 83.5 84
    84.5 85 85.5 86 86.5 87 87.5 88 88.5 89 89.5 90 90.5 91 91.5 92 92.5 93
    93.5 94 94.5 95 95.5 96 96.5 97 97.5 98 98.5 99 99.5 100)
```

#### SYNOPSIS:

```
(defun force-length (list new-len)
```

## 14.22 utilities/get-harmonics

[ utilities ] [ Functions ]

#### DESCRIPTION:





### 14.23 utilities/get-sublist-indices

[ utilities ] [ Functions ]

**DESCRIPTION:**

Get the starting position of sublists within a list as though the complete set of items were a flat list.

**ARGUMENTS:**

- A list of lists.

**RETURN VALUE:**

A list of integers that are the indices of the sublists.

**EXAMPLE:**

```
(get-sublist-indices '((1 2) (3 4 5 6) (7 8 9) (10 11 12 13 14) (15)))
```

```
=> (0 2 6 9 14)
```

**SYNOPSIS:**

```
(defun get-sublist-indices (list)
```

### 14.24 utilities/get-sublist-lengths

[ utilities ] [ Functions ]

**DESCRIPTION:**

Get the lengths of all sublists in a given list.

**ARGUMENTS:**

- A list of lists.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to first remove zeros caused by empty sublists from the result.

**RETURN VALUE:**

A list of integers.

#### EXAMPLE:

```
;; Straightforward usage allows zeros in the result
(get-sublist-lengths '((1 2) (3 4 5 6) (7 8 9) (10 11 12 13 14) ()))

=> (2 4 3 5 0)

;; Setting the optional argument to T removes zeros from the result
(get-sublist-lengths '((1 2) (3 4 5 6) (7 8 9) (10 11 12 13 14) ()) t)

=> (2 4 3 5)
```

#### SYNOPSIS:

```
(defun get-sublist-lengths (list &optional (remove-zeros nil))
```

### 14.25 utilities/hailstone

[ *utilities* ] [ *Functions* ]

#### DESCRIPTION:

Implementation of the Collatz conjecture (see  
[http://en.wikipedia.org/wiki/Collatz\\_conjecture](http://en.wikipedia.org/wiki/Collatz_conjecture) )

The Collatz conjecture suggests that by starting with a given number, and if it is even dividing it by two or if it is odd multiplying it by three and adding one, then repeating with the new result, the process will eventually always result in one.

#### ARGUMENTS:

- A number to start with.

#### RETURN VALUE:

A list of the results collected from each iteration starting with the specified number and ending with one.

#### EXAMPLE:

```
(hailstone 11)
```

```
=> (11 34 17 52 26 13 40 20 10 5 16 8 4 2 1)
```

**SYNOPSIS:**

```
(defun hailstone (n)
```

**14.26 utilities/hz2ms**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Convert a frequency in Hertz to the equivalent number of milliseconds.

**ARGUMENTS:**

- A number that is a Hertz frequency.

**RETURN VALUE:**

A number that is the millisecond equivalent of the specified Hertz frequency.

**EXAMPLE:**

```
(hz2ms 261.63)
```

```
=> 3.8221915
```

**SYNOPSIS:**

```
(defun hz2ms (hertz)
```

**14.27 utilities/interpolate**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Get the interpolated value at a specified point within an envelope. The envelope must be specified in the form of a list of break-point pairs.

**ARGUMENTS:**

- A number that is the point within the specified envelope for which to return the interpolated value.
- A list of break-point pairs.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :scaler. A number that is the factor by which to scale the values of the break-point pairs in the given envelope before retrieving the interpolated value. Default = 1.
- :exp. A number that is the exponent to which the result should be raised. Default = 1.
- :warn. T or NIL to indicate whether the method should print a warning if the specified point is outside of the bounds of the x-axis specified in the list of break-point pairs. T = warn. Default = T.

**RETURN VALUE: EXAMPLE:**

```
;;; Using the defaults
(interpolate 50 '(0 0 100 1))
```

```
=> 0.5
```

```
;;; Specifying a different scaler
(interpolate 50 '(0 0 100 1) :scaler 2)
```

```
=> 1.0
```

```
;;; Specifying a different exponent by which the result is to be raised
(interpolate 50 '(0 0 100 1) :exp 2)
```

```
=> 0.25
```

**SYNOPSIS:**

```
(defun interpolate (point env &key (scaler 1) (exp 1) (warn t))
```

**14.28 utilities/list-to-string**

```
[ utilities ] [ Functions ]
```

**DESCRIPTION:**

Convert a list to a string.

#### ARGUMENTS:

- A list.

#### OPTIONAL ARGUMENTS:

- A string that will serve as a separator between the elements.  
Default = " ".
- T or NIL to indicate whether a list value of NIL is to be returned as "NIL" or NIL. T = "NIL" as a string. Default = T.

#### RETURN VALUE: EXAMPLE:

```
;;; Using defaults
(list-to-string '(1 2 3 4 5))
```

```
=> "1 2 3 4 5"
```

```
;;; Specifying a different separator
(list-to-string '(1 2 3 4 5) "-")
```

```
=> "1-2-3-4-5"
```

```
;;; A NIL list returns "NIL" as a string by default
(list-to-string NIL)
```

```
=> "nil"
```

```
;;; Setting the second optional argument to NIL returns a NIL list as NIL
;;; rather than as "NIL" as a string
(list-to-string NIL "" nil)
```

```
=> NIL
```

#### SYNOPSIS:

```
(defun list-to-string (list &optional (separator " ") (nil-as-string t))
```

## 14.29 utilities/logarithmic-steps

[ utilities ] [ Functions ]

#### DESCRIPTION:

Create a list of progressing from the first specified argument to the second specified argument over the specified number of steps using an exponential curve rather than linear interpolation.

#### ARGUMENTS:

- A number that is the starting value in the resulting list.
- A number that is the ending value in the resulting list.
- An integer that will be the length of the resulting list - 1.

#### OPTIONAL ARGUMENTS:

- A number that will be used as the exponent when determining the exponential interpolation between values. Default = 2.

#### RETURN VALUE:

A list of numbers.

#### EXAMPLE:

```
(logarithmic-steps 1 100 19)
```

```
=> (1.0 1.3055556 2.2222223 3.75 5.888889 8.638889 12.0 15.972222 20.555555
    25.75 31.555555 37.97222 45.0 52.63889 60.88889 69.75 79.22222 89.30556
    100.0)
```

#### SYNOPSIS:

```
(defun logarithmic-steps (low high num-steps &optional (exponent 2))
```

### 14.30 utilities/middle

[ *utilities* ] [ *Functions* ]

#### DESCRIPTION:

Get the number value that is middle of two number values.

#### ARGUMENTS:

- A first number.
- A second number.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
(middle 7 92)
```

```
=> 49.5
```

**SYNOPSIS:**

```
(defun middle (lower upper)
```

**14.31 utilities/mins-secs-to-secs**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Derive the number of seconds from a minutes-seconds value that is indicated as a two-item list in the form '(minutes seconds).

**ARGUMENTS:**

- A two-item list of integers in the form '(minutes seconds).

**RETURN VALUE:**

A decimal number that is a number in seconds.

**EXAMPLE:**

```
(mins-secs-to-secs '(2 1))
```

```
=> 121.0
```

**SYNOPSIS:**

```
(defun mins-secs-to-secs (list)
```

**14.32 utilities/move-elements***[ utilities ] [ Functions ]***DATE:**

02-Mar-2011

**DESCRIPTION:**

Move the specified elements from one list (if they are present in that list) to another, deleting them from the first.

**ARGUMENTS:**

- A list of elements that are the elements to be moved.
- A list from which the specified elements are to be moved and deleted.
- A list to which the specified elements are to be moved.

**OPTIONAL ARGUMENTS:**

- A predicate by which to test that the specified elements are equal to elements of the source list. Default = #'eq.

**RETURN VALUE:**

Two values: A first list that is the source list after the items have been moved; a second list that is the target list after the items have been moved.

**EXAMPLE:**

```
(move-elements '(3 5 8) '(1 2 3 4 5 6 7 8 9) '(a b c d e))
```

```
=> (1 2 4 6 7 9), (8 5 3 A B C D E)
```

**SYNOPSIS:**

```
(defun move-elements (what from to &optional (test #'eq))
```

**14.33 utilities/move-to-end***[ utilities ] [ Functions ]***DATE:**



22-May-2011

#### DESCRIPTION:

Move a specified element of a given list to the end of the list, returning the new list.

NB: If the element exists more than once in the given list, all but one of the occurrences will be removed and only one of them will be placed at the end.

#### ARGUMENTS:

- An item that is an element of the list that is the second argument.
- A list.

#### RETURN VALUE:

A list.

#### EXAMPLE:

```
;;; All unique items
(move-to-end 2 '(1 2 3 4 5))
```

```
=> (1 3 4 5 2)
```

```
;;; Duplicate items
(move-to-end 2 '(1 2 3 2 4 2 5))
```

```
=> (1 3 4 5 2)
```

#### SYNOPSIS:

```
(defun move-to-end (what list &optional (test #'eql))
```

### 14.34 utilities/nconc-sublists

[ utilities ] [ Functions ]

#### DESCRIPTION:

Concatenate corresponding sublists of a given list. Each sublist in the argument should have the same length and number of sublists etc.

**ARGUMENTS:**

A list of lists.

**RETURN VALUE:**

A list of lists.

**EXAMPLE:**

```
(nconc-sublists '(((1 2) (a b) (cat dog))
                  ((3 4) (c d) (bird fish))
                  ((5 6) (e f) (pig cow))))

=> ((1 2 3 4 5 6) (A B C D E F) (CAT DOG BIRD FISH PIG COW))
```

**SYNOPSIS:**

```
(defun nconc-sublists (lists)
```

**14.35 utilities/nearest-power-of-2**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Return the closest number to the specified value that is a power of two but not greater than the specified value.

**ARGUMENTS:**

- A number.

**RETURN VALUE:**

An integer that is a power of two.

**EXAMPLE:**

```
(nearest-power-of-2 31)

=> 16

(nearest-power-of-2 32)
```

```
=> 32
```

```
(nearest-power-of-2 33)
```

```
=> 32
```

**SYNOPSIS:**

```
(defun nearest-power-of-2 (num)
```

**14.36 utilities/octave-freqs**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

A boolean test to determine whether two specified frequencies are octave transpositions of the same pitch class.

**ARGUMENTS:**

- A first number that is a frequency in Hertz.
- A second number that is a frequency in Hertz.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether identical frequencies ("unison") are also to be considered octave transpositions of the same pitch class.  
T = unisons are also octaves. Default = T.

**RETURN VALUE:**

T or NIL.

**EXAMPLE:**

```
(octave-freqs 261.63 2093.04)
```

```
=> T
```

```
(octave-freqs 261.63 3000.00)
```

```
=> NIL
```

```
(octave-freqs 261.63 261.63)
```

```
=> T
```

```
(octave-freqs 261.63 261.63 nil)
```

```
=> NIL
```

### SYNOPSIS:

```
(defun octave-freqs (freq1 freq2 &optional (unison-also t))
```

## 14.37 utilities/parse-audacity-label-file-for-loops

[ *utilities* ] [ *Functions* ]

### DESCRIPTION:

Read an audacity label file and return its loop points as groups.

NB: If this fails it's probably because there's a tab between time and label instead of spaces: save in emacs to detab.

NB: Beware that marker files created on different operating systems from the one on which this function is called might trigger errors due to newline character mismatches.

### ARGUMENTS:

- A string that is the name of the label file to be parsed, including directory path and extension.

### RETURN VALUE:

Returns a list of lists which are the grouped time points.

Also prints separate feedback to the listener.

### EXAMPLE:

```
(parse-audacity-label-file-for-loops "/path/to/24-7loops1.txt")
```

```
=>
```

```
313 markers, 50 loops read
```

```
((25.674559 25.829296 26.116327 26.649048 27.038843)
(32.211884 32.33669 32.481815 32.618233 32.716915 32.902676 33.227757
 33.61959)
(36.893604 37.059048 37.160633 37.27383 37.439274 37.4683 37.627937)
(39.52907 39.81932 39.999275 40.2634 40.338867 40.605896)
(45.612698 45.818775 46.050976 46.145306 46.275192)
(46.4566 46.644535 46.76934 46.886894 46.971066 47.16553)
(84.15927 84.260864 84.292786 84.355194 84.47274 84.52789 84.556915
 84.65415)
...
(676.1075 676.79114 677.1503 677.57904 678.12366)
(799.29205 799.8019 800.58984 800.96063 801.13446 801.45886)
(804.98145 805.2016 805.5724 805.83887 806.31396))
```

**SYNOPSIS:**

```
(defun parse-audacity-label-file-for-loops (label-file)
```

**14.38 utilities/parse-wavelab-marker-file-for-loops**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Read a wavelab marker file and return its loop points as groups.

The marker file must contain markers with the word "loop". A marker with that name will start a new set of loop points, and nameless markers will belong to the group until the next "loop" marker.

**ARGUMENTS:**

- A string that is the name of the marker file to be parsed, including directory path and extension.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :sampling-rate. An integer that is the sampling rate of the sound file to which the marker file refers. This value will affect the resulting time points. Default = 44100.
- :max-length. The maximum duration in seconds between two points: anything greater than this will result in a warning being printed.

**RETURN VALUE:**

Returns a list of lists which are the grouped time points.

Also prints separate feedback to the listener.

**EXAMPLE:**

```
(parse-wavelab-marker-file-for-loops "/path/to/24-7loops1.mrk")
```

```
=>
```

```
WARNING:
```

```
  utilities::parse-wavelab-marker-file-for-loops
  loop points 10:13.213 to 10:14.475 are too long (1.2620239)
```

```
WARNING:
```

```
  utilities::parse-wavelab-marker-file-for-loops
  loop points 10:33.223 to 10:34.486 are too long (1.2630615)
```

```
WARNING:
```

```
  utilities::parse-wavelab-marker-file-for-loops
  loop points 10:36.456 to 10:37.522 are too long (1.06604)
```

```
312 markers, 50 loops read
```

```
((25.674559 25.829296 26.116327 26.649048 27.038843)
 (32.211884 32.33669 32.481815 32.618233 32.716915 32.902676 33.227757
  33.61959)
 (36.893604 37.059048 37.160633 37.27383 37.439274 37.4683 37.627937)
 (39.52907 39.81932 39.999275 40.2634 40.338867 40.605896)
 (45.612698 45.818775 46.050976 46.145306 46.275192)
 (46.4566 46.644535 46.76934 46.886894 46.971066 47.16553)
 (84.15927 84.260864 84.292786 84.355194 84.47274 84.52789 84.556915
  84.65415)
 ...
 (655.91077 656.4554 656.80304 657.4519 658.04285 658.8192)
 (676.1075 676.79114 677.1503 677.57904 678.12366)
 (799.29205 799.8019 800.58984 800.96063 801.13446 801.45886)
 (804.98145 805.2016 805.5724 805.83887 806.31396))
```

**SYNOPSIS:**

```
(defun parse-wavelab-marker-file-for-loops
  (marker-file &key (sampling-rate 44100) (max-length 1.0))
```

**14.39 utilities/partial-freqs***[ utilities ] [ Functions ]***DATE:**

13-Dec-2011

**DESCRIPTION:**

A Boolean test to determine whether either of two specified frequencies can be considered a harmonic partial of the other.

**ARGUMENTS:**

- A first frequency in Hertz.
- A second frequency in Hertz.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether identical frequencies ("unison") are also to be considered partials of each other. T = unison are partials.  
Default = T.

**RETURN VALUE:**

T if one of the frequencies has the ratio of a harmonic partial to the other, otherwise NIL.

**EXAMPLE:**

```
(partial-freqs 300 900)
```

```
=> T
```

```
(partial-freqs 300 700)
```

```
=> NIL
```

```
(partial-freqs 300 300)
```

```
=> T
```

```
(partial-freqs 300 300 nil)
```

```
=> NIL
```

**SYNOPSIS:**

```
(defun partial-freqs (freq1 freq2 &optional (unison-also t))
```

**14.40 utilities/pdivide**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Creates a list of proportional times, dividing a starting duration into a number of smaller durations a specified number of times. We start with a proportion as a ratio (e.g. 3/2) and divide the given duration into two parts according to that ratio. Then those two parts will be divided into the same ratios. This will iterate the number of times indicated by the second argument.

The following are some classical proportions:

	Latin	(Greek)
(3 : 2)	Sesquialtera	(Diapente)
(4 : 3)	Sesquitertia	(Diatessaron)
(5 : 4)	Sesquiquarta	(Diatonus Semitonus)
(8 : 3)	Duplasuperbipartiens	(Diapson Diatesseron)
(9 : 8)	Sesquioctava	(Tonus)

**ARGUMENTS:**

- an integer or ratio (in Lisp terms, a rational) e.g. 3/2
- an integer >=1 specifying the number of times to iterate the process of dividing the duration into proportions.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :duration. The overall duration to apply the proportional divisions to. Units are arbitrary of course as this is just a number. Default 1.0.
- :print. If T, print each level of division as we proceed. Default NIL.
- :reverse. If T reverse the proportion (so 3/2 becomes 2/3). Default NIL.
- :alternate. If T, reverse the proportion every other division (not iteration) so that if we have a proportion of 3/2 on the second iteration we divide into 3/2 then 2/3. Default NIL.
- :increment. If T, then each time we divide we increment both sides of the proportion, so 3:2 becomes 4:3 which becomes 5:4 etc. Default NIL.
- :halves. This will only make a difference if :increment is T: As results tend overall towards increasing (when numerator < denominator e.g. 2/3) or



decreasing (numerator > denominator e.g. 3/2) numbers, we can mix things up by dividing the resultant list into two halves and splicing their elements one after the other. Default NIL.

- :shuffle. Mix things up by shuffling the resultant list. As this uses the shuffle algorithm we have fixed-seed randomness so results will be the same upon each call within the same Lisp implementation/version. Default NIL.

### RETURN VALUE:

Three values: the list of ascending timings from the last generation of the calculated proportions; the durations of each part for the last generation; the list of ascending timings for `_each_` generation of the calculated proportions (a list of lists).

### EXAMPLE:

Notice here that each generation prints the proportions along with the durations these correspond to and the start time of each (cumulative durations).

```
(pdivide 3/2 4 :duration 35 :print t)
```

#### PRINTS:

```
Generation 1: 3 (21.00=21.00), 2 (14.00=35.00),
```

```
Generation 2: 3 (12.60=12.60), 2 (8.40=21.00), 3 (8.40=29.40), 2 (5.60=35.00),
```

```
Generation 3: 3 (7.56=7.56), 2 (5.04=12.60), 3 (5.04=17.64), 2 (3.36=21.00),
3 (5.04=26.04), 2 (3.36=29.40), 3 (3.36=32.76), 2 (2.24=35.00),
```

```
Generation 4: 3 (4.54=4.54), 2 (3.02=7.56), 3 (3.02=10.58), 2 (2.02=12.60),
3 (3.02=15.62), 2 (2.02=17.64), 3 (2.02=19.66), 2 (1.34=21.00), 3 (3.02=24.02),
2 (2.02=26.04), 3 (2.02=28.06), 2 (1.34=29.40), 3 (2.02=31.42), 2 (1.34=32.76),
3 (1.34=34.10), 2 (0.90=35.00),
```

#### RETURNS:

```
(0.0 4.5360003 7.5600004 10.584001 12.6 15.624001 17.640001 19.656002 21.000002
24.024002 26.040003 28.056004 29.400003 31.416004 32.760006 34.104008
35.000008)
```

```
(4.5360003 3.0240002 3.0240004 2.0160003 3.0240004 2.0160003 2.0160003
1.3440002 3.0240004 2.0160003 2.0160003 1.3440002 2.0160003 1.3440001
1.3440001 0.896)
```

```
((0.0 4.5360003 7.5600004 10.584001 12.6 15.624001 17.640001 19.656002
21.000002 24.024002 26.040003 28.056004 29.400003 31.416004 32.760006
34.104008 35.000008)
```

```
(0.0 7.5600004 12.6 17.640001 21.000002 26.040003 29.400003 32.760002
```

```

35.000004)
(0.0 12.6 21.0 29.400002 35.0) (0.0 21.0 35.0))

(pddivide 3/2 4 :duration 35 :print t :increment t :halves t)

PRINTS:
Generation 1: 3 (21.00=21.00), 2 (14.00=35.00),

Generation 2: 4 (12.00=12.00), 3 (9.00=21.00), 5 (7.78=28.78), 4 (6.22=35.00),

Generation 3: 6 (6.55=6.55), 5 (5.45=12.00), 7 (4.85=16.85), 6 (4.15=21.00),
8 (4.15=25.15), 7 (3.63=28.78), 9 (3.29=32.07), 8 (2.93=35.00),

Generation 4: 10 (3.44=3.44), 9 (3.10=6.55), 11 (2.86=9.40), 10 (2.60=12.00),
12 (2.53=14.53), 11 (2.32=16.85), 13 (2.16=19.01), 12 (1.99=21.00),
14 (2.15=23.15), 13 (2.00=25.15), 15 (1.88=27.03), 14 (1.75=28.78),
16 (1.70=30.48), 15 (1.59=32.07), 17 (1.51=33.58), 16 (1.42=35.00),

RETURNS:
(0.0 3.4449766 5.595868 8.696347 10.6936035 13.550747 15.428142 18.025545
19.77778 22.30621 24.0064 26.324125 27.918053 30.078053 31.58647 33.580315
35.0)
(3.4449766 2.1508918 3.100479 1.9972568 2.8571434 1.8773947 2.5974028 1.752235
2.5284283 1.7001898 2.317726 1.593928 2.16 1.5084175 1.9938462 1.4196872)
((0.0 3.4449766 6.5454555 9.402599 12.000002 14.52843 16.846155 19.006155
21.000002 23.150894 25.148151 27.025547 28.777782 30.477972 32.0719 33.58032
35.000004)
(0.0 6.5454555 12.000002 16.846157 21.000004 25.148151 28.77778 32.0719
35.000004)
(0.0 12.000001 21.0 28.777779 35.0) (0.0 21.0 35.0))

```

**SYNOPSIS:**

```

(defun pddivide (start levels &key (duration 1.0) print reverse alternate
                halves shuffle increment)

```

**14.41 utilities/pexpand**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Instead of dividing an overall duration (pddivide) we start with a proportion and expand outwards from there, keeping each newly created part

in the same proportion. This is repeated the number of times specified in the first argument. Useful for generating maps (section structure).

#### ARGUMENTS:

The number of times to expand proportionally.

#### OPTIONAL ARGUMENTS:

As many integer proportions as required. If the last argument here is t, then instead of using letters to denote sections we use numbers instead.

#### RETURN VALUE:

3 values:

- 1) a list showing the cumulative count (e.g. bar numbers) of where major and minor sections occur. Topmost sections will have the labels A, B, C, etc. with subsections such as A.A, A.B, ... C.C.C.C. Of course, wherever a major section starts, an arbitrary number of subsections also begin, but only the most major section is present in the list.
- 2) the structure of the sections and subsections in the form of a list of sublists for each, and containing the section labels paired with their length. The bottommost subsection will have a length of the sum of the proportions, with higher subsection groupings showing multiples of this.
- 3) the overall length of the structure produced (also the first element of the second returned value).

#### EXAMPLE:

```
;;; 2 generations:
(pexpand 2 3 2) =>
(1 (A) 6 (A A A B) 11 (A A A C) 16 (A A B) 21 (A A B B) 26 (A B) 31 (A B A B)
36 (A B A C) 41 (A B B) 46 (A B B B) 51 (A C) 56 (A C A B) 61 (A C A C) 66
(A C B) 71 (A C B B) 76 (B) 81 (B A A B) 86 (B A A C) 91 (B A B) 96 (B A B B)
101 (B B) 106 (B B A B) 111 (B B A C) 116 (B B B) 121 (B B B B))
(125
(((A) 75)
 (((A A) 25) (((A A A) 15) ((A A A A) 5) ((A A A B) 5) ((A A A C) 5))
  (((A A B) 10) ((A A B A) 5) ((A A B B) 5)))
 (((A B) 25) (((A B A) 15) ((A B A A) 5) ((A B A B) 5) ((A B A C) 5))
  (((A B B) 10) ((A B B A) 5) ((A B B B) 5)))
 (((A C) 25) (((A C A) 15) ((A C A A) 5) ((A C A B) 5) ((A C A C) 5))
  (((A C B) 10) ((A C B A) 5) ((A C B B) 5)))
((B) 50)
 (((B A) 25) (((B A A) 15) ((B A A A) 5) ((B A A B) 5) ((B A A C) 5))
```

```

      (((B A B) 10) ((B A B A) 5) ((B A B B) 5)))
      (((B B) 25) (((B B A) 15) ((B B A A) 5) ((B B A B) 5) ((B B A C) 5))
      (((B B B) 10) ((B B B A) 5) ((B B B B) 5))))
125

;;; 3 generations:
(pexpand 3 3 2) =>
(1 (A) 6 (A A A A A B) 11 (A A A A A C) 16 (A A A A B) 21 (A A A A B B) 26
 (A A A B) 31 (A A A B A B) 36 (A A A B A C) 41 (A A A B B) 46 (A A A B B B) 51
 (A A A C) 56 (A A A C A B) 61 (A A A C A C) 66 (A A A C B) 71 (A A A C B B) 76
...
581 (B B B A A B) 586 (B B B A A C) 591 (B B B A B) 596 (B B B A B B) 601
 (B B B B) 606 (B B B B A B) 611 (B B B B A C) 616 (B B B B B) 621
 (B B B B B B))
625
(((A) 375)
 (((A A) 125)
  (((A A A) 75)
   (((A A A A) 25)
    (((A A A A A) 15) ((A A A A A A) 5) ((A A A A A B) 5) ((A A A A A C) 5))
    (((A A A A B) 10) ((A A A A B A) 5) ((A A A A B B) 5))))
...
(((B B B) 50)
 (((B B B A) 25)
  (((B B B A A) 15) ((B B B A A A) 5) ((B B B A A B) 5) ((B B B A A C) 5))
  (((B B B A B) 10) ((B B B A B A) 5) ((B B B A B B) 5))))
(((B B B B) 25)
 (((B B B B A) 15) ((B B B B A A) 5) ((B B B B A B) 5) ((B B B B A C) 5))
 (((B B B B B) 10) ((B B B B B A) 5) ((B B B B B B) 5))))))
625

;;; 2 generations of 3 proportional values, returning numbers for labels
(pexpand 2 3 2 4 t) =>
(1 (1) 10 (1 1 1 2) 19 (1 1 1 3) 28 (1 1 2) 37 (1 1 2 2) 46 (1 1 3) 55
 (1 1 3 2) 64 (1 1 3 3) 73 (1 1 3 4) 82 (1 2) 91 (1 2 1 2) 100 (1 2 1 3) 109
 (1 2 2) 118 (1 2 2 2) 127 (1 2 3) 136 (1 2 3 2) 145 (1 2 3 3) 154 (1 2 3 4)
... (3 4 2 2) 694 (3 4 3) 703 (3 4 3 2) 712 (3 4 3 3) 721 (3 4 3 4))

(729
 (((1) 243)
  (((1 1) 81) (((1 1 1) 27) (((1 1 1 1) 9) ((1 1 1 2) 9) ((1 1 1 3) 9))
   (((1 1 2) 18) ((1 1 2 1) 9) ((1 1 2 2) 9))
   (((1 1 3) 36) ((1 1 3 1) 9) ((1 1 3 2) 9) ((1 1 3 3) 9) ((1 1 3 4) 9))))
...
  (((3 2 2) 18) ((3 2 2 1) 9) ((3 2 2 2) 9))
  (((3 2 3) 36) ((3 2 3 1) 9) ((3 2 3 2) 9) ((3 2 3 3) 9) ((3 2 3 4) 9)))

```

```

(((3 3) 81) (((3 3 1) 27) ((3 3 1 1) 9) ((3 3 1 2) 9) ((3 3 1 3) 9))
  (((3 3 2) 18) ((3 3 2 1) 9) ((3 3 2 2) 9))
    (((3 3 3) 36) ((3 3 3 1) 9) ((3 3 3 2) 9) ((3 3 3 3) 9) ((3 3 3 4) 9)))
  (((3 4) 81) (((3 4 1) 27) ((3 4 1 1) 9) ((3 4 1 2) 9) ((3 4 1 3) 9))
    (((3 4 2) 18) ((3 4 2 1) 9) ((3 4 2 2) 9))
      (((3 4 3) 36) ((3 4 3 1) 9) ((3 4 3 2) 9) ((3 4 3 3) 9) ((3 4 3 4) 9))))))
729

```

**SYNOPSIS:**

```
(defun pexpand (generations &rest proportions)
```

**14.42 utilities/pexpand-find**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Find the cumulative number of where a label occurs in a list returned by pexpand.

**ARGUMENTS:**

- the label we're looking for
- a list of the type returned by pexpand (first returned value).

**OPTIONAL ARGUMENTS:**

- a function to be called when the label cannot be found. Default = #'error but could also be #'warn or NIL.

**RETURN VALUE:**

An integer.

**SYNOPSIS:**

```
(defun pexpand-find (label list &optional (on-error #'error))
```

**14.43 utilities/power-of-2**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Test whether the specified number is a power of two and return the logarithm of the specified number to base 2.

This method returns two values: T or NIL for the test and a decimal that is the logarithm of the specified number to base 2.

**ARGUMENTS:**

- A number.

**RETURN VALUE:**

Two values: T or NIL for the test and a decimal number that is the logarithm of the specified number to base 2.

**EXAMPLE:**

(power-of-2 16)

=> T, 4.0

(power-of-2 17.3)

=> NIL, 4.1127

**SYNOPSIS:**

(defun power-of-2 (float)

**14.44 utilities/pts2cm**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Convert a specified number of points to a length in centimeters at a resolution of 72ppi.

**ARGUMENTS:**

- A number.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
(pts2cm 150)
```

```
=> 5.2916665
```

**SYNOPSIS:**

```
(defun pts2cm (points)
```

**14.45 utilities/random-amount**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Return a random number from within a total range of <percent> of the given number, centering around zero. Thus, if the <number> is 100, and the <percent> is 5, the results will be a random number between -2.5 and +2.5.

**ARGUMENTS:**

A number.

**OPTIONAL ARGUMENTS:**

A number that will be a percent of the given number.

**RETURN VALUE:**

A random positive or negative number.

**EXAMPLE:**

```
;;; Using the default will return numbers within a 5% span of the given number,
;;; centering around zero. With 100 that means between -2.5 and +2.5.
(loop repeat 10 collect (random-amount 100))
```

```
=> (0.7424975 -1.4954442 -1.7126495 1.5918689 -0.43478793 -1.7916341 -1.9115914
    0.8541988 0.057197176 2.0713913)
```

```
;;; Specifying 10% of 80 will return random numbers between -4.0 and +4.0
(loop repeat 10 collect (random-amount 80 10))
```

```
=> (-0.66686153 3.0387697 3.4737322 -2.3753185 -0.8495751 -0.47580242
    -0.25743783 -1.1395472 1.3560238 -0.5958566)
```

**SYNOPSIS:**

```
(defun random-amount (number &optional (percent 5))
```

**14.46 utilities/random-from-list**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Return a random element from a specified list of elements.

**ARGUMENTS:**

- A list.

**OPTIONAL ARGUMENTS:**

- An integer can be passed stating the length of the list, for more efficient processing. NB: There is no check to ensure this number is indeed the length of the list. If the number is less than the length of the list, only elements from the first part of the list will be returned. If it is greater than the length of the list, the method may return NIL.

**RETURN VALUE:**

An element from the specified list.

**EXAMPLE:**

```
(random-from-list '(3 5 7 11 13 17 19 23 29))
```

```
=> 13
```

**SYNOPSIS:**

```
(defun random-from-list (list &optional list-length) ; for efficiency
```

**14.47 utilities/randomise**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**



Return a random decimal number close to the number specified (within a certain percentage of that number's value).

**ARGUMENTS:**

- A number.

**OPTIONAL ARGUMENTS:**

- A number that is a percentage value, such that any random number returned will be within that percentage of the original number's value.  
Default = 5.

**RETURN VALUE:**

A decimal number.

**EXAMPLE:**

```
(loop repeat 10 collect (randomise 100))
```

```
=> (99.413795 99.15346 98.682014 100.76199 97.74929 99.05693 100.59494 97.96452  
    100.42091 100.01329)
```

**SYNOPSIS:**

```
(defun randomise (number &optional (percent 5))
```

## 14.48 utilities/read-from-file

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Read a Lisp expression from a file. This is determined by the Lisp parenthetical syntax.

**ARGUMENTS:**

- A string that is a file name including directory path and extension.

**RETURN VALUE:**

The Lisp expression contained in the file.

**EXAMPLE:**

```
(read-from-file "/path/to/lisp-lorem-ipsuam.txt")
```

```
=> (LOREM IPSUM DOLOR SIT AMET CONSECTETUR ADIPISCING ELIT CRAS CONSEQUAT
    CONVALLIS JUSTO VITAE CONSECTETUR MAURIS IN NIBH VEL EST TEMPUS LOBORTIS
    SUSPENDISSE POTENTI SED MAURIS MASSA ADIPISCING VITAE DIGNISSIM CONDIMENTUM
    VOLUTPAT VEL FELIS FUSCE AUGUE DUI PULVINAR ULTRICIES IMPERDIET SED
    PHARETRA EU QUAM INTEGER IN VULPUTATE VELIT ALIQUAM ERAT VOLUTPAT VIVAMUS
    SIT AMET ORCI EGET EROS CONSEQUAT TINCIDUNT NUNC ELEMENTUM ADIPISCING
    LOBORTIS MORBI AT LOREM EST EGET MATTIS ERAT DONEC AC RISUS A DUI MALESUADA
    LOBORTIS AC AT EST INTEGER AT INTERDUM TORTOR VIVAMUS HENDRERIT CONSEQUAT
    AUGUE QUISQUE ALIQUAM TELLUS NEC VESTIBULUM LOBORTIS RISUS TURPIS LUCTUS
    LIGULA IN BIBENDUM FELIS SEM PULVINAR DOLOR VIVAMUS RHONCUS NISI GRAVIDA
    PORTA VULPUTATE IPSUM LACUS PORTA RISUS A VULPUTATE MAGNA JUSTO A EST)
```

**SYNOPSIS:**

```
(defun read-from-file (file)
```

**14.49 utilities/reflect-list**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Order a list of numbers from least to greatest, then transpose the list so that if an element is the second lowest, it will be replaced by the second highest etc.

**ARGUMENTS:**

- A list of numbers.

**RETURN VALUE:**

A list of numbers.

**EXAMPLE:**

```
(reflect-list '(1 4 3 5 9 6 2 7 8 8 9))
```

```
=> (9 6 7 5 1 4 8 3 2 2 1)
```

**SYNOPSIS:**

```
(defun reflect-list (list)
```

## 14.50 utilities/remove-all

[ utilities ] [ Functions ]

### DESCRIPTION:

Remove all of the specified elements from a list, returning a list containing only those elements that are not in the first argument list.

### ARGUMENTS:

- A first list that is the list of items to remove.
- A second list that is the original list.

### OPTIONAL ARGUMENTS:

- A predicate for testing equality between the elements of the two lists.  
Default = #'eq.

### RETURN VALUE:

A list.

### EXAMPLE:

```
(remove-all '(3 5 8 13) '(1 2 3 4 5 6 7 8 9 10 11 12 13))
```

```
=> (1 2 4 6 7 9 10 11 12)
```

### SYNOPSIS:

```
(defun remove-all (rm-list list &optional (test #'eq))
```

## 14.51 utilities/remove-elements

[ utilities ] [ Functions ]

### DESCRIPTION:

Remove a specified number of elements from a given list starting at a specified position (0-based) within the list.

### ARGUMENTS:

- A list.
- An integer that is the 0-based position within that list that will be the first element to be removed.
- An integer that is the number of elements to remove.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
(remove-elements '(1 2 3 4 5 6 7) 2 4)
```

```
=> (1 2 7)
```

**SYNOPSIS:**

```
(defun remove-elements (list start how-many)
```

**14.52 utilities/remove-more**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Remove all instances of a list of specified elements from an original list. The predicate used to test the presence of the specified elements in the original list must be specified by the user (such as #'eq, #'equalp, #'= etc.)

**ARGUMENTS:**

- A list.
- A predicate with which to test the presence of the specified elements.
- A sequence of elements to be removed from the given list.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
(remove-more '(1 2 3 4 5 5 5 6 7 7 8) #'= 5 7 2)
```

```
=> (1 3 4 6 8)
```

**SYNOPSIS:**

```
(defun remove-more (list test &rest remove)
```

**14.53 utilities/replace-elements**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Replace the elements in list between start and end (inclusive) with the new list.

**ARGUMENTS:**

- A list.
- An integer that is first position of the segment of the original list to be replaced.
- An integer that is the last position of the segment of the original list to be replaced.
- A list that is to replace the specified segment of the original list. This list can be of a different length than that of the segment of the original specified by the start and end positions.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
(replace-elements '(1 2 3 4 5 6 7 8 9) 3 7 '(dog cat goldfish))
```

```
=> (1 2 3 DOG CAT GOLDFISH 9)
```

**SYNOPSIS:**

```
(defun replace-elements (list start end new)
```

**14.54 utilities/round-if-close**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Round a decimal number if it is within a given tolerance to the next whole number.

**ARGUMENTS:**

- A decimal number.

**OPTIONAL ARGUMENTS:**

- If the given number is this amount or less than the nearest whole number, round the given number to the nearest whole number.

**RETURN VALUE:**

If the given number is within the tolerance, return the number, otherwise return the nearest whole number.

**EXAMPLE:**

```
(round-if-close 1.999998)
```

```
=> 1.999998
```

```
(round-if-close 1.999999)
```

```
=> 2
```

**SYNOPSIS:**

```
(defun round-if-close (num &optional (tolerance 0.000001))
```

**14.55 utilities/scale-env**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Scale either the x-axis values, the data values, or both of a list of break-point pairs by specified factors.

**ARGUMENTS:**

- An envelope in the form of a list of break-point pairs.
- A number that is the factor by which the y values (data segment of the break-point pairs) are to be scaled.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :y-min. A number that is the minimum value for all y values after scaling. NB The -min/-max arguments are hard-limits only; they do not factor into the arithmetic.
- :y-max. A number that is the maximum value for all y values after scaling.
- :x-scaler. A number that is the factor by which to scale the x-axis values of the break-point pairs.
- :x-min. A number that is the minimum value for all x values after scaling. NB: This optional argument can only be used if a value has been specified for the :x-scaler.
- :x-max. A number that is the maximum value for all x values after scaling. NB: This optional argument can only be used if a value has been specified for the :x-scaler.

**RETURN VALUE:**

An envelope in the form of a list of break-point pairs.

**EXAMPLE:**

```
;;; Scaling only the y values.
```

```
(scale-env '(0 53 25 189 50 7 75 200 100 3) 0.5)
```

```
=> (0 26.5 25 94.5 50 3.5 75 100.0 100 1.5)
```

```
;;; Scaling the y values and setting a min and max for those values
```

```
(scale-env '(0 53 25 189 50 7 75 200 100 3) 0.5 :y-min 20 :y-max 100)
```

```
=> (0 26.5 25 94.5 50 20 75 100 100 20)
```

```
;;; Scaling only the x-axis values
```

```
(scale-env '(0 53 25 189 50 7 75 200 100 3) 1.0 :x-scaler 2)
```

```
=> (0 53.0 50 189.0 100 7.0 150 200.0 200 3.0)
```

```
;;; Scaling the x values and setting a min and max for those values
```

```
(scale-env '(0 53 25 189 50 7 75 200 100 3) 1.0 :x-scaler 2 :x-min 9 :x-max 90)
```

```
=> (9 53.0 50 189.0 90 7.0 90 200.0 90 3.0)
```

**SYNOPSIS:**

```
(defun scale-env (env y-scaler &key x-scaler
```

```
(x-min most-negative-double-float)
(y-min most-negative-double-float)
(x-max most-positive-double-float)
(y-max most-positive-double-float))
```

### 14.56 utilities/secs-to-mins-secs

[ utilities ] [ Functions ]

**DESCRIPTION:** **ARGUMENTS:** **OPTIONAL ARGUMENTS:** **RETURN VALUE:**  
**EXAMPLE:** **SYNOPSIS:**

```
(defun secs-to-mins-secs (seconds &key
                          (mins-separator ":")
                          (secs-separator ".")
                          (msecs-separator "")
                          (same-width nil))
```

### 14.57 utilities/semitones

[ utilities ] [ Functions ]

**DESCRIPTION:**

Return the sample-rate conversion factor required for transposing an audio file by a specific number of semitones. The number of semitones can be given as a decimal number, and may be positive or negative.

**ARGUMENTS:**

- A number of semitones.

**OPTIONAL ARGUMENTS:**

- A number that is the factor required to transpose by an octave.  
Default = 2.0.
- A number that is the number of semitones per octave. Default = 12.

**RETURN VALUE:**

A number.

**EXAMPLE:**



```
;;; Usage with default values
(semitones 3)
```

```
=> 1.1892071
```

```
;;; Specifying a different number of semitones per octave
(semitones 3 2.0 13)
```

```
=> 1.1734605
```

```
;;; Specifying a different factor for transposing by an octave
(semitones 3 4.0)
```

```
=> 1.4142135
```

```
;;; Fractional semitones are allowed
(semitones 3.72)
```

```
=> 1.2397077
```

```
;;; Negative semitones are also allowed
(semitones -3.72)
```

```
=> 0.80664176
```

## SYNOPSIS:

```
(defun semitones (st &optional (octave-size 2.0) (divisions-per-octave 12))
```

## 14.58 utilities/setf-last

[ *utilities* ] [ *Functions* ]

### DESCRIPTION:

Change the last element in a given list to a specified new element.

### ARGUMENTS:

- A list.
- The new last element of that list.

### RETURN VALUE:

Returns the new last element.

**EXAMPLE:**

```
(let ((l '(1 2 3 4 5)))  
  (setf-last l 'dog)  
  l)
```

```
=> (1 2 3 4 DOG)
```

**SYNOPSIS:**

```
(defmacro setf-last (list new-last)
```

**14.59 utilities/sort-symbol-list**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Sort a list of symbols alphabetically ascending, case-insensitive.

**ARGUMENTS:**

A list of symbols.

**RETURN VALUE:**

The same list of symbols sorted alphabetically ascending, case-insensitive.

**EXAMPLE:**

```
(sort-symbol-list '(Lorem ipsum dolor sit amet consectetur adipiscing))
```

```
=> (ADIPISCING AMET CONSECTETUR DOLOR IPSUM LOREM SIT)
```

**SYNOPSIS:**

```
(defun sort-symbol-list (list)
```

**14.60 utilities/splice**

[ utilities ] [ Functions ]

**DESCRIPTION:**

Insert the elements of a first list into a second list beginning at a specified index (0-based).

**ARGUMENTS:**

- A list that contains the elements to be inserted into the second list.
- A list into which the elements of the first argument are to be inserted.
- An integer that is the index within the second list where the elements are to be inserted.

**RETURN VALUE:**

- A list.

**EXAMPLE:**

```
(splice '(dog cat goldfish) '(1 2 3 4 5 6 7 8 9) 3)
```

```
=> (1 2 3 DOG CAT GOLDFISH 4 5 6 7 8 9)
```

**SYNOPSIS:**

```
(defun splice (elements into-list where)
```

**14.61 utilities/split-groups**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Create a list consisting of as many repetitions of a specified number as will fit into a given greater number, with the last item in the new list being the value of any remainder.

**ARGUMENTS:**

- A number that is to be split into repetitions of a specified smaller number (the second argument).
- The number that is to be the repeating item in the new list. This number must be smaller than the first number.

**RETURN VALUE:**

A list consisting of repetitions of the specified number, with the last element being any possible remainder.

**EXAMPLE:**

```
(split-groups 101 17)

=> (17 17 17 17 17 16)
```

**SYNOPSIS:**

```
(defun split-groups (num divider)
```

**14.62 utilities/split-into-sub-groups**

[ *utilities* ] [ *Functions* ]

**DESCRIPTION:**

Create a new list consisting of sublists made from the elements of the original flat list, whose lengths are determined by the second argument to the function.

NB: The lengths given in the second argument are not required to add up to the length of the original list. If their sum is less than the original list, the resulting list of sublists will only contain a segment of the original elements. If their sum is greater than the length of the original list, the last sublist in the new list will be shorter than the corresponding group value.

**ARGUMENTS:**

- A flat list.
- A list of integers that are the lengths of the consecutive subgroups into which the original list is to be divided.

**RETURN VALUE:**

A list of lists.

**EXAMPLE:**

```
;; Used with a list of subgroup lengths whose sum is equal to the length of the
;; original list
(split-into-sub-groups '(1 2 3 4 5 6 7 8 9 10) '(2 2 3 2 1))

=> ((1 2) (3 4) (5 6 7) (8 9) (10))
```

```
;; Used with a list of subgroup lengths whose sum is less than the length of the
;; original list
(split-into-sub-groups '(1 2 3 4 5 6 7 8 9 10) '(2 1))
```

```
=> ((1 2) (3))
```

```
;; Used with a list of subgroup lengths whose sum is greater than the length of
;; the original list
(split-into-sub-groups '(1 2 3 4 5 6 7 8 9 10) '(2 3 17))
```

```
=> ((1 2) (3 4 5) (6 7 8 9 10))
```

### SYNOPSIS:

```
(defun split-into-sub-groups (list groups)
```

## 14.63 utilities/split-into-sub-groups2

[ *utilities* ] [ *Functions* ]

### DESCRIPTION:

Create a new list of lists by splitting the original flat list into sublists of the specified length.

NB: The length given as the second argument is not required to be fit evenly into the length of the original flat list. If the original list is not evenly divisible by the specified length, the resulting list of sublists will contain a final sublist of a different length.

### ARGUMENTS:

- A flat list.
- An integer that is the length of each of the sublists to be created.

### RETURN VALUE:

A list of lists.

### EXAMPLE:

```
;; The second argument fits evenly into the length of the original list.
(split-into-sub-groups2 '(1 2 3 4 5 6 7 8 9 10 11 12) 3)
```

```
=> ((1 2 3) (4 5 6) (7 8 9) (10 11 12))
```

```
;; The second argument does not fit evenly into the length of the original
;; list.
```

```
(split-into-sub-groups2 '(1 2 3 4 5 6 7 8 9 10 11 12) 5)
```

```
=> ((1 2 3 4 5) (6 7 8 9 10) (11 12))
```

#### SYNOPSIS:

```
(defun split-into-sub-groups2 (list length)
```

### 14.64 utilities/split-into-sub-groups3

[ *utilities* ] [ *Functions* ]

#### DESCRIPTION:

Split a given flat list into sublists of the specified length, putting any remaining elements, if there are any, into the last sublist.

#### ARGUMENTS:

- A flat list.
- An integer that is the length of the new sublists.

#### RETURN VALUE:

A list of lists.

#### EXAMPLE:

```
(split-into-sub-groups3 '(1 2 3 4 5 6 7 8 9 10 11 12) 3)
```

```
=> ((1 2 3) (4 5 6) (7 8 9) (10 11 12))
```

```
(split-into-sub-groups3 '(1 2 3 4 5 6 7 8 9 10 11 12) 5)
```

```
=> ((1 2 3 4 5) (6 7 8 9 10 11 12))
```

#### SYNOPSIS:

```
(defun split-into-sub-groups3 (list length)
```

**14.65 utilities/srt***[ utilities ] [ Functions ]***DESCRIPTION:**

Return the semitone transposition for a given sampling rate conversion factor.

**ARGUMENTS:**

- A number that is a sample-rate conversion factor.

**OPTIONAL ARGUMENTS:**

- A number that is the factor required for transposing one octave.
- A number that is the number of scale degrees in an octave.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
;;; Using the defaults
(srt 1.73)
```

```
=> 9.4893
```

```
;;; Using a sample-rate conversion factor of 4.0 for the octave and specifying
;;; 13 divisions of the octave
(srt 1.73 4.0 13)
```

```
=> 5.14
```

**SYNOPSIS:**

```
(let ((last8vesize 0)
      (log8ve 0.0)) ;; so we don't have to recalculate each time
  (defun srt (srt &optional (octave-size 2.0) (divisions-per-octave 12)
              ;; MDE Tue Feb 7 16:59:45 2012 -- round so we don't get tiny
              ;; fractions of semitones due to float inaccuracies?
              (round-to 0.0001))
```

## 14.66 utilities/string-replace

[ utilities ] [ Functions ]

### DESCRIPTION:

Replace specified segments of a string with a new specified string.

### ARGUMENTS:

- A string that is the string segment to be replaced.
- A string that is the string with which the specified string segment is to be replaced.
- The string in which the specified segment is to be sought and replaced.

### RETURN VALUE:

A string.

### EXAMPLE:

```
(string-replace "flat" "\\flat" "bflat clarinet")  
  
=> "b\\flat clarinet"
```

### SYNOPSIS:

```
(defun string-replace (what with string)
```

## 14.67 utilities/swap-elements

[ utilities ] [ Functions ]

### DESCRIPTION:

Swap the order of each consecutive pair of elements in a list.

### ARGUMENTS:

- A list.

### RETURN VALUE:

A list.



**EXAMPLE:**

```
(swap-elements '(1 2 3 4 5 6 7 8 9 10))
```

```
=> (2 1 4 3 6 5 8 7 10 9)
```

```
(swap-elements '(1 2 3 4 5 6 7 8 9))
```

```
=> (2 1 4 3 6 5 8 7 9)
```

**SYNOPSIS:**

```
(defun swap-elements (list)
```

**14.68 utilities/update-app-src**

[ *utilities* ] [ *Functions* ]

**DATE:**

June 1st 2013

**DESCRIPTION:**

NB This function currently works in SBCL and CCL on UNIX systems only.

For users of the slippery chicken app, this function will update the source code of the app to the latest in the online subversion (svn) repository. An internet connection is therefore necessary.

The first time it is run it will delete the current source code and download all the new source code, so make sure to back up if you've modified the source code yourself. When it is run from then on, it will only update the source code that is out of date.

Once the source code is updated, you'll need to restart the app or just Lisp for the changes to be recompiled.

Users without the app can always download the latest source code in a terminal by issuing the following command.

```
svn co https://svn.ecdf.ed.ac.uk/repo/user/medward2/sc-tags/sc-latest/src
```

The first time you call this function, you might get a certificate error. In order to accept the certificate, start the terminal application and type the following:

```
cd /tmp/
svn co https://svn.ecdf.ed.ac.uk/repo/user/medward2/sc-tags/sc-latest/src
```

That should give you a prompt in the terminal from which you can accept the certificate. Then the next time you try it from Lisp the certificate should not cause a problem.

### ARGUMENTS:

The full path to the slippery-chicken application, minus the last slash. Remember that this can't include any spaces in file/folder names

### OPTIONAL ARGUMENTS:

```
keyword arguments:
- :rm. The path to the shell 'rm' command. Default = "/bin/rm"
- :svn. The path to the shell 'svn' command. Default = "/usr/bin/svn"
```

### RETURN VALUE:

The shell return value of the call to SVN, usually 0 on success.

### EXAMPLE:

```
Running for the first time:
(update-app-src "/tmp/sc-app/slippy-chicken.app")
A    /tmp/sc-app/slippy-chicken.app/Contents/Resources/sc/src/sndfile.lsp
A    /tmp/sc-app/slippy-chicken.app/Contents/Resources/sc/src/osc.lsp
A    /tmp/sc-app/slippy-chicken.app/Contents/Resources/sc/src/osc-sc.lsp
[...]
Checked out revision 3608.
0
```

or after successfully updating a previously updated version:

```
...
At revision 3608.
0
```

### SYNOPSIS:

```
(defun update-app-src (path-to-app &key (rm "/bin/rm") (svn "/usr/bin/svn"))
```

### 14.69 utilities/wavelab-to-audacity-marker-file

[ utilities ] [ Functions ]

#### DESCRIPTION:

Write a .txt file suitable for import to audacity with the same name and in the same directory as the file argument.

#### ARGUMENTS:

- A string that is the name of a wavelab marker file, including directory path and extension.

#### OPTIONAL ARGUMENTS:

- An integer that is the sampling rate of the sound file to which the wavelab marker file refers. This value will affect the times of the output.

#### RETURN VALUE:

Returns T and prints the number of markers read to the listener.

#### EXAMPLE:

```
(wavelab-to-audacity-marker-file "/path/to/24-7.mrk" 44100)
```

```
=> 51 markers read
```

#### SYNOPSIS:

```
(defun wavelab-to-audacity-marker-file (file &optional (sampling-rate 44100))
```

### 14.70 utilities/wrap-list

[ utilities ] [ Functions ]

#### DESCRIPTION:

Shift the elements of a list to start at a specified position and wrap to the beginning of the list to the list's tail.

#### ARGUMENTS:

- A list.
- An integer which is the 0-based position in the original list where the new list is to begin.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
(wrap-list '(1 2 3 4 5 6 7 8 9) 4)
```

```
=> (5 6 7 8 9 1 2 3 4)
```

**SYNOPSIS:**

```
(defun wrap-list (list start)
```

## 15 clm/clm-loops

[ *Functions* ]

**DESCRIPTION:**

Generate a sound file from an existing specified sound file by shuffling and repeating specified segments within the source sound file.

This function was first introduced in the composition "breathing Charlie" (under the name loops): see charlie-loops.lsp in that project for examples.

The first required argument to the function is the name of the sound file, including path and extension, looped. This must be a mono file.

The second required argument (entry-points) is a list of times, in seconds, where attacks (or something significant) happen in the file. These are used to create loop start/end points.

Be careful when doing shuffles as if, e.g., the transpositions list is more than 6 elements, shuffling will take a very long time.

The entry-points are used randomly so that any segment may start at any point and transition to any other segment (i.e. skipping intervening segments, always forwards however). There are always two segments in use at any time. The function randomly selects which segments are used, then a

transition (see fibonacci-transitions) from repeated segment 1 to repeated segment 2 is made. Then the next segment is chosen and the process is repeated (i.e. from previous segment 2 to new segment) until the max-start-time (in seconds) is achieved.

fibonacci-transitions are first shuffled and then made into a circular list. Then they are expanded to create the transpositions (each number becomes a series of 1s and 0s--length is the number itself--with a transition from all 0s to all 1s: e.g. (fibonacci-transition 20) -> (0 0 0 0 1 0 0 1 0 1 0 1 0 1 0 1 1 1)) This is then used to select one or the other of the current two segments.

The sample-rate transpositions are simply randomly permuted and selected.

#### ARGUMENTS:

- The name of a sound file, including path and extension.
- A list of numbers that are time in seconds. These serve as the "entry-points", i.e. loop markers within the file, and delineate the beginning and end of segments that will be shuffled and played back at random in the resulting file.

#### OPTIONAL ARGUMENTS:

keyword arguments.

- :max-perms. A number that is the maximum number of permutations generated for the transitions. Default = 1000.
- :fibonacci-transitions. A list of numbers that serve as the number of steps in each transition from one segment to the next. These numbers will be used as the first argument to the call to fibonacci-transition. Default = '(34 21 13 8)
- :max-start-time. A number that is the maximum time in second at which a segment can start in the resulting sound file. Default = 60.0.
- :output-dir. The directory path for the output file. Default = (get-sc-config 'default-dir).
- :srate. The sampling rate. If specified by the user, this will generally be a number. By default it takes the CLM global sample-rate, i.e. `clm::*clm-srate*`
- :data-format. The data format of the resulting file. This must be preceded by the clm package qualifier. See `clm.html` for types of data formats, such as `mus-bshort`, `mus-l24float` etc. Default is the whatever the CLM global `clm::*clm-data-format*` is set to.
- :header-type. The header type of the resulting file. This must be preceded by the clm package qualifier. See `clm.html` for possible header types, such as `mus-riff`, `mus-aifc` etc. By default it takes the CLM global `clm::*clm-header-type*`.

- :sndfile-extension. A string or NIL. If a string, this will be appended to the resulting sound file as a file extension. If NIL, the sound file extension will automatically be selected based on the header type. NB: This argument does not affect the header type! Default = NIL.
- :channels. An integer that is the number of channels in the resulting output. If greater than one, the segments will be automatically panned amongst the channels. Default = 1.
- :transpositions. A list of number that are transpositions in semitones. These will be shuffled and applied randomly to each consecutive segment in the output. Default = '(0).
- :num-shuffles. An integer that will indicate how many times the lists passed to fibonacci-transitions and entry-points will be shuffled before generating output. Default = - 1.
- :suffix. A string that will be automatically appended to the end of the file name. Default = "".
- :src-width. A number that represents the accuracy of the sample-rate conversions undertaken for transposition. The higher this number is, the more accurate the transposition will be, but the longer it will take to process the file. Default = 5.

#### RETURN VALUE:

Returns the name of the file generated.

#### EXAMPLE:

;;; A straightforward example with a number of the variables.

```
(clm-loops "/path/to/sndfile-3.aiff"
  '(0.180 2.164 4.371 7.575 9.4 10.864)
  :fibonacci-transitions '(1 2 3 4 5)
  :max-perms 7
  :output-dir "/tmp/"
  :channels 1
  :transpositions '(1 12 -12)
  :num-shuffles 3
  :src-width 20)
```

```
=> "/tmp/sndfile-3-loops-from-00m00.180-.wav"
```

#### SYNOPSIS:

```
#+clm
(defun clm-loops (sndfile entry-points &key
  (max-perms 1000)
  (fibonacci-transitions '(34 21 13 8))
```

```

(max-start-time 60.0)
(output-dir (get-sc-config 'default-dir))
(srate clm::*clm-srate*)
(data-format clm::*clm-data-format*)
;; MDE Fri May 11 15:33:45 2012
(header-type clm::*clm-header-type*)
;; MDE Fri May 11 15:34:17 2012 --
(sndfile-extension nil)
(channels 1)
;; semitones
(transpositions '(0))
;; added 31/7/05 to vary the order of
;; entry points, transpositions and
;; fibonacci-transitions (could be 0!)
(num-shuffles 1)
(suffix "")
(src-width 5))

```

## 16 clm/clm-loops-all

[ Functions ]

### DESCRIPTION:

Similar to `clm-loops`, but takes a list of lists of entry points (which can also be generated using the `random-loop-points` function, for example) and produces one output sound file for each list of entry points that list contains.

### ARGUMENTS:

- A string that is the name of the source sound file including directory path and extension.
- A list of lists of numbers that are entry points (loop markers) in the specified source sound file.

### OPTIONAL ARGUMENTS:

keyword arguments:

- `:max-perms`. A number that is the maximum number of permutations generated for the transitions. Default = 1000.
- `:fibonacci-transitions`. A list of numbers that serve as the number of steps in each transition from one segment to the next. These numbers will be used as the first argument to the call to `fibonacci-transition`.

```

Default = '(34 21 13 8).
- :max-start-time. A number that is the maximum time in seconds at which a
  segment can start in the resulting sound file. Default = 60.0.
- :output-dir. The directory path for the output file.
  Default = (get-sc-config 'default-dir).
- :srate. The sampling rate. If specified by the user, this will generally
  be a number. By default it takes the CLM global sample-rate, i.e.
  clm::*clm-srate*
- :data-format. The data format of the resulting file. This must be
  preceded by the clm package qualifier. See clm.html for types of data
  formats, such as mus-bshort, mus-l24float etc.
  Default is the whatever the CLM global clm::*clm-data-format* is set to.
- :header-type. The header type of the resulting file. This must be
  preceded by the clm package qualifier. See clm.html for possible header
  types, such as mus-riff, mus-aifc etc. By default it takes the CLM global
  clm::*clm-header-type*.
- :sndfile-extension. A string or NIL. If a string, this will be appended
  to the resulting sound file as a file extension. If NIL, the sound file
  extension will automatically be selected based on the header type. NB:
  This argument does not affect the header type! Default = NIL.
- :channels. An integer that is the number of channels in the resulting
  output. If greater than one, the segments will be automatically panned
  amongst the channels. Default = 1.
- :do-shuffles. T or NIL to indicate whether to shuffle the lists passed to
  fibonacci-transitions and entry-points before generating output.
  T = do shuffles. Default = T.
- :start-after. A number. All loops will be excluded that start before this
  number of seconds. Default = -1.0.
- :stop-after. A number. All loops will be excluded that start after this
  number of seconds. Default = 99999999.0.
- :suffix. A string that will be automatically appended to the end of the
  file name. Default = "".
- :transpositions. A list of number that are transpositions in
  semitones. These will be shuffled and applied randomly to each
  consecutive segment in the output. Default = '(0).
- :transposition-offset. A number that is an additional number of semitones
  to be added to each transposition value before performing the
  transposition. Default = 0.0.
- :src-width. A number that represents the accuracy of the sample-rate
  conversions undertaken for transposition. The higher this number is, the
  more accurate the transposition will be, but the longer it will take to
  process the file. Default = 5.

```

#### RETURN VALUE:

Returns NIL.



**EXAMPLE:**

```
(clm-loops-all
  (concatenate 'string
    cl-user::+slippery-chicken-home-dir+
    "test-suite/test-sndfiles-dir-1/test-sndfile-3.aiff")
  '((0.794 0.961 1.061 1.161 1.318 1.436 1.536)
    (0.787 0.887 0.987 1.153 1.310 1.510)
    (0.749 0.889 1.056 1.213 1.413)
    (0.311 0.411 0.611 0.729)
    (0.744 0.884 1.002))
  :max-perms 6
  :fibonacci-transitions '(31 8 21 13)
  :output-dir "/tmp/"
  :channels 1
  :transpositions '(1 12 -12)
  :src-width 20)
```

**SYNOPSIS:**

```
#+clm
(defun clm-loops-all (sndfile entry-points-list
  &key
    (max-perms 1000)
    (fibonacci-transitions '(34 21 13 8))
    (max-start-time 60.0)
    (output-dir (get-sc-config 'default-dir))
    (srate clm::*clm-srate*)
    (data-format clm::*clm-data-format*)
    ;; MDE Fri May 11 15:33:45 2012
    (header-type clm::*clm-header-type*)
    ;; MDE Fri May 11 15:34:17 2012 --
    (sndfile-extension nil)
    (channels 1)
    (do-shuffles t) ;; see clm-loops
    ;; exclude all those loops who start before this
    ;; number of seconds.
    (start-after -1.0)
    (stop-after 99999999.0)
    (suffix ""))
  ;; semitones
  ;; 6/10/06: using just one list of transpositions passed
  ;; onto clm-loops created the same tone structure for
  ;; every file generated (boring). This list will now be
  ;; shuffled and 10 versions collected which will then be
  ;; passed (circularly) one after the other to clm-loops.
```

```
(transpositions '(0))
(transposition-offset 0.0)
(src-width 5))
```

## 17 clm/random-loop-points

[ Functions ]

### DESCRIPTION:

Return a list of lists of randomly generated entry points (loop markers) for use with clm-loops-all.

This function also produces an output text file containing the same list of lists. This file is in Lisp syntax and can therefore be accessed using read-from-file.

### ARGUMENTS:

- A string that is the file name, including directory path and extension, of the output file to produce.
- A string that is the sound file for which to generate random entry points.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :min-points. An integer that is the least number of entry points to generate for each list. Default = 5.
- :max-points. An integer that is the greatest number of entry points to generate for each list. Default = 13.
- :min-dur. A number that is the shortest duration between two entry points. Default = 0.05.
- :num-loop-sets. An integer that is the number of lists of entry points to generate. Default = 20.
- :scalers. A list of fractions that are durations relative to the min-dur, such that, for example, a min-dur of 0.05 with a scaler of 13/8 would result in a scaled duration of 0.08125. The fractions in this list will be chosen at random when calculating the duration of the next loop segment. Default = '(1/1 2/1 3/2 5/3 8/5 13/8).

### RETURN VALUE: EXAMPLE:

```
(random-loop-points
```

```

/tmp/outfile"
"/path/to/test-sndfile-3.aiff"
:min-points 3
:max-points 7
:min-dur 0.1
:num-loop-sets 5
:scalars '(1/1 2/1 3/2 5/3 7/5 11/7 13/11))

=> ((0.789 0.929 1.079) (0.028 0.228 0.368 0.487 0.687) (0.014 0.164 0.321)
    (0.256 0.406 0.524 0.681) (0.069 0.235 0.353 0.472 0.572 0.69))

```

**SYNOPSIS:**

```

#+clm
(defun random-loop-points (outfile sndfile
  &key
  ;; MDE Thu May 17 17:02:15 2012 -- could also be
  ;; :error or anything else that with-open-file
  ;; accepts
  (if-outfile-exists :overwrite)
  ;; the minimum number of time points for an output
  ;; loop--number of looped sound segments is 1- this
  (min-points 5)
  ;; max number of time points--the actual number of
  ;; points will be randomly chosen between these two
  ;; numbers.
  (max-points 13)
  ;; minimum duration of a loop segment--this number
  ;; will actually be used and scaled by scalars
  (min-dur 0.05)
  ;; how many sets of loops should be generated
  (num-loop-sets 20)
  ;; scalars for the min-dur: these are all
  ;; proportions relative to min-dur so if we have
  ;; 13/8 in this list and min-dur of 0.05 then the
  ;; duration for such a segment would be 0.08125.
  ;; these will be chosen at random when calculating
  ;; the next loop segment duration
  (scalars '(1/1 2/1 3/2 5/3 8/5 13/8)))

```

**18 globals/+slippery-chicken-config-data+**

[ *Global Parameters* ]

**DESCRIPTION:**

A global to hold various user-settable configuration settings. Use e.g. (set-sc-config 'default-dir "~/Desktop") or (get-sc-config 'default-dir) to set or query the settings.

## SYNOPSIS:

```
(defparameter +slippery-chicken-config-data+
  (make-instance
    'assoc-list
    :id 'slippery-chicken-config-data
    :data
    ;; MDE Sun Mar 25 10:39:07 2012 -- The following two are used in
    ;; pitch-seq::get-notes to indicate which lowest number in a pitch-seq would
    ;; indicate that we should select the highest or lowest notes possible for
    ;; the instrument/set.
    ;;
    ;; The first is used to indicate the lowest number in a pitch-seq that would
    ;; indicate that the get-notes algorithm should select the highest notes
    ;; possible for the instrument/set.
    '(pitch-seq-lowest-equals-prefers-high 5)
    ;; the lowest number in a pitch-seq that would indicate that the get-notes
    ;; algorithm should select the lowest notes possible for the
    ;; instrument/set.
    (pitch-seq-lowest-equals-prefers-low 1)
    ;; Whether to automatically open EPS files generated with CMN via
    ;; cmn-display. Currently only works with SBCL and CCL on Mac OSX.
    (cmn-display-auto-open #+sc-auto-open T #-sc-auto-open nil)
    ;; Whether to automatically open PDF files generated with via lp-display.
    ;; Currently only works with SBCL and CCL on Mac OSX.
    (lp-display-auto-open #+sc-auto-open T #-sc-auto-open nil)
    ;; Whether to automatically open MIDI files generated with via midi-play.
    ;; Currently only works with SBCL and CCL on Mac OSX.
    (midi-play-auto-open #+sc-auto-open T #-sc-auto-open nil)
    ;; The default directory for output of sound files, EPS files, and
    ;; Lilypond files. Don't forget the trailing slash (i.e. "/tmp/" not
    ;; "/tmp"). Bear in mind that on OSX the /tmp directory is emptied upon
    ;; reboot so you shouldn't store any files you'd like to keep in there.
    (default-dir "/tmp/")
    ;; The full path to the lilypond command. We need to set this if we'll
    ;; call lp-display, i.e. if we want to automatically call Lilypond and
    ;; open the resultant PDF directly from Lisp. The default should work if
    ;; you have the Lilypond app in your Applications folder on OSX.
    (lilypond-command
      "/Applications/LilyPond.app/Contents/Resources/bin/lilypond")
    ;; The default amplitude for all events that don't have amplitude/dynamic
    ;; set via some means such as marks.
```

```
(default-amplitude 0.7)
;; whether to warn when there's no CMN mark for a given Lilypond mark
(warn-no-cmn-mark t)
;; sim for Lilypond
(warn-no-lp-mark t)
;; Bar number offsets for CMN
(cmn-bar-num-dx-for-sc -0.2)
(cmn-bar-num-dy-for-sc 1.2)
;; font size for CMN bar numbers
(cmn-bar-num-size-for-sc 6)))
```

## 19 osc-sc/osc-call

[ Functions ]

### DESCRIPTION:

Allow OSC (over UDP) messages to be sent for processing. The function waits for input and processes in an endless loop; send 'quit' to stop the function and return to the interpreter. Messages the function doesn't understand will be ignored after a warning being printed.

As this function only terminates when a 'quit' message is sent via OSC, the only way to quit from within Lisp is to send the Interrupt Command (usually Control-C, twice). In that case, the open sockets will remain open, and only closed before reopening the next time this function is called.

Lisp code can be sent, e.g. in MaxMSP via a message, including opening/closing parentheses and nested calls; symbols should be quoted as per usual.

The first two tokens in the list must be /osc-sc and a (usually unique) identifier e.g. ((/osc-sc 1060-osc-sc-eval (print 'dog) )) Both of these tokens will be sent back over OSC in a list, along with the result of the Lisp call. If you're using MaxMSP I would recommend using osc-sc-eval.maxpat (see below) to evaluate your Lisp code as this will package it up with the right tokens and send the evaluated result out of its outlet without causing conflicts with other instances of itself.

For an example MaxMSP patch, see osc-test.maxpat in the examples folder of the documentation (<http://michael-edwards.org/sc/examples/osc-test.maxpat>). You'll also need <http://michael-edwards.org/sc/examples/osc-sc-eval.maxpat>

NB: Currently only works in SBCL.

Some lists (e.g. those including strings/symbols) might not be

recognised as lists by MaxMPS's [route], so process them directly after [fromsymbol].

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :listen-port. The UDP port to listen to for messages. Default = 8000.
- :send-ip. The IP address to send UDP messages back out on.  
Default = #(127 0 0 1))
- :send-port. The UDP port to send messages back out on. Default = 8001.

#### RETURN VALUE:

T

#### SYNOPSIS:

```
(defun osc-call (&key
                  (listen-port 8000)
                  (send-ip #(127 0 0 1))
                  (send-port 8001))
```

## 20 sc/named-object

[ *Classes* ]

#### NAME:

named-object

File: named-object.lsp

Class Hierarchy: None: base class of all slippery-chicken classes.

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the named-object class which is the base class for all of the slippery-chicken classes.

The data slot of the named-object class and its subclasses generally holds the original data passed when creating the object. In anything but the simplest of

classes this may quickly become out-of-date as the object is manipulated, but is nevertheless retained so that a) the user can see what data was used to create an object, and b) the user can derive new objects from an object's original data. Data relevant to a specific subclass is often stored in slots other than :data, e.g. bars, rhythms, etc. so the user should not be alarmed if the data slot itself does not seem to reflect changes made to an object.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 4th December 2000

\$\$ Last modified: 09:12:22 Tue Dec 31 2013 WIT

SVN ID: \$Id: named-object.lsp 4348 2014-01-01 04:26:25Z medward2 \$

## 20.1 named-object/activity-levels

[ *named-object* ] [ *Classes* ]

### NAME:

activity-levels

File: activity-levels.lsp

Class Hierarchy: named-object -> activity-levels

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Class used in rthm-chain. Used on a call-by-call basis to determine (deterministically) whether a process is active or not (boolean).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 4th February 2010

\$\$ Last modified: 14:31:33 Fri May 24 2013 BST

SVN ID: \$Id: activity-levels.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.1.1 activity-levels/active***[ activity-levels ] [ Methods ]***DESCRIPTION:**

Returns t or nil depending on whether we're active at this point. The object remembers where we were last time; this means if we change level before getting to the end of a ten-list, we'll pick up where we left off next time we return to that level. <level> can be a floating point number: in this case it will be rounded. But <level> must be between 0 and 10, where 0 is always inactive, 10 is always active, and anything inbetween will use the data lists circularly.

**ARGUMENTS:**

- the activity-levels object
- the activity-level number we want to test

**RETURN VALUE:**

T or NIL

**EXAMPLE:**

```
(let ((al (make-al)))
  (print (loop for i below 15 collect (active al 0)))
  (print (loop for i below 15 collect (active al 5)))
  (print (loop for i below 15 collect (active al 1)))
  (print (loop for i below 15 collect (active al 9)))
  (loop for i below 15 collect (active al 10)))

=>
(NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL)
(T T NIL NIL T NIL T T NIL NIL NIL T NIL T NIL)
(T NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL T NIL)
(T T NIL T T T T T T T T T NIL)
(T T T T T T T T T T T T T T)
```

**SYNOPSIS:**

```
(defmethod active ((al activity-levels) level)
```

**20.1.2 activity-levels/make-al***[ activity-levels ] [ Functions ]*



**DESCRIPTION:**

Make an activities-level object for determining (deterministically) on a call-by-call basis whether a process is active or not (boolean). This is determined by nine 10-element lists (actually three versions of each) of hand-coded 1s and 0s, each list representing an 'activity-level' (how active the process should be). The first three 10-element lists have only one 1 in them, the rest being zeros. The second three have two 1s, etc. Activity-levels of 0 and 10 would return never active and always active respectively.

**ARGUMENTS:**

None required.

**OPTIONAL ARGUMENTS:**

start-at (default NIL): which of the three 10-element lists to start with (reset to). Should be 1, 2, or 3 though if NIL will default to 1.

**RETURN VALUE:**

The activities-level object.

**SYNOPSIS:**

```
(defun make-al (&optional start-at)
```

**20.1.3 activity-levels/reset**

[ *activity-levels* ] [ *Methods* ]

**DESCRIPTION:**

Reset the activity-levels object to restart at the first element of the 1st (or user-specified) 10-element list.

**ARGUMENTS:**

The activity-levels object.

**OPTIONAL ARGUMENTS:**

start-at: should be between 1 and 3; it indicates which of the 10-lists we're going to start with. Default = 1.

**RETURN VALUE:**

T

**SYNOPSIS:**

```
(defmethod reset ((al activity-levels) &optional (start-at 1) ignore)
```

**20.2 named-object/linked-named-object**

[ *named-object* ] [ *Classes* ]

**NAME:**

linked-named-object

File: linked-named-object.lsp

Class Hierarchy: named-object -> linked-named-object

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Extension of named-object class to provide slots for the previous and next objects in a recursive-assoc-list.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 10th 2002

\$\$ Last modified: 09:18:07 Wed May 16 2012 BST

SVN ID: \$Id: linked-named-object.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.1 linked-named-object/bar-holder**

[ *linked-named-object* ] [ *Classes* ]

**NAME:**

bar-holder

File: bar-holder.lsp

Class Hierarchy: `named-object -> linked-named-object -> bar-holder`

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: This class is meant to be sub-classed by piece, section and sequence, all of which hold each other or, ultimately a list of bars with relevant rhythms, timings, pitches etc.

Author: Michael Edwards: `m@michael-edwards.org`

Creation date: 16th February 2002

\$\$ Last modified: 17:51:50 Fri Dec 27 2013 WIT

SVN ID: \$Id: bar-holder.lsp 4345 2013-12-28 13:11:39Z medward2 \$

## 20.2.2 bar-holder/change-pitches

[ *bar-holder* ] [ *Methods* ]

### DESCRIPTION:

Change the pitches in the specified bars to the specified new pitches.

NB: This method requires that full bars be given, even if not all pitches are being changed.

### ARGUMENTS:

- A bar-holder object (such as the PIECE slot within a slippery-chicken object).
- The ID of the player whose part is to be changed.
- An integer that is the number of the first bar in which pitches are to be changed.
- A list of lists of note-name symbols, each sublist representing a consecutive bar and containing the same number of note-name symbols as there are rhythms in that bar. A NIL in these lists means no change is to be made to the corresponding rhythm or bar (see example below). NB: This method counts tied notes rather than just attacked notes.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :use-last-octave. T or NIL to indicate whether the method is to require that each note-name symbols in the <new-pitches> list has an octave indicator. If this argument is set to NIL, each note-name symbol must have an octave indicator (e.g., the 4 in c4). If this argument is set to T, only the first note-name symbol in the bar is required to have an octave indicator, and all subsequent note-name symbols without octave indicators will use the last octave indicated; e.g. '((a3 b g cs4)). NB: This feature does not work with chords. Default = T.
- :written. T or NIL to indicate whether these are the written or sounding notes for a transposing instrument. Default = NIL.

### RETURN VALUE:

Always returns T.

### EXAMPLE:

;;; NIL indicates that no change is to be made; this applies to single rhythms  
 ;;; as well as entire bars.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                       (vc (cello :midi-channel 2))))
       :set-palette '((1 ((c2 d2 e2 f2 g2 a2 b2
                          c3 d3 e3 f3 g3 a3 b3
                          c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e (s) s))
                                :pitch-seq-palette ((1 (2) 3 4))))
       :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))))
      (change-pitches (piece mini) 'cl 2 '((c4 d4 e4 f4)))
      (change-pitches (piece mini) 'vc 3 '((c3 d e f) nil (g3 nil b c4))))
```

=> T

### SYNOPSIS:

```
(defmethod change-pitches ((bh bar-holder) player start-bar new-pitches
                           &key (use-last-octave t) written)
```

#### 20.2.3 bar-holder/delete-all-marks

[ bar-holder ] [ Methods ]

**DESCRIPTION:**

Delete all marks from the MARKS slots of all events in the specified measure range of a given bar-holder object and set the slot to NIL.

This method always applies to full bars.

**ARGUMENTS:**

- A bar-holder object.
- An integer that is the number of the first bar from which all marks are to be deleted.
- An integer that is the number of consecutive bars including the first bar from which all marks are to be deleted.
- The ID of the player from whose part the marks are to be deleted.

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2)))))
      :set-palette '((1 ((c2 d2 e2 f2 g2 a2 b2
                          c3 d3 e3 f3 g3 a3 b3
                          c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '((1 (1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) h q e (s) s))
                               :pitch-seq-palette ((1 (2) 3 4))
                               :marks (a 1 s 2 te 3 as 4))))
      :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))))
      (delete-all-marks (piece mini) 2 2 'vc))

=> T
```

**SYNOPSIS:**

```
(defmethod delete-all-marks ((bh bar-holder) start-bar num-bars player)
```

**20.2.4 bar-holder/get-note***[ bar-holder ] [ Methods ]***DESCRIPTION:**

Return the event object (or pitch object, if accessing a note within a chord) from a specified bar and note within a given bar-holder object.

**ARGUMENTS:**

- A bar-holder object (e.g. PIECE slot of a slippery-chicken object).
- An integer that is the 1-based number of the bar from which the note is to be retrieved.
- An integer or two-item list of integers that is the 1-based number of the note to retrieve within the specified bar. If an integer, the entire event object is retrieved. A two-item list of integers is used to retrieve a specific note from within a chord, in the form '(2 1), where 2 is the second note (or non-rhythm event) in the bar, and 1 is the first note in the chord counting from the bottom. NB: This argument also counts tied notes, not just attacked notes.
- The ID of the player from whose part the note is to be retrieved.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether, when accessing a pitch in a chord, to return the written or sounding pitch. T = written. Default = NIL.

**RETURN VALUE:**

An event object, or single pitch object if accessing a note within a chord.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                       (vc (cello :midi-channel 2))))
       :set-palette '((1 ((c2 d2 e2 f2 g2 a2 b2
                           c3 d3 e3 f3 g3 a3 b3
                           c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
```

```

                                :pitch-seq-palette ((1 (2) 3 4 5))))
:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(print (get-note (piece mini) 3 '(2 1) 'vc)) ; single pitch within a chord
(print (get-note (piece mini) 3 2 'vc)) ; entire chord event
(print (get-note (piece mini) 5 3 'cl)))

```

**SYNOPSIS:**

```
(defmethod get-note ((bh bar-holder) bar-num note-num player &optional written)
```

**20.2.5 bar-holder/piece**

[ bar-holder ] [ Classes ]

**NAME:**

piece

File: piece.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
piece

AND

named-object -> linked-named-object -> bar-holder ->  
piece

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the piece class which holds all the  
note information for a whole piece in the form of  
sections (possibly subsections), which then contain  
player-sections, sequences and rthm-seq-bars.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 16th February 2002

\$\$ Last modified: 11:44:23 Fri Nov 8 2013 GMT

SVN ID: \$Id: piece.lsp 4252 2013-11-08 14:04:55Z medward2 \$

**20.2.6 piece/delete-sequenzes***[ piece ] [ Methods ]***DESCRIPTION:**

Delete one or more consecutive sequenz objects from a given piece object by specifying any bar number within the first sequenz object to be deleted.

This method deletes the whole sequenz object which contains the bar with a given number.

NB: This method only deletes the sequenz object for the specified player, so the remaining players will have a different structure, making MIDI or printable output impossible. The user must be sure that each section has the same number of sequenzes of identical time-signature structure in each section.

NB: The user must call the update-slots method to ensure that changes to the NUM-BARS slot etc. are reflected in the given slippery-chicken object.

**ARGUMENTS:**

- A piece object.
- An integer that is the number of the bar for which the containing sequenz is to be deleted.
- The ID of the player from whose part the sequenz is to be deleted.

**OPTIONAL ARGUMENTS:**

- An integer that is the number of consecutive sequenz objects to delete, including the first sequenz indicated by the <bar-num> argument.  
Default = 1.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
;;; Print the number of sequenz objects contained in section 2 of each player's ; ; ;
;;; part, delete two sequenz objects from each part in that section, and print ; ; ;
;;; the number of sequenz objects again to see the difference. Update the slots ; ; ;
;;; and call cmn-display for printable output. ; ; ;
```



```

      (let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((hn (french-horn :midi-channel 1))
(vc (cello :midi-channel 2))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1))
(2 (1 1 1 1 1))
(3 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
:pitch-seq-palette ((1 2 3 4 5))))
(2 (((4 4) h h))
:pitch-seq-palette ((1 2))))
:rthm-seq-map '((1 ((hn (1 1 1 1 1))
(vc (1 1 1 1 1))))
(2 ((hn (2 2 2 2 2))
(vc (2 2 2 2 2))))
(3 ((hn (1 1 1 1 1))
(vc (1 1 1 1 1)))))))
(print (length (get-data-data 'hn (get-section mini 2))))
(print (length (get-data-data 'vc (get-section mini 2))))
(delete-sequences (piece mini) 8 'hn 2)
(delete-sequences (piece mini) 8 'vc 2)
(print (length (get-data-data 'hn (get-section mini 2))))
(print (length (get-data-data 'vc (get-section mini 2))))
(update-slots mini)
(cmn-display mini))

```

**SYNOPSIS:**

```
(defmethod delete-sequences ((p piece) bar-num player &optional (how-many 1))
```

**20.2.7 piece/get-nth-sequenz**

[ *piece* ] [ *Methods* ]

**DESCRIPTION:**

Get the sequenz object from a specified section of a piece object by specifying a position index and a player.

NB: This is the primary method for accessing player sequences, as it handles cases in which a player doesn't play in a sequence, and it is called automatically by slippery-chicken.

When the specified player has no note events in the specified sequence and the optional argument <create-rest-seq> is set to T, this method creates a rest sequence (one that consists of the correct number of bars with the right time signatures, but in which the bars are only rest bars) based on a simultaneous sequence in one of the playing instruments.

#### ARGUMENTS:

- A piece object.
- The ID of the section in from which the sequenz object is to be returned.
- The ID of the player from whose part the sequenz object is to be returned.
- An integer that is the index (position) of the desired sequenz object within the given section. This number is 0-based.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to convert sequenz objects that are NIL (i.e., the specified player has no events in the specified sequenz) to sequenz objects consisting of full-bar rests. T = create rest sequences. Default = T. NB: This argument is already called by slippery-chicken with a value of T, so has no effect when used as a post-generation editing method and can be thus considered for internal use only.

#### RETURN VALUE:

Returns a sequenz object.

#### EXAMPLE:

```
;;; Returns a sequenz object
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((hn (french-horn :midi-channel 1))
                       (vc (cello :midi-channel 2))))
       :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1))
                   (2 (1 1 1 1 1))
                   (3 (1 1 1 1 1)))
      :rthm-seq-palette '(((1 (((4 4) h q e s s))
                               :pitch-seq-palette ((1 2 3 4 5))))))
      :rthm-seq-map '(((1 ((hn (1 1 1 1 1))
```

```

                (vc (1 1 1 1 1)))
            (2 ((hn (nil nil nil nil nil))
                (vc (1 1 1 1 1))))
            (3 ((hn (1 1 1 1 1))
                (vc (1 1 1 1 1))))))
(get-nth-sequenz (piece mini) 3 'hn 2))

=>

SEQUENZ: pitch-curve: (1 2 3 4 5)
RTHM-SEQ: num-bars: 1
          num-rhythms: 5
          num-notes: 5
          num-score-notes: 5
          num-rests: 0
          duration: 4.0
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
          (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: (1), next: NIL
BAR-HOLDER:
  start-bar: 13
  end-bar: 13
  num-bars: 1
  start-time: 48.0
  end-time: 52.0
  start-time-qtrs: 48.0
  end-time-qtrs: 52.0
  num-notes (attacked notes, not tied): 5
  num-score-notes (tied notes counted separately): 5
  num-rests: 0
  duration-qtrs: 4.0
  duration: 4.0 (4.000)

```

**SYNOPSIS:**

```

(defmethod get-nth-sequenz ((p piece) section player seq-num ; 0-based
                           &optional (create-rest-seq t))

```

**20.2.8 piece/get-sequenz-from-bar-num**

[ piece ] [ Methods ]

**DESCRIPTION:**

Get the specified sequenz object located at a specified bar-number location of a specified player's part in a given piece object.

**ARGUMENTS:**

- A piece object.
- An integer that is the number of the bar from which to return the sequenz object.
- The ID of the player from whose part the sequenz object is to be returned.

**RETURN VALUE:**

A sequenz object.

**EXAMPLE:**

```
(let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((hn (french-horn :midi-channel 1))
(vc (cello :midi-channel 2))))
:set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1))
(2 (1 1 1 1 1))
(3 (1 1 1 1 1)))
:rthm-seq-palette '(((1 (((4 4) h q e s s))
:pitch-seq-palette ((1 2 3 4 5))))
:rthm-seq-map '(((1 ((hn (1 1 1 1 1))
(vc (1 1 1 1 1))))
(2 ((hn (1 1 1 1 1))
(vc (1 1 1 1 1))))
(3 ((hn (1 1 1 1 1))
(vc (1 1 1 1 1)))))))
(get-sequenz-from-bar-num (piece mini) 7 'vc))
```

```
=>
SEQUENZ: pitch-curve: (1 2 3 4 5)
RTHM-SEQ: num-bars: 1
num-rhythms: 5
num-notes: 5
num-score-notes: 5
num-rests: 0
```

```

duration: 4.0
psp-inversions: NIL
marks: NIL
time-sigs-tag: NIL
handled-first-note-tie: NIL
(for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: (1), next: NIL
BAR-HOLDER:
start-bar: 7
end-bar: 7
num-bars: 1
start-time: 24.0
end-time: 28.0
start-time-qtrs: 24.0
end-time-qtrs: 28.0
num-notes (attacked notes, not tied): 5
num-score-notes (tied notes counted separately): 5
num-rests: 0
duration-qtrs: 4.0
duration: 4.0 (4.000)

```

**SYNOPSIS:**

```
(defmethod get-sequenz-from-bar-num ((p piece) bar-num player)
```

**20.2.9 piece/insert-bar**

[ *piece* ] [ *Methods* ]

**DESCRIPTION:**

Insert a `rthm-seq-bar` object into an existing `piece` object.

NB: As this is a post-generation editing method when used with this class, the `rthm-seq-bar` object must consist of event objects (with pitches), not just rhythm objects. If used to insert a bar into an isolated `rthm-seq` object (not a `sequenz` object), the inserted `rthm-seq-bar` could then consist of rhythm objects rather than events.

NB: Slippery chicken does not check to ensure that a new bar is inserted for each player at a given point; this is up to the user.

NB: The user must call the `update-slots` method to ensure that changes to the `num-bars` slot etc. are reflected in the given `slippery-chicken` object.

**ARGUMENTS:**

- A piece object.
- A rthm-seq-bar object.
- An integer that is the bar-number within the rthm-seq-bar object before which the new bar is to be inserted.
- NB: The optional arguments are actually required for use with this class.

**OPTIONAL ARGUMENTS:**

NB: The optional arguments are actually required for use with this class.

- An integer that is the section of in which the bar is to be inserted.
- The ID of the player into whose part the new bar is to be added.
- An integer that is the number of the sequenz object into which the bar is to be inserted. This is one-based.
- A list of integers that are the curve for a pitch-seq object to be applied to the bar that is to be inserted.

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((hn (french-horn :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                              :pitch-seq-palette ((1 2 3 4 5))))
                          (2 (((4 4) h h))
                              :pitch-seq-palette ((1 2))))
       :rthm-seq-map '((1 ((hn (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (2 ((hn (1 1 1 1 1))
                              (vc (1 2 1 1 1))))
                       (3 ((hn (1 1 1 1 1))
                              (vc (1 1 1 1 1))))))
      (new-bar (make-rthm-seq-bar '((4 4) (w)))))
```

```

(fill-with-rhythms new-bar (loop for r in '(h q. e)
                                for p in '(c4 e4 g4)
                                collect (make-event p r)))
;; slippery-chicken object has 15 bars
(print (num-bars mini))
;; print the number of bars in the sequenz in piece=mini, section=2,
;; seq=2 (0=based), player='hn.
;; has 1 bar
(print (num-bars (get-nth-sequenz (piece mini) 2 'hn 2)))
;; insert an rsb in piece=mini, section=2, seq=3 (1-based), player='hn,
;; before rsb=1 of the existing seq
(insert-bar (piece mini) new-bar 1 2 'hn 3 '(1 2 3))
;; insert an rsb in piece=mini, section=2, seq=3 (1-based), player='vc,
;; before rsb=1 of the existing seq
(insert-bar (piece mini) new-bar 1 2 'vc 3 '(1 2 3))
;; print the number of bars in the sequenz in piece=mini, section=2,
;; seq=2 (0=based), player='hn.
;; now has 2 bars.
(print (num-bars (get-nth-sequenz (piece mini) 2 'hn 2)))
;; update slots of the sc object.
(update-slots mini)
;; print the number of bars of the slippery-chicken object.
;; now 16.
(print (num-bars mini)))

=>
15
1
2
16

```

**SYNOPSIS:**

```

(defmethod insert-bar ((p piece) (rsb rthm-seq-bar) bar-num
                      ;; these aren't actually optional but we don't
                      ;; need them in the rthm-seq method
                      &optional section player seq-num ; seq-num is 1-based!
                      ;; this really is optional
                      pitch-seq)

```

**20.2.10 piece/rebar**

[ piece ] [ Methods ]

**DATE:**

29-Jan-2010

#### DESCRIPTION:

Go through the sequences and rebar according to the first one that has the least number of bars (but following the player hierarchy).

#### ARGUMENTS:

- A piece object (usually provided by calling from the slippery-chicken class)

#### OPTIONAL ARGUMENTS:

- A list of player IDs from the given piece object, ordered in terms of importance i.e. which instrument's bar structure should take precedence.

NB: The optional arguments are actually required in this class (not in slippery-chicken) but the rebar-fun is not yet used.

#### RETURN VALUE:

Always T.

#### SYNOPSIS:

```
(defmethod rebar ((p piece) &optional instruments-hierarchy rebar-fun)
```

#### 20.2.11 bar-holder/player-section

[ bar-holder ] [ Classes ]

#### NAME:

player-section

File: player-section.lsp

Class Hierarchy: named-object -> linked-named-object -> bar-holder  
                  -> player-section  
                  AND  
                  named-object -> linked-named-object -> sclist  
                  -> player-section



Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of player-section class which is simply a bar holder that contains a list of sequences for a particular player.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 18th March 2002

\$\$ Last modified: 15:18:15 Fri Apr 19 2013 BST

SVN ID: \$Id: player-section.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.12 bar-holder/section

[ bar-holder ] [ Classes ]

#### NAME:

section

File: section.lsp

Class Hierarchy: named-object -> linked-named-object -> bar-holder  
-> section

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of section class which is simply a bar holder and recursive-assoc-list that contains (possibly subsections which contain) player-sections.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 23rd March 2002

\$\$ Last modified: 19:08:02 Thu Oct 17 2013 BST

SVN ID: \$Id: section.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.13 section/get-all-players***[ section ] [ Methods ]***DESCRIPTION:**

Return a list of the IDs from all players in a section object. NB: When retrieving from a section within a slippery-chicken object, all players in the ensemble will be returned, as the slippery-chicken object will generate rest bars for players even when they're not active in a given section.

**ARGUMENTS:**

- A section object.

**RETURN VALUE:**

- A list of player IDs (symbols).

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (hn (french-horn :midi-channel 2))
                        (vc (cello :midi-channel 3))))
       :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1))
                   (2 (1 1 1 1 1))
                   (3 (1 1 1 1 1)))
      :rthm-seq-palette '(((1 (((4 4) h q e s s)
                                :pitch-seq-palette ((1 2 3 4 5))))
      :rthm-seq-map '(((1 ((cl (1 1 1 1 1))
                               (hn (1 1 1 1 1))
                               (vc (1 1 1 1 1))))
                       (2 ((cl (1 1 1 1 1))
                               (vc (1 1 1 1 1))))
                       (3 ((hn (1 1 1 1 1))
                               (vc (1 1 1 1 1)))))))
      (print (get-all-players (get-section mini 1)))
      (print (get-all-players (get-section mini 2)))
      (print (get-all-players (get-section mini 3)))))
```

=&gt;

(CL HN VC)

```
(CL HN VC)
(CL HN VC)
```

**SYNOPSIS:**

```
(defmethod get-all-players ((s section))
```

**20.2.14 section/get-bar**

```
[ section ] [ Methods ]
```

**DESCRIPTION:**

Return the `rthm-seq-bar` object at the specified bar number within the given section.

NB: The bar number is counted from the beginning of the entire piece, not the beginning of the section.

**ARGUMENTS:**

- A section object.
- An integer that is the bar number for which to return the `rthm-seq-bar` object. This number is 1-based and counts from the beginning of the piece, not the beginning of the section.

**OPTIONAL ARGUMENTS:**

NB: The `<player>` argument is actually required, but is listed as optional for reasons of class inheritance.

- The ID of the player for whose part the `rthm-seq-bar` object is to be returned.

**RETURN VALUE:**

A `rthm-seq-bar` object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
```

```

(hn (french-horn :midi-channel 2))
(vc (cello :midi-channel 3)))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5)))
              (2 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5)))
              (3 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1))
          (2 (2 2 2 2 2))
          (3 (3 3 3 3 3)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
                      :pitch-seq-palette ((1 2 3 4 5))))
                  (2 (((4 4) q e s s h))
                      :pitch-seq-palette ((1 2 3 4 5))))
                  (3 (((4 4) e s s h q))
                      :pitch-seq-palette ((1 2 3 4 5))))
:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                     (hn (1 1 1 1 1))
                     (vc (1 1 1 1 1)))))
              (2 ((cl (2 2 2 2 2))
                 (hn (2 2 2 2 2))
                 (vc (2 2 2 2 2)))))
              (3 ((cl (3 3 3 3 3))
                 (hn (3 3 3 3 3))
                 (vc (3 3 3 3 3))))))
(get-bar (get-section mini 3) 11 'hn))

=>
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: T, bar-num: 11,
old-bar-nums: NIL, write-bar-num: NIL, start-time: 40.000,
start-time-qtrs: 40.0, is-rest-bar: NIL, multi-bar-rest: NIL,
show-rest: T, notes-needed: 5,
tuplets: NIL, nudge-factor: 0.35, beams: NIL,
current-time-sig: 2, write-time-sig: NIL, num-rests: 0,
num-rhythms: 5, num-score-notes: 5, parent-start-end: NIL,
missing-duration: NIL, bar-line-type: 0,
player-section-ref: (3 HN), nth-seq: 0, nth-bar: 0,
rehearsal-letter: NIL, all-time-sigs: (too long to print)
sounding-duration: 4.000,
rhythms: (
[...]
)
SCLIST: sclist-length: 6, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "3-bar1", tag: NIL,
data: ((4 4) E S S H Q)

```

SYNOPSIS:

```
(defmethod get-bar ((s section) bar-num &optional player)
```

### 20.2.15 section/get-sequenz

[ section ] [ Methods ]

**DESCRIPTION:**

Get the specified sequenz object from a given section object.

**ARGUMENTS:**

- A section object.
- The ID of the player from whose part the sequenz object is to be returned.
- An integer that is the number of the sequence object to be returned from within the given section object. This number is 1-based.

**RETURN VALUE:**

A sequenz object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                          (vc (cello :midi-channel 2))))
        :set-palette '(((f3 g3 a3 b3 c4)))
        :set-map '(((1 (1 1 1 1 1))
                      (2 (1 1 1 1 1))
                      (3 (1 1 1 1 1)))
        :rthm-seq-palette '(((4 4) h q e s s)
                              :pitch-seq-palette ((1 2 3 4 5)))
                              (2 (((4 4) q e s s h)
                                   :pitch-seq-palette ((1 2 3 4 5)))
                              (3 (((4 4) e s s h q)
                                   :pitch-seq-palette ((1 2 3 4 5))))
        :rthm-seq-map '(((cl (1 1 1 1 1))
                          (vc (1 1 1 1 1)))
                        (2 ((cl (2 2 2 2 2))
                          (vc (2 2 2 2 2))))
                        (3 ((cl (3 3 3 3 3))
                          (vc (3 3 3 3 3)))))))
```

```

(get-sequenz (get-section mini 2) 'vc 2))

=>
SEQUENZ: pitch-curve: (1 2 3 4 5)
RTHM-SEQ: num-bars: 1
          num-rhythms: 5
          num-notes: 5
          num-score-notes: 5
          num-rests: 0
          duration: 4.0
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
          (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: (1), this: (2), next: (3)
BAR-HOLDER:
          start-bar: 7
          end-bar: 7
          num-bars: 1
          start-time: 24.0
          end-time: 28.0
          start-time-qtrs: 24.0
          end-time-qtrs: 28.0
          num-notes (attacked notes, not tied): 5
          num-score-notes (tied notes counted separately): 5
          num-rests: 0
          duration-qtrs: 4.0
          duration: 4.0 (4.000)

```

**SYNOPSIS:**

```
(defmethod get-sequenz ((s section) player seq-num) ; 1-based
```

**20.2.16 section/has-subsections**

[ *section* ] [ *Methods* ]

**DESCRIPTION:**

Boolean test to determine whether a specified section of a slippery-chicken object has subsections.

**ARGUMENTS:**

- A section object.

# RETURN VALUE:

T if the specified section has subsections, otherwise NIL.

# EXAMPLE:

```
(let (mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1
                    ((a (1 1 1))
                     (b (1 1 1))))
                  (2 (1 1 1 1))
                  (3
                    ((a (1 1 1))
                     (b
                      ((x (1 1 1))
                       (y (1 1 1))))))
                  (4
                    ((a (1 1 1))
                     (b (1 1 1))
                     (c (1 1 1 1))))))
      :rthm-seq-palette '((1 (((2 4) (q) e (s) s))
                              :pitch-seq-palette ((1 2))))
      :rthm-seq-map '((1
                       ((a ((vn (1 1 1)))
                            (b ((vn (1 1 1))))))
                       (2 ((vn (1 1 1 1))))
                       (3
                        ((a ((vn (1 1 1)))
                             (b
                              ((x ((vn (1 1 1)))
                               (y ((vn (1 1 1)))))))))
                       (4
                        ((a ((vn (1 1 1)))
                             (b ((vn (1 1 1)))
                             (c ((vn (1 1 1 1))))))))))
      (print (has-subsections (get-section mini 1)))
      (print (has-subsections (get-section mini 2))))
```

=>

T

NIL

## SYNOPSIS:

```
(defmethod has-subsections ((s section))
```

### 20.2.17 section/num-sequences

[ *section* ] [ *Methods* ]

## DESCRIPTION:

Get the number of sequenz objects in a given section object.

## ARGUMENTS:

- A section object.

## RETURN VALUE:

An integer that is the number of sequenz objects in the specified section object.

## EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :set-palette '((1 ((f3 g3 a3 b3 c4))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((vc (1 1 1 1 1))))
                      (2 ((vc (1 1 1 1 1))))
                      (3 ((vc (1 1 1 1 1)))))))
  (num-sequences (get-section mini 2)))
```

=> 5

## SYNOPSIS:

```
(defmethod num-sequences ((s section))
```



**20.2.18 section/re-bar**

[ section ] [ Methods ]

**DESCRIPTION:**

Regroup the consecutive note and rest events of a given section object into new bars of the specified time signature.

This method will only combine short bars into longer ones; it will not split up longer bars and recombine them.

The method will also use the specified (or default) time signature as a target, and may be forced to create a number of bars that are not of the specified time signature if the number of beats in the given section object do not correspond.

NB: The user must call the update-slots method after using this method as a post-generation editing method.

**ARGUMENTS:**

- A section object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :start-bar. An integer that is the first bar within the specified section that is to be re-barred. Default = First bar of the given section.
- :end-bar. An integer that is the last bar within the specified section that is to be re-barred. Default = Last bar of the given section.
- :min-time-sig. The target time signature for all new bars. NB: Depending on the number of beats in the given section, the method may have to deviate from this target time signature. Default = '(2 4).
- :verbose. T or NIL to indicate whether to print feedback on the re-barring process to the Lisp listener. Default = NIL.
- :auto-beam. T, NIL, or an integer. If T, the method will automatically attach beam indications to the corresponding events according to the beat unit of the time signature. If an integer, the method will beam in accordance with a beat unit that is equal to that integer. If NIL, the method will not automatically place beams. Default = T.

**RETURN VALUE:**

T.

**EXAMPLE: SYNOPSIS:**

```
(defmethod re-bar ((s section)
                  &key start-bar
                  end-bar
                  (min-time-sig '(2 4))
                  verbose
                  ;; could also be a beat rhythmic unit
                  (auto-beam t))
```

**20.2.19 bar-holder/sequenz**

[ bar-holder ] [ Classes ]

**NAME:**

sequenz

File: sequenz.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> rthm-seq  
-> sequenz  
AND  
named-object -> linked-named-object -> bar-holder  
-> sequenz

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the sequenz class which holds the  
necessary data (pitch, rhythms etc.) for one sequenz for  
one instrument.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 15th 2002

\$\$ Last modified: 21:54:21 Fri May 17 2013 BST

SVN ID: \$Id: sequenz.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.20 bar-holder/transpose-bars**

[ bar-holder ] [ Methods ]

Transpose the pitches of the specified bars in a given player's part by a specified number of semitones.

- A bar-holder object (such as the PIECE slot of a slippery-chicken object).
- A positive or negative integer that is the number of semitones by which the pitches of the specified bars are to be transposed.
- An integer that is the number of the first bar in which the pitches are to be transposed.
- An integer that is the number of consecutive bars, including the start-bar, in which the pitches are to be transposed.
- The ID of the player whose part is to be changed.

```
keyword arguments:
- :destructively. T or NIL to indicate whether the transposed pitches are
  to replace the existing pitches of the given bar-holder object. This must
  be set to T if the pitches of the original object are to be transposed
  before, for example, generating output. If NIL, the original object will
  first be cloned, the pitches of the original object will be left
  untouched and the changes will be made to the copy. Default = NIL.
- :print-bar-nums. T or NIL to indicate whether the method should print
  feedback about which bars have been transposed to the listener.
  T = print feedback. Default = NIL.
- :chord-function. The function that is to be used for transposition of
  chords objects. Default = #'transpose (of the chord class).
- :pitch-function. The function that is to be used for transposition of
  pitch objects. Default = #'transpose (of the pitch class).
```

Returns a list of the `rthm-seq-bar` objects that have been transposed.

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                       (vc (cello :midi-channel 2))))
```

```

:set-palette '((1 ((c2 d2 e2 f2 g2 a2 b2
                  c3 d3 e3 f3 g3 a3 b3
                  c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e (s) s))
                       :pitch-seq-palette ((1 (2) 3 4))))
:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(transpose-bars (piece mini) 11 2 2 'cl
                :destructively t
                :print-bar-nums t))

```

**SYNOPSIS:**

```

(defmethod transpose-bars ((bh bar-holder) semitones start-bar num-bars player
                           &key
                           (destructively nil)
                           (print-bar-nums nil)
                           ;; the default functions are the class methods for
                           ;; pitch or chord.
                           (chord-function #'transpose)
                           (pitch-function #'transpose))

```

**20.2.21 linked-named-object/instrument**

[ *linked-named-object* ] [ *Classes* ]

**NAME:**

instrument

File: instrument.lsp

Class Hierarchy: named-object -> linked-named-object -> instrument

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the instrument class which defines musical instrument properties like range and collects/stores information about what the instrument plays: how many notes, in how many bars etc.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 4th September 2001

\$\$ Last modified: 18:26:19 Fri Dec 27 2013 WIT

SVN ID: \$Id: instrument.lsp 4345 2013-12-28 13:11:39Z medward2 \$

### 20.2.22 instrument/default-chord-function

[ *instrument* ] [ *Functions* ]

#### DESCRIPTION:

If an instrument is able to play chords, a function must be defined to select pitches from a list that it can play as a chord. This function (as a symbol) is passed as a slot to the instrument instance.

This is the default function. It returns a 2-note chord with the pitch at index plus that below it, or that above it if there are no lower pitches available. Or it just returns a single-pitch chord object if neither of those cases are possible.

NB: The arguments are supplied by slippery chicken when it calls the function.

#### ARGUMENTS:

- The current number from the pitch-seq. Currently ignored by default.
- The index that the first argument was translated into by the offset and scaler (based on trying to get a best fit for the instrument and set). This can be assumed to be a legal reference into pitch-list as it was calculated as fitting in pitch-seq::get-notes. (zero-based.)
- The pitch-list created from the set, taking into account the instrument's range and other notes already played by other instruments.
- The current pitch-seq object. Currently ignored by default.
- The current instrument object. Currently ignored by default.
- The current set object. Currently ignored by default.

#### RETURN VALUE:

A chord object.

#### SYNOPSIS:

```
(defun default-chord-function (curve-num index pitch-list pitch-seq instrument
                               set)
```

**20.2.23 instrument/force-in-range***[ instrument ] [ Methods ]***DATE:**

October 9th 2013

**DESCRIPTION:**

Forces a pitch to be within an instrument's range by transposing up or down the required number of octaves.

**ARGUMENTS:**

- the instrument object
- the piece object

**OPTIONAL ARGUMENTS:**

- whether the pitch should be considered a sounding pitch. Default = NIL.

**RETURN VALUE:**

A pitch object within the instrument's range.

**EXAMPLE:**

```
(let ((cl (get-data 'b-flat-clarinet
                    +slippery-chicken-standard-instrument-palette+)))

;; needs to go down 1 octave
(print (data (force-in-range cl (make-pitch 'e7))))
;; needs to go up 2 octaves
(print (data (force-in-range cl (make-pitch 'g1))))
;; the t indicates we're dealing with sounding pitches so here there's no
;; transposition...
(print (data (force-in-range cl (make-pitch 'd3) t)))
;; ... but here there is
(print (data (force-in-range cl (make-pitch 'd3)))))

=>
E6
G3
D3
D4
```

**SYNOPSIS:**

```
(defmethod force-in-range ((ins instrument) pitch &optional sounding)
```

**20.2.24 instrument/in-range**

```
[ instrument ] [ Methods ]
```

**DESCRIPTION:**

Checks whether a specified pitch falls within the defined range of a given instrument object or not.

**ARGUMENTS:**

- An instrument object.
- A pitch item (pitch object or note-name symbol).

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the pitch specified is to be compared with the given pitch object's sounding or written range. T = Sounding. Default = NIL. If T, a secondary NIL is also returned to indicate that the specified pitch is neither too high nor too low.

**RETURN VALUE:**

Returns T if the specified pitch falls between the lowest-sounding/lowest-written and the highest-sounding/highest-written pitches of the given pitch object.

If the specified pitch is outside of the range, an additional value of 0 or 1 is also returned to indicate whether the specified pitch is too high (1) or too low (0).

**EXAMPLE:**

```
;; Determine if a pitch provided as a note-name symbol falls within the written
;; range of a non-transposing instrument
(let ((i1 (make-instrument 'inst1 :lowest-written 'bf3 :highest-written 'a6)))
  (in-range i1 'c4))
```

```
=> T, NIL
```

```
;; Determine if a pitch provided as a note-name symbol falls within the
```

```
;; sounding range of a transposing instrument, using the optional argument T
(let ((i2 (make-instrument 'inst1 :lowest-written 'fs3 :highest-written 'c6
                           :transposition 'BF)))
  (in-range i2 'c6 T))
```

```
=> NIL, 1
```

```
;; A pitch object can be used as the specified pitch
(let ((i2 (make-instrument 'inst1 :lowest-written 'fs3 :highest-written 'c6
                           :transposition 'BF)))
  (in-range i2 (make-pitch 'd6)))
```

```
=> NIL, 1
```

## SYNOPSIS:

```
(defmethod in-range ((ins instrument) pitch &optional sounding)
```

### 20.2.25 instrument/make-instrument

[ *instrument* ] [ *Functions* ]

## DESCRIPTION:

Create an instrument object, specifying the values for a number of parameters for describing characteristics of a given instrument, such as lowest and highest pitch, transposition, clefs used by the instrument etc.

NB: The user will generally define instruments will in the context of the `make-instrument-palette` function and added directly to the `+slippery-chicken-standard-instrument-palette+` parameter of the file `instruments.lsp`, using the keyword structure shown below in the **OPTIONAL ARGUMENTS**.

## ARGUMENTS:

- A symbol that is the instrument ID.

## OPTIONAL ARGUMENTS:

keyword arguments:

- `:staff-name`. String. This is the unabbreviated instrument name that will be used for the first page of printed scores.
- `:staff-short-name`. String. This is the abbreviated instrument name that will be used for subsequent pages of printed scores.



- `:lowest-written`. Note-name symbol. This is the lowest written pitch available on the given instrument. Defaults to NIL. A user may only define either the lowest-written value or the lowest-sounding value. If a lowest-written value is given, the method automatically determines the lowest-sounding value based on the lowest-written value and the transposition value.
- `:highest-written`. Note-name symbol. This is the highest written pitch available on the given instrument. Defaults to NIL. A user may only define either the highest-written value or the highest-sounding value. If a highest-written value is given, the method automatically determines the highest-sounding value based on the highest-written value and the transposition value.
- `:lowest-sounding`. Note-name symbol. This is the lowest sounding pitch available on the given instrument. Defaults to NIL. A user may only define either the lowest-sounding value or the lowest-written value. If a lowest-sounding value is given, the method automatically determines the lowest-written value based on the lowest-sounding value and the transposition value.
- `:highest-sounding`. Note-name symbol. This is the highest sounding pitch available on the given instrument. Defaults to NIL. A user may only define either the highest-sounding value or the highest-written value. If a highest-sounding value is given, the method automatically determines the highest-written value based on the highest-sounding value and the transposition value.
- `:transposition`. Note-name symbol. This is the key of the given instrument (such as the "B-flat" of the "B-flat clarinet"), given as a note-name symbol (such as 'BF for B-flat). If a value is only given for the `:transposition` argument but not for the `:transposition-semitones` argument, and there are multiple semitone transposition options for the key specified, the method will choose the most common semitone transposition for that given key. NB: When using keyword argument `:transposition` rather than `:transposition-semitones`, sc will have a warning printed by cm with indications as to which direction the transposition has been undertaken.
- `:transposition-semitones`. Integer (positive or negative). The number of semitones lower that a given instrument sounds than written, e.g. -2 for B-flat Clarinet. If a value is only given for the `:transposition-semitones` argument but not for the `:transposition` argument, the method will automatically determine the key for the `:transposition` argument. The listener will drop into the debugger with an error if a key is given for the `:transposition` argument and the number specified for the `:transposition-semitones` does not correspond with that key.
- `:starting-clef`. Symbol. This value determines the first clef that a given instrument is to use if that instrument can use different clefs. For a list of available clefs see the `:clefs` argument below.

Default = 'treble.

- :clefs. List of symbols. All clefs that a given instrument may use in the course of a piece. Clefs available are treble, alto, tenor, bass, percussion, double-treble, and double-bass. Clefs are to be given in order of preference. Defaults automatically to the value given to :starting-clef if no other clefs are specified. NB: If a separate list is indeed given here, the method will automatically add the value for :starting-clef as well, should it have been omitted. In this case, a warning will also be printed.
- :clefs-in-c. List of symbols. Similar to :clefs, but designates which clefs an instrument uses in a C-score; for example, bass clarinet may notated in bass clef for sounding pitches though it is standardly notated in treble clef for written pitches. For a list of clefs available see the :clefs argument above.
- :largest-fast-leap. Number. This value indicates the largest interval, in semitones, that a player can feasibly perform at a fast tempo on the given instrument. Default = 999. "Fast" here is determined for the whole piece by the slippery-chicken class's fast-leap-threshold slot.
- :score-write-in-c. T or NIL. Determines whether the musical material for the given instrument should be printed in C. T = print in C. Default = NIL.
- :score-write-bar-line. Integer. This argument is used for indicating system-grouping in the printed score. The given integer specifies how many instruments above this one should be grouped together with an unbroken bar-line. Default = 1.
- :midi-program. Integer. The number of the MIDI program to be used for playing back this instrument. Default = 1.
- :chords. T or NIL. Indicates whether the given instrument is capable of playing chords (starting with 2-note simultaneities, but not multiphonics).
- :subset-id. Symbol, string, number, or NIL. Indicates the ID of a specific subset of the current set to which the instrument's pitch selection is limited. No error will occur if no subset with this ID exists in a given set, i.e. some may include this subset, some may not and everything will function correctly--if the specified subset is not present in the current set the pitch selection routine will select from the whole set. In every case however, the usual set limiting according to instrument range etc. will also apply. Default = NIL.
- :microtones. T or NIL. Indicates whether the instrument can play microtones. T = can play microtones. Default = NIL. NB: If this value is set to T, a separate :microtones-midi-channel must be specified; this can be done for the given instrument object in the :ensemble block of the make-slippery-chicken function.
- :missing-notes. A list of note-name symbols. This is a list of any notes which the given instrument can't play, for example certain quarter-tones. These are to be given by the user as written-pitch

note-name symbols, but are always stored by the method as sounding pitches.

- :prefers-notes. Symbol. 'high, 'low or NIL. This value indicates whether to give preference, when choosing notes for the given instrument, to pitches from the upper or lower end of the instrument's range. When NIL, preference is given to notes from its middle register. Default = NIL.
- :chord-function. If the given instrument can play chords then it will need a reference to a function that can select chords for it. NB This should be a symbol not a function object; thus, 'my-fun not #'my-fun. Default = NIL.

**RETURN VALUE:**

Returns an instrument object.

**EXAMPLE:**

```
;; Make-instrument for the flute:
(make-instrument 'flute :staff-name "Flute" :staff-short-name "Fl."
  :lowest-written 'c4 :highest-written 'd7
  :starting-clef 'treble :midi-program 74 :chords nil
  :microtones t :missing-notes '(cqs4 dqf4))

=>
INSTRUMENT: lowest-written:
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
, highest-written:
PITCH: frequency: 2349.318, midi-note: 98, midi-channel: 0
[...]
lowest-sounding:
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
, highest-sounding:
PITCH: frequency: 2349.318, midi-note: 98, midi-channel: 0
  starting-clef: TREBLE, clefs: (TREBLE), clefs-in-c: (TREBLE)
  prefers-notes: NIL, midi-program: 74
  transposition: C, transposition-semitones: 0
  score-write-in-c: NIL, score-write-bar-line: 1
  chords: NIL, chord-function: NIL,
  total-bars: 0 total-notes: 0, total-duration: 0.0
  total-degrees: 0, microtones: T
  missing-notes: (CQS4 DQF4), subset-id: NIL
  staff-name: Flute, staff-short-name : Fl.,
  largest-fast-leap: 999
[...]
```

NAMED-OBJECT: id: FLUTE, tag: NIL,  
data: NIL

```
;; A make-instrument for the b-flat bass clarinet
(make-instrument 'bass-clarinet :staff-name "Bass Clarinet" :lowest-written 'c3
  :highest-written 'g6 :staff-short-name "Bass Cl."
  :chords nil :midi-program 72 :starting-clef 'treble
  :microtones t :prefers-notes 'low
  :missing-notes '(aqs4 bqf4 bqs4 cqs5 dqf5 gqf3 fqs3 fqf3 eqf3
    dqs3 dqf3 cqs3)
  :clefs '(treble) :clefs-in-c '(treble bass)
  :transposition-semitones -14)
```

=>

```
INSTRUMENT: lowest-written:
PITCH: frequency: 130.813, midi-note: 48, midi-channel: 0
[...]
, highest-written:
PITCH: frequency: 1567.982, midi-note: 91, midi-channel: 0
[...]
      lowest-sounding:
PITCH: frequency: 58.270, midi-note: 34, midi-channel: 0
[...]
, highest-sounding:
PITCH: frequency: 698.456, midi-note: 77, midi-channel: 0
[...]
NAMED-OBJECT: id: BASS-CLARINET, tag: NIL,
data: NIL
```

## SYNOPSIS:

```
(defun make-instrument (id &key
  staff-name
  staff-short-name
  lowest-written
  highest-written
  lowest-sounding
  highest-sounding
  transposition
  transposition-semitones
  (starting-clef 'treble)
  clefs
  (largest-fast-leap 999)
  score-write-in-c
  (score-write-bar-line 1)
  (midi-program 1))
```

```

chords
clefs-in-c
subset-id
microtones
missing-notes
prefers-notes
chord-function)

```

### 20.2.26 instrument/prefers-high

[ *instrument* ] [ *Methods* ]

#### DESCRIPTION:

Determine whether the PREFERS-NOTES slot of a given instrument object is set to 'HIGH.

#### ARGUMENTS:

- An instrument object.

#### RETURN VALUE:

Returns T if the PREFERS-NOTES slot of the given instrument object is set to 'HIGH, otherwise NIL.

#### EXAMPLE:

```

;; Returns T if the PREFERS-NOTES slot of the given instrument object is set to
;; 'HIGH
(let ((i1 (make-instrument 'inst :prefers-notes 'high)))
  (prefers-high i1))

```

=> T

```

;; Returns NIL if the PREFERS-NOTES slot of the given instrument object is not
;; set to 'HIGH
(let ((i1 (make-instrument 'inst1))
      (i2 (make-instrument 'inst2 :prefers-notes 'low)))
  (print (prefers-high i1))
  (print (prefers-high i2)))

```

=>

NIL

NIL

**SYNOPSIS:**

```
(defmethod prefers-high ((ins instrument))
```

**20.2.27 instrument/prefers-low**

```
[ instrument ] [ Methods ]
```

**DESCRIPTION:**

Determine whether the PREFERS-NOTES slot of a given instrument object is set to 'LOW.

**ARGUMENTS:**

- An instrument object.

**RETURN VALUE:**

Returns T if the PREFERS-NOTES slot of the given instrument object is set to 'LOW, otherwise NIL.

**EXAMPLE:**

```
;; Returns T if the PREFERS-NOTES slot of the given instrument object is set to
;; 'LOW
(let ((i1 (make-instrument 'inst :prefers-notes 'low)))
  (prefers-low i1))
```

```
=> T
```

```
;; Returns NIL if the PREFERS-NOTES slot of the given instrument object is not
;; set to 'LOW
(let ((i1 (make-instrument 'inst1))
      (i2 (make-instrument 'inst2 :prefers-notes 'high)))
  (print (prefers-low i1))
  (print (prefers-low i2)))
```

```
=>
NIL
NIL
```

**SYNOPSIS:**

```
(defmethod prefers-low ((ins instrument))
```

**20.2.28 instrument/set-prefers-high***[ instrument ] [ Methods ]***DATE:**

05 Feb 2011

**DESCRIPTION:**

Sets the PREFERS-NOTES slot of the given instrument object to 'HIGH.

**ARGUMENTS:**

- An instrument object.

**OPTIONAL ARGUMENTS:**

(- optional ignore argument; for internal use only).

**RETURN VALUE:**

Returns symbol HIGH.

**EXAMPLE:**

```
;; Returns symbol HIGH by default
(let ((i1 (make-instrument 'inst)))
  (set-prefers-high i1))
```

=&gt; HIGH

```
;; Create an instrument object with only an ID, print the PREFERS-NOTES slot to
;; see that it is NIL by default, apply the set-prefers-high, and print the
;; slot again to see the changes
(let ((i1 (make-instrument 'inst)))
  (print (prefers-notes i1))
  (set-prefers-high i1)
  (print (prefers-notes i1)))
```

=&gt;

NIL

HIGH

;; Reset to HIGH from LOW

```
(let ((i1 (make-instrument 'inst :prefers-notes 'low)))
  (print (prefers-notes i1))
  (set-prefers-high i1)
  (print (prefers-notes i1)))
```

```
=>
LOW
HIGH
```

**SYNOPSIS:**

```
(defmethod set-prefers-high ((ins instrument) &optional ignore)
```

**20.2.29 instrument/set-prefers-low**

```
[ instrument ] [ Methods ]
```

**DATE:**

05 Feb 2011

**DESCRIPTION:**

Sets the PREFERS-NOTES slot of the given instrument object to 'LOW.

**ARGUMENTS:**

- An instrument object.

**OPTIONAL ARGUMENTS:**

(- optional ignore argument; for internal use only).

**RETURN VALUE:**

Returns symbol LOW.

**EXAMPLE:**

```
;; Returns symbol LOW by default
(let ((i1 (make-instrument 'inst)))
  (set-prefers-low i1))
```

```
=> LOW
```



```
;; Create an instrument object with only an ID, print the PREFERS-NOTES slot to
;; see that it is NIL by default, apply the set-prefers-low, and print the
;; slot again to see the changes
(let ((i1 (make-instrument 'inst)))
  (print (prefers-notes i1))
  (set-prefers-low i1)
  (print (prefers-notes i1)))
```

```
=>
NIL
LOW
```

```
;; Reset to LOW from HIGH
(let ((i1 (make-instrument 'inst :prefers-notes 'high)))
  (print (prefers-notes i1))
  (set-prefers-low i1)
  (print (prefers-notes i1)))
```

```
=>
HIGH
LOW
```

#### SYNOPSIS:

```
(defmethod set-prefers-low ((ins instrument) &optional ignore)
```

#### 20.2.30 instrument/transposing-instrument-p

[ *instrument* ] [ *Methods* ]

#### DESCRIPTION:

Determine whether a given instrument object defines a transposing instrument.

#### ARGUMENTS:

- An instrument object.

#### OPTIONAL ARGUMENTS:

- ignore-octaves. T or NIL to indicate whether instruments that transpose at the octave are to be considered transposing instruments.  
T = instruments that transpose at the octave are not considered transposing instruments. Default = T.

Returns T if the given instrument object defines a transposing instrument, otherwise NIL.

```
;; Returns NIL if the instrument is not a transposing instrument
(let ((i1 (make-instrument 'instrument-one)))
  (transposing-instrument-p i1))
```

```
;; Returns T if the instrument object has been defined using a non-NIL value
;; for :transposition
(let ((i2 (make-instrument 'instrument-two :transposition 'bf)))
  (transposing-instrument-p i2))
```

```
;; Returns T if the instrument object has been defined using a non-0 value for
;; :transposition-semitones
(let ((i3 (make-instrument 'instrument-two :transposition-semitones -3)))
  (transposing-instrument-p i3))
```

```
;; Setting the optional argument to NIL causes instruments that transpose at
;; the octave to return T.
(let ((i3 (make-instrument 'instrument-two :transposition-semitones -12)))
  (transposing-instrument-p i3))
```

```
(let ((i3 (make-instrument 'instrument-two :transposition-semitones -12)))
  (transposing-instrument-p i3 nil))
```

**SYNOPSIS:**

[illegible]

**20.2.31 linked-named-object/pitch***[ linked-named-object ] [ Classes ]***NAME:**

pitch

File: pitch.lsp

Class Hierarchy: named-object -&gt; linked-named-object -&gt; pitch

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the pitch class for holding pitch  
 information: symbolic representation (eg c4), MIDI note  
 number, frequency, sampling-rate conversion etc.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 18th 2001

\$\$ Last modified: 08:59:26 Tue Jan 14 2014 GMT

SVN ID: \$Id: pitch.lsp 4353 2014-01-14 09:50:34Z medward2 \$

**20.2.32 pitch/add-mark***[ pitch ] [ Methods ]***DESCRIPTION:**

Add a specified mark to the MARKS slot of the given pitch object.

NB: The add-mark method does not check first to see whether the mark being added is a legitimate mark. It does print a warning, however, when the specified mark is already present in the MARKS slot, though it adds it anyway.

**ARGUMENTS:**

- A pitch object.
- A symbol that is a mark.

**RETURN VALUE:**

A list. The method returns the entire contents of the given pitch object's MARKS slot as a list.

Prints a warning when the specified mark is already present in the given pitch object's MARKS slot.

**EXAMPLE:**

```
;; By default the MARKS slot of a newly created pitch object is set to NIL
(let ((p (make-pitch 'c4)))
  (marks p))
```

=> NIL

```
;; Add two marks and print the contents of the given pitch object's MARKS slot
;; to see the changes
(let ((p (make-pitch 'c4)))
  (add-mark p 'pizz)
  (add-mark p 'a)
  (print (marks p)))
```

=>

(A PIZZ)

```
;; Prints a warning when the specified mark is already present in the MARKS
;; slot, though it adds it again anyway.
(let ((p (make-pitch 'c4)))
  (add-mark p 'pizz)
  (add-mark p 'pizz)
  (marks p))
```

=> (PIZZ PIZZ)

WARNING:

pitch::add-mark: mark PIZZ already present but adding again!

**SYNOPSIS:**

```
(defmethod add-mark ((p pitch) mark &optional warn-rest)
```

**20.2.33 pitch/cents-hertz**

[ *pitch* ] [ *Methods* ]

**DATE:**

December 24th 2013

#### DESCRIPTION:

Convert an offset in cents into the frequency deviation of a pitch.

#### ARGUMENTS:

- a pitch object
- the number of cents to offset the pitch and return the frequency deviation for

#### RETURN VALUE:

The frequency deviation in Hertz of the offset pitch.

#### EXAMPLE:

```
;;; taking as a given the usual floating point round errors:
(cents-hertz (make-pitch 'a4) 1200)
=> 439.9999694824219d0 ; i.e. going up an octave from a4 would be 440 Hz higher
(cents-hertz (make-pitch 'a4) -1200)
=> -219.99998474121094d0
(cents-hertz (make-pitch 'a4) 3)
=> 0.7631253666877456d0
(cents-hertz (make-pitch 'a4) 10)
=> 2.5489090105293144d0
(cents-hertz (make-pitch 'a3) 10)
=> 1.2744545052646572d0
```

#### SYNOPSIS:

```
(defmethod cents-hertz ((p pitch) cents)
```

#### 20.2.34 pitch/cmn-display-pitch-list

[ *pitch* ] [ *Functions* ]

#### DESCRIPTION:

Use CMN to display a list of pitch objects.

#### ARGUMENTS:

The list of pitch objects

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :staff. The CMN staff object to display with. Default = cmn::treble.
- :size. The CMN size for the staff. Default = 20.
- :file. The path of the file to (over)write.  
Default = "pitches.eps" in the directory (get-sc-config 'default-dir) (default /tmp)
- :auto-open. Whether to open the .EPS file once written. Currently only available on OSX with SBCL and CCL. Uses the default app for .EPS files, as if opened with 'open' in the terminal. Default = Value of (get-sc-config cmn-display-auto-open).

**RETURN VALUE:**

A CMN score object.

**SYNOPSIS:**

```
(defun cmn-display-pitch-list
  (pitches &key (staff cmn::treble) (size 20)
    (auto-open (get-sc-config 'cmn-display-auto-open))
    (file (concatenate 'string (get-sc-config 'default-dir) "pitches.eps")))
```

**20.2.35 pitch/degree-**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Determine the difference between the quarter-tone degree of one pitch object and that of a second.

NB: This method does not return absolute difference; instead, it may return positive or negative results depending on the order in which the pitch objects are given. (This will aid in revealing directionality.)

NB: The DEGREE slot is measured in quarter-tones, not semitones. Thus, middle-C is degree 120, not 60, and the difference between two consecutive semitones is 2, not 1.

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**RETURN VALUE:**

Returns a number. The number may be positive or negative.

**EXAMPLE:**

```
;; Subtracting the lower pitch object from the higher returns a positive number
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (degree- p1 p2))

=> 4
```

```
;; Reversing the order in which the pitch objects are entered may return a
;; negative number
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (degree- p2 p1))

=> -4
```

**SYNOPSIS:**

```
(defmethod degree- ((p1 pitch) (p2 pitch))
```

**20.2.36 pitch/delete-marks**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Delete all marks stored in the MARKS slot of the given pitch object and reset the slot to NIL.

**ARGUMENTS:**

- A pitch object.

**RETURN VALUE:**

Always returns NIL

**EXAMPLE:**

```
;; Add two marks, then delete them. The method returns NIL
(let ((p (make-pitch 'c4)))
  (add-mark p 'pizz)
  (add-mark p 'a)
  (delete-marks p))
```

=> NIL

```
;; Add two marks and print the MARKS slot to see the changes. Then apply the
;; delete-marks method and print the MARKS slot to see the changes.
(let ((p (make-pitch 'c4)))
  (add-mark p 'pizz)
  (add-mark p 'a)
  (print (marks p))
  (delete-marks p)
  (print (marks p)))
```

=>

(A PIZZ)

NIL

## SYNOPSIS:

```
(defmethod delete-marks ((p pitch))
```

### 20.2.37 pitch/enharmonic

[ *pitch* ] [ *Methods* ]

## DESCRIPTION:

Get the enharmonic equivalent of the given pitch object. Two chromatically consecutive "white-note" pitches (e.g. B-sharp/C-natural) are considered enharmonically equivalent. If there is no enharmonic equivalent, the method just returns the same note.

## ARGUMENTS:

- A pitch object.

## OPTIONAL ARGUMENTS:

- T or NIL to print a warning when no enharmonic can be found. Default = T.

## RETURN VALUE:



A pitch object.

**EXAMPLE:**

```
;; A "black-key" enharmonic equivalent
(let ((p (make-pitch 'cs4)))
  (data (enharmonic p)))
```

=> DF4

```
;; Two chromatically consecutive "white-keys" are enharmonically equivalent
(let ((p (make-pitch 'f4)))
  (data (enharmonic p)))
```

=> ES4

```
;; The method returns a pitch object with the same pitch value if there is no
;; enharmonic equivalent
(let ((p (make-pitch 'g4)))
  (data (enharmonic p)))
```

=> G4

**SYNOPSIS:**

```
(defmethod enharmonic ((p pitch) &key (warn t))
```

**20.2.38 pitch/enharmonic-equivalents**

[ *pitch* ] [ *Methods* ]

**DATE:**

25th December 2013

**DESCRIPTION:**

Test whether two pitches are enharmonically equivalent.

**ARGUMENTS:**

- pitch object 1
- pitch object 2

**RETURN VALUE:**

T or NIL

#### EXAMPLE:

```
(enharmonic-equivalents (make-pitch 'gs4) (make-pitch 'af4))
=> T
(enharmonic-equivalents (make-pitch 'gs4) (make-pitch 'gs4))
=> NIL
```

#### SYNOPSIS:

```
(defmethod enharmonic-equivalents ((p1 pitch) (p2 pitch))
```

#### 20.2.39 pitch/in-octave

[ *pitch* ] [ *Functions* ]

#### DESCRIPTION:

Test to see if a specified pitch item falls within a specified octave. The pitch item can be a pitch object, a numerical frequency value, or a note-name symbol.

#### ARGUMENTS:

- A pitch item. This can be a pitch object, a numerical frequency value, or a note-name symbol.
- A number that is the specified octave designator (e.g. the "4" in "C4").

#### RETURN VALUE:

T if the specified pitch item falls within the specified octave, otherwise NIL.

#### EXAMPLE:

```
;; The function returns NIL if the specified pitch item does not fall within
;; the specified octave.
(let ((p (make-pitch 'c4)))
  (in-octave p 3))

=> NIL

;; The function will accept pitch objects
```

```
(let ((p (make-pitch 'c4)))
  (in-octave p 4))
```

=> T

```
;; The function will accept numerical frequency values
(let ((p 261.63))
  (in-octave p 4))
```

=> T

```
;; The function will accept note-name symbols
(let ((p 'c4))
  (in-octave p 4))
```

=> T

#### SYNOPSIS:

```
(defun in-octave (pitch octave)
```

#### 20.2.40 pitch/invert-pitch-list

[ *pitch* ] [ *Functions* ]

#### DESCRIPTION:

Using the lowest note in the list as the reference point, invert the rest of a given list of pitch items according to their distance from it.

The list of pitch items may consist of either note-name symbols, pitch objects or frequency numbers.

NB: This function adheres to a concept of inversion more related to interval set theory than to the traditional inversion of a melodic contour. The given list of pitch items is first sorted from low to high before the internal semitone intervals are assessed. The resulting list will therefore always be in chromatic order, rather than having the inverted melodic contour of the original.

#### ARGUMENTS:

- A list of pitch items. This may consist of pitch objects, note-name symbols, or frequency numbers.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether the result should be a list of pitch objects or a list of note-name symbols. T = note-name symbols. Default = NIL.
- The package in which the process is to be performed. Default = :sc.

**RETURN VALUE:**

Returns list of pitch objects by default. If the first optional argument is set to T, the function will return a list of note-name symbols instead.

**EXAMPLE:**

;; The function returns a list of pitch objects by default

```
(let ((pl))
  (setf pl (loop for m in '(E4 G4 A4 C4) collect (make-pitch m)))
  (invert-pitch-list pl))
```

=>

```
(
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
[...]
PITCH: frequency: 207.652, midi-note: 56, midi-channel: 0
[...]
data: AF3
[...]
PITCH: frequency: 174.614, midi-note: 53, midi-channel: 0
[...]
data: F3
[...]
PITCH: frequency: 155.563, midi-note: 51, midi-channel: 0
[...]
data: EF3
)
```

;; Setting the first optional argument to T will cause the function to return a  
;; list of note-name symbols instead

```
(let ((pl))
  (setf pl '(329.63 392.00 440.00 261.63))
  (invert-pitch-list pl t))
```

=> (C4 AF3 F3 EF3)

**SYNOPSIS:**

```
(defun invert-pitch-list (pitch-list &optional
```

```
(return-symbols nil)
(package :sc))
```

### 20.2.41 pitch/make-pitch

[ *pitch* ] [ *Functions* ]

#### DESCRIPTION:

Create a pitch object, specifying a note as either a symbol or a number. When the note is specified as a symbol, it is treated as a note-name; when it is specified as a number, it is treated as a frequency in hertz.

NB If a pitch object is created from a frequency (rather than note symbol) then the given frequency is stored and the note/midi-note etc. nearest to it will be stored also. So the frequency might not be the exact frequency of the reflected note. This is by design, so that unusual temperaments can retain exact frequencies and show nearest notes etc.

#### ARGUMENTS:

- A note, either as a alphanumeric note name or a numeric hertz frequency.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :src-ref-pitch. A note-name symbol indicating the perceived fundamental pitch of a given digital audio file, to allow for later transposition of that audio file using note-names.
- :midi-channel. An integer indicating which MIDI channel is to be used for playback of this pitch.

#### RETURN VALUE:

- A pitch object.

#### EXAMPLE:

```
;; Make a pitch object using a note-name symbol
(make-pitch 'c4)
```

=>

```
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
      pitch-bend: 0.0
```

```

    degree: 120, data-consistent: T, white-note: C4
    nearest-chromatic: C4
    src: 1.0, src-ref-pitch: C4, score-note: C4
    qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
    micro-tone: NIL,
    sharp: NIL, flat: NIL, natural: T,
    octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
    show-accidental: T, white-degree: 28,
    accidental: N,
    accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4

;; Make a pitch object using a frequency in hertz and including a value for the
;; keyword argument :midi-channel, then print the DATA and MIDI-NOTE slots to
;; see the method's automatic conversion for those values.
(let ((p (make-pitch 261.63 :midi-channel 1)))
  (print (data p))
  (print (midi-note p)))

=>
C4
60

;; Make a pitch object for use with a digital audio file that includes a
;; note-name symbol for the sample-rate-conversion reference pitch; then print
;; the SRC slot of the resulting pitch object
(let ((p (make-pitch 'c4 :src-ref-pitch 'a4)))
  (src p))

=> 0.5946035487490308

```

**SYNOPSIS:**

```
(defun make-pitch (note &key (src-ref-pitch 'c4) (midi-channel 0))
```

**20.2.42 pitch/midi-**

[ pitch ] [ Methods ]

**DESCRIPTION:**

Determine the difference in number of semitones between the values of the MIDI values of two given pitch objects.

NB: This method does not return absolute difference; instead, it may return positive or negative results depending on the order in which the pitch objects are given. (This will aid in revealing directionality.)

#### ARGUMENTS:

- A first pitch object.
- A second pitch object.

#### RETURN VALUE:

Returns a number. The number may be positive or negative.

#### EXAMPLE:

```
;; Subtracting the lower pitch object from the higher returns a positive number
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (midi- p1 p2))
```

=> 2

```
;; Reversing the order in which the pitch objects are entered may return a
;; negative number
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (midi- p2 p1))
```

=> -2

#### SYNOPSIS:

```
(defmethod midi- ((p1 pitch) (p2 pitch))
```

#### 20.2.43 pitch/no-accidental

[ *pitch* ] [ *Metadata* ]

#### DESCRIPTION:

Set the SHOW-ACCIDENTAL and ACCIDENTAL-IN-PARENTHESES slots of a specified pitch object to NIL, preventing any accidentals or accidentals in parentheses from being shown for that event in the printed score.

NB: This will only be effective if the `:respell-notes` option for `cmn-display` and `write-lp-data-for-all` is set to `NIL`.

#### ARGUMENTS:

- A pitch object.

#### RETURN VALUE:

Always `NIL`.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c4 cs4 fs4))))
       :set-map '((1 (1)))
       :rthm-seq-palette '((1 (((2 4) - s s s s - - s s s s -))
                               :pitch-seq-palette ((1 2 3 2 1 2 3 2))))
       :rthm-seq-map '((1 ((vn (1))))))
      (no-accidental (pitch-or-chord (get-note mini 1 7 'vn)))
      (cmn-display mini :respell-notes nil)
      (write-lp-data-for-all mini :respell-notes nil)))
```

#### SYNOPSIS:

```
(defmethod no-accidental ((p pitch))
```

#### 20.2.44 pitch/note=

[ *pitch* ] [ *Methods* ]

#### DESCRIPTION:

Tests to see the note-name symbols (values in the DATA slots) of two given pitch objects are equal.

NB: This method allows for the comparison of pitch objects created using frequency numbers and those created using note-name symbols.

#### ARGUMENTS:

- A first pitch object.  
- A second pitch object.



**RETURN VALUE:**

T if the note-name symbols of the given pitch objects are equal, otherwise NIL.

**EXAMPLE:**

```
;; Two pitch objects with equal note-name symbols return T
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
  (note= p1 p2))
```

=> T

```
;; Two pitch objects with unequal note-name symbols return F
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (note= p1 p2))
```

=> NIL

```
;; Pitch objects created using frequency numbers and those created using
;; note-name symbols can be effectively compared using this method
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 261.63)))
  (note= p1 p2))
```

=> T

**SYNOPSIS:**

```
(defmethod note= ((p1 pitch) (p2 pitch) &optional ignore)
```

**20.2.45 pitch/pitch-**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Get the distance in semitones between the values of two pitch objects. This method also takes fractional values into consideration. The

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**RETURN VALUE: EXAMPLE:**

```
;; Get the distance between two "white-keys"
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (pitch- p1 p2))
```

```
=> 2.0
```

```
;; Get the distance in semitones between two frequencies (rounded to the
;; nearest degree, which by default is quarter-tones)
(let ((p1 (make-pitch 293.66))
      (p2 (make-pitch 261.63)))
  (pitch- p1 p2))
```

```
=> 2.0
```

```
;; Getting the distance in semitones between pitches with fractional values can
;; return fractional results
(let ((p1 (make-pitch 'dqs4))
      (p2 (make-pitch 'c4)))
  (pitch- p1 p2))
```

```
=> 2.5
```

**SYNOPSIS:**

```
(defmethod pitch- ((p1 pitch) (p2 pitch))
```

**20.2.46 pitch/pitch-class-eq**

```
[ pitch ] [ Methods ]
```

**DATE:**

14 Aug 2010

**DESCRIPTION:**

Test whether the values of two pitch objects are of the same pitch class, i.e. both Cs, or F#s, irrespective of octave.

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not enharmonic pitches are considered equal. T = enharmonic pitches are considered equal. Default = NIL.

**RETURN VALUE:**

T if the values of the two pitch objects are of the same pitch class, otherwise NIL.

**EXAMPLE:**

```
;; A comparison of two pitch objects with values of the same pitch class
;;; returns T
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c5)))
  (pitch-class-eq p1 p2))
```

=> T

```
;; A comparison of two pitch objects with values of differing pitch classes
;;; returns NIL
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'cs5)))
  (pitch-class-eq p1 p2))
```

=> NIL

```
;; A comparison of two pitch objects with enharmonically equivalent pitch
;; classes returns NIL by default
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'bs4)))
  (pitch-class-eq p1 p2))
```

=> NIL

```
;; Setting the optional argument to T causes the method to consider
;; enharmonically equivalent pitch classes equal
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'bs4)))
  (pitch-class-eq p1 p2 t))
```

=> T

**SYNOPSIS:**

```
(defmethod pitch-class-eq ((p1 pitch) (p2 pitch)
                           &optional enharmonics-are-equal)
```

### 20.2.47 pitch/pitch-in-range

[ *pitch* ] [ *Methods* ]

#### DESCRIPTION:

Determine whether the frequency of a given pitch object falls between the frequencies of two other given pitch objects.

#### ARGUMENTS:

- A first pitch object.
- A second pitch object, which must be lower than the third.
- A third pitch object, which must be higher than the second.

#### RETURN VALUE:

T if the frequency value of the first specified pitch object falls between the second and third specified pitch objects, otherwise NIL.

#### EXAMPLE:

```
;; The method returns T when the frequency value of the first pitch object
;; falls between that of the second and third pitch objects.
```

```
(let ((p (make-pitch 'c4))
      (l (make-pitch 'g3))
      (h (make-pitch 'a7)))
  (pitch-in-range p l h))
```

=> T

```
;; The method returns NIL when the frequency value of the first pitch object is
;; below the range designated by the frequency values of the other two objects.
```

```
(let ((p (make-pitch 'g3))
      (l (make-pitch 'c4))
      (h (make-pitch 'a7)))
  (pitch-in-range p l h))
```

=> NIL

```
;; The method returns NIL when the frequency value of the first pitch object is
;; above the range designated by the frequency values of the other two objects.
```

```
(let ((p (make-pitch 'a7))
      (l (make-pitch 'g3))
      (h (make-pitch 'c4)))
  (pitch-in-range p l h))
```

=> NIL

;; The method will also return NIL if the frequency value of the second pitch  
;; object is higher than that of the third

```
(let ((p (make-pitch 'c4))
      (l (make-pitch 'a7))
      (h (make-pitch 'g3)))
  (pitch-in-range p l h))
```

=> NIL

## SYNOPSIS:

```
(defmethod pitch-in-range ((p pitch) (lowest pitch) (highest pitch))
```

### 20.2.48 pitch/pitch-inc

[ *pitch* ] [ *Methods* ]

## DESCRIPTION:

Increment the value of a given pitch object by one degree (default) or by a specified number of degrees (optional argument).

NB: The slippery-chicken package uses a quarter-tone degree system by default, so any function or method involving a degree argument will be measured in quarter-tones, not semitones. Thus, while the MIDI note value for 'C4 is 60 (chromatic semitones), (note-to-degree 'C4) will return 120. Thus, this method will increment by one quarter-tone by default, and any value the chooser uses for the optional argument is also number of quarter-tones.

NB: This method returns a new pitch object rather than modifying the values of the original.

## ARGUMENTS:

- A pitch object.

## OPTIONAL ARGUMENTS:

- A number indicating the step (in degrees) by which the pitch value is to be incremented. Defaults = 1.

**RETURN VALUE:**

Returns a pitch object.

**EXAMPLE:**

```
;; The method by default returns a pitch object and increments by one
;; quarter-tone
(let ((p (make-pitch 'c4)))
  (pitch-inc p))
```

=>

```
PITCH: frequency: 269.292, midi-note: 60, midi-channel: 0
      pitch-bend: 0.5
      degree: 121, data-consistent: T, white-note: C4
      nearest-chromatic: C4
      src: 1.0293022394180298, src-ref-pitch: C4, score-note: CS4
      qtr-sharp: 1, qtr-flat: NIL, qtr-tone: 1,
      micro-tone: T,
      sharp: NIL, flat: NIL, natural: NIL,
      octave: 4, c5ths: 0, no-8ve: CQS, no-8ve-no-acc: C
      show-accidental: T, white-degree: 28,
      accidental: QS,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: CQS4, tag: NIL,
data: CQS4
```

```
;; Using the optional argument, increment steps can be changed; for example,
;; here to one semitone (= 2 quarter-tones)
(let ((p (make-pitch 'c4)))
  (data (pitch-inc p 2)))
```

=> CS4

```
;; Here the method increments by 4 quarter-tones = 1 whole-tone
(let ((p (make-pitch 'c4)))
  (data (pitch-inc p 4)))
```

=> D4

```
;; Incrementing by an additional number of quarter-tones at each pass
(let ((p (make-pitch 'c4)))
```

```
(loop for i from 0 to 4 collect (data (pitch-inc p i))))
=> (C4 CQS4 CS4 DQF4 D4)
```

**SYNOPSIS:**

```
(defmethod pitch-inc ((p pitch) &optional (degrees 1))
```

**20.2.49 pitch/pitch-intersection**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Return pitch objects whose values consist of pitches common to two given lists of pitch items. The given lists of pitch items can consist of pitch objects or note-name symbols, or one list of one type and the second of the other.

**ARGUMENTS:**

- A first list of pitch objects.
- A second list of pitch objects.

**RETURN VALUE:**

Returns a list of pitch objects that are common to both original lists.

**EXAMPLE:**

```
;; Returns a list of pitch objects
(let ((p1 '(c4 d4 e4 f4))
      (p2 (loop for nn in '(d4 e4 f4 g4) collect (make-pitch nn))))
  (pitch-intersection p1 p2))

(
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
[...]
data: D4
[...]
PITCH: frequency: 329.628, midi-note: 64, midi-channel: 0
[...]
data: E4
[...]
PITCH: frequency: 349.228, midi-note: 65, midi-channel: 0
```

```
[...]
data: F4
[...]
)
```

**SYNOPSIS:**

```
(defun pitch-intersection (pitch-list1 pitch-list2)
```

**20.2.50 pitch/pitch-list-to-symbols**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Return as a list the note-name values from a given list of pitch objects.

**ARGUMENTS:**

- A list of pitch objects.

**OPTIONAL ARGUMENTS:**

- The package in which to process the list of pitches. Default = :sc.

**RETURN VALUE:**

A list of note-name symbols

**EXAMPLE:**

```
;; Create a list of pitch objects and apply the pitch-list-to-symbols method
(let ((pl))
  (setf pl (loop for m from 0 to 127 by 13
                 collect (make-pitch (midi-to-note m))))
  (pitch-list-to-symbols pl))

=> (C-1 CS0 D1 EF2 E3 F4 FS5 G6 AF7 A8)
```

**SYNOPSIS:**

```
(defun pitch-list-to-symbols (pitch-list &optional (package :sc))
```



**20.2.51 pitch/pitch-max***[ pitch ] [ Methods ]***DESCRIPTION:**

Determine which of two specified pitch objects has the greater frequency value and return that pitch object.

NB: If the two frequency values are equal, the method returns a pitch object equivalent to both.

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**RETURN VALUE:**

A pitch object.

**EXAMPLE:**

```
;; Compare two pitch objects and return the one with the greater frequency
;; value
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch-max p1 p2))
```

=>

```
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
       pitch-bend: 0.0
       degree: 124, data-consistent: T, white-note: D4
       nearest-chromatic: D4
       src: 1.1224620342254639, src-ref-pitch: C4, score-note: D4
       qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
       micro-tone: NIL,
       sharp: NIL, flat: NIL, natural: T,
       octave: 4, c5ths: 0, no-8ve: D, no-8ve-no-acc: D
       show-accidental: T, white-degree: 29,
       accidental: N,
       accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: D4, tag: NIL,
data: D4
```

```
;; Comparing two pitch objects with equal frequency values returns a pitch
;; object equal to both
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
  (data (pitch-max p1 p2)))

=> C4
```

**SYNOPSIS:**

```
(defmethod pitch-max ((p1 pitch) (p2 pitch))
```

**20.2.52 pitch/pitch-member**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Test whether a specified pitch is a member of a given list of pitches.

This function can take pitch objects, note-name symbols or numerical frequency values (or lists thereof) as its arguments.

**ARGUMENTS:**

- A pitch item. This may be a pitch object, a note-name symbol or a numerical frequency value.
- A list of pitch items. These items may be pitch objects, note-name symbols, or numerical frequency values.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not the function should consider enharmonically equivalent pitches to be equal. T = enharmonics are considered equal. Default = T.
- The second optional argument allows the user to specify the test for comparison, such as `note=`, `pitch-class-eq`, or the default `pitch=`. If the user wants to specify his or her own, the test must take three arguments: `p1`, `p2` and `<enharmonics-are-equivalent>` (which may of course be ignored).

**RETURN VALUE:**

Similar to Lisp's "member" function, this method returns the tail of the tested list starting with the specified pitch if the pitch is indeed a member of that list, otherwise returns NIL. NB: The list returned is a list of pitch objects.

**EXAMPLE:**

```
;; Returns NIL if the specified pitch item is not a member of the given list
(let ((pl '(c4 d4 e4)))
  (pitch-member 'f4 pl))

=> NIL

;; Returns the tail of the given list starting from the specified pitch if that
;; pitch is indeed a member of the tested list
(let ((pl '(c4 d4 e4)))
  (pitch-list-to-symbols (pitch-member 'd4 pl)))

=> (D4 E4)

;; Enharmonically equivalent pitches are considered equal by default
(let ((pl '(c4 ds4 e4)))
  (pitch-list-to-symbols (pitch-member 'ef4 pl)))

=> (DS4 E4)

;; Enharmonic equivalence can be turned off by setting the first optional
;; argument to NIL
(let ((pl '(c4 ds4 e4)))
  (pitch-list-to-symbols (pitch-member 'ef4 pl nil)))

=> NIL
```

**SYNOPSIS:**

```
(defun pitch-member (pitch pitch-list
                    &optional (enharmonics-are-equal t)
                    (test #'pitch=))
```

**20.2.53 pitch/pitch-min**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Determine which of two specified pitch objects has the lower frequency value and return that pitch object.

NB: If the two frequency values are equal, the method returns a pitch object equivalent to both.

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**RETURN VALUE:**

A pitch object.

**EXAMPLE:**

```
;; Compare two pitch objects and return the one with the lower frequency value
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch-min p1 p2))
```

=>

```
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
       pitch-bend: 0.0
       degree: 120, data-consistent: T, white-note: C4
       nearest-chromatic: C4
       src: 1.0, src-ref-pitch: C4, score-note: C4
       qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
       micro-tone: NIL,
       sharp: NIL, flat: NIL, natural: T,
       octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
       show-accidental: T, white-degree: 28,
       accidental: N,
       accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4
```

```
;; Comparing two pitch objects with equal frequency values returns a pitch
;; object equal to both
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
  (data (pitch-min p1 p2)))
```

=> C4

**SYNOPSIS:**

```
(defmethod pitch-min ((p1 pitch) (p2 pitch))
```

**20.2.54 pitch/pitch-round***[ pitch ] [ Methods ]***DESCRIPTION:**

Rounds the value of a specified pitch object to the nearest chromatic semitone (non-microtonal MIDI) pitch.

**ARGUMENTS:**

- A pitch object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :as-symbol. T or NIL to indicate whether the method is to return an entire pitch object or just a note-name symbol of the new pitch. NIL = a new pitch object. Default = NIL.
- :package. Used to identify a separate Lisp package in which to process result. This is really only applicable in combination with :as-symbol set to T. Default = :sc.

**RETURN VALUE:**

A pitch object by default.

If the :as-symbol argument is set to T, then a note-name symbol is returned instead.

**EXAMPLE:**

```
;; Returns a pitch object by default; here an example rounding a quarter-tone
;;; note-name symbol to the nearest chromatic pitch
```

```
(let ((p (make-pitch 'CQS4)))
  (pitch-round p))
```

```
=>
```

```
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
```

```
[...]
```

```
NAMED-OBJECT: id: C4, tag: NIL,
```

```
data: C4
```

```
;; Also rounds frequencies to the nearest chromatic pitch. This example first
;; prints the original values automatically stored with frequency 269.0
```

```
;; (rounded by default to the nearest quarter-tone), then the new value rounded
;; to the nearest chromatic semitone
(let ((p (make-pitch 269.0)))
  (print (data p))
  (print (pitch-round p :as-symbol t)))
```

```
=>
CQS4
C4
```

### SYNOPSIS:

```
(defmethod pitch-round ((p pitch)
                        &key
                        (as-symbol nil)
                        (package :sc))
```

### 20.2.55 pitch/pitch<

[ *pitch* ] [ *Methods* ]

### DESCRIPTION:

Test to see if the frequency value of one specified pitch object is less than that of a second.

NB: Due to the fact that a given note-name may encompass several fractionally different frequencies (e.g. both 261.626 and 261.627 are both considered to be C4), this method is not suitable for comparing pitch objects of which one was created using a frequency and the other was created using a note-name symbol.

### ARGUMENTS:

- A pitch object.
- A second pitch object.

### RETURN VALUE:

Returns T if the frequency value of the first pitch object is less than that of the second, otherwise NIL.

### EXAMPLE:

```
;; T is returned when the frequency of the first pitch is less than that of
```

```
;; the second
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch< p1 p2))
```

=> T

```
;; NIL is returned when the frequency of the first pitch is not less than
;; that of the second
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch< p2 p1))
```

=> NIL

```
;; Equivalent pitches return NIL
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
  (pitch< p2 p1))
```

=> NIL

```
;; This method can be effectively used to compare the frequency values of two
;; pitch objects that were both created using frequency numbers
(let ((p1 (make-pitch 261.63))
      (p2 (make-pitch 293.66)))
  (pitch< p1 p2))
```

=> T

```
;; Due to sc's numerical accuracy, this method is not suitable for comparing
;; pitch objects of which one was created using a note-name symbol and the
;; other was created using a numerical frequency value. Such comparisons may
;; return misleading results.
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 261.63)))
  (pitch< p1 p2))
```

=> T

## SYNOPSIS:

```
(defmethod pitch< ((p1 pitch) (p2 pitch))
```

**20.2.56 pitch/pitch<=***[ pitch ] [ Methods ]***DESCRIPTION:**

Test to see if the frequency value of one specified pitch object is less than or equal to that of a second.

NB: Due to the fact that a given note-name may encompass several fractionally different frequencies (e.g. both 261.626 and 261.627 are both considered to be C4), this method is not suitable for comparing pitch objects of which one was created using a frequency and the other was created using a note-name symbol.

**ARGUMENTS:**

- A pitch object.
- A second pitch object.

**RETURN VALUE:**

Returns T if the frequency value of the first pitch object is less than or equal to that of the second, otherwise NIL.

**EXAMPLE:**

```
;; T is returned when the frequency of the first pitch is less than or equal to
;; that of the second
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch<= p1 p2))
```

=> T

```
;; NIL is returned when the frequency of the first pitch is not less than or
;; equal to that of the second
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'd4)))
  (pitch<= p2 p1))
```

=> NIL

```
;; Equivalent pitches return T
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
```



```

    (pitch<= p2 p1))

=> T

;; This method can be effectively used to compare the frequency values of two
;; pitch objects that were both created using frequency numbers
(let ((p1 (make-pitch 261.63))
      (p2 (make-pitch 293.66)))
    (pitch<= p1 p2))

=> T

;; Due to sc's numerical accuracy, this method is not suitable for comparing
;; pitch objects of which one was created using a note-name symbol and the
;; other was created using a numerical frequency value. Such comparisons may
;; return misleading results.
(let ((p1 (make-pitch 261.63))
      (p2 (make-pitch 'c4)))
    (pitch<= p1 p2))

=> NIL

```

**SYNOPSIS:**

```
(defmethod pitch<= ((p1 pitch) (p2 pitch))
```

**20.2.57 pitch/pitch=**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Determines if the note-name and chromatic semitone MIDI values of two specified pitch objects are the same (or very close to each other in the case of frequency and src slot comparison).

By default, this method returns NIL when comparing enharmonic pitches. This can behavior can be changed by setting the optional argument to T, upon which enharmonic pitches are considered equal.

NB: This method may return NIL when comparing pitch objects created using frequencies with those created using note-names. The method `pitch::note=` may be more useful in this case.

NB: Pitch objects created using frequencies are only considered equal if their frequency values are within 0.01Hz of each other.

**ARGUMENTS:**

- A first pitch object.
- A second pitch object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not enharmonic pitches are considered equal. T = enharmonic pitches are considered equal. Default = NIL.
- a number to indicate the frequency deviation allowed before returning NIL.

**RETURN VALUE:**

T if the values of the two specified pitch objects are equal, otherwise NIL.

**EXAMPLE:**

```
;; Comparison of equal pitch objects created using note-name symbols returns T
(let ((p1 (make-pitch 'C4))
      (p2 (make-pitch 'C4)))
    (pitch= p1 p2))
```

=> T

```
;; Comparison of unequal pitch objects created using note-name symbols returns
NIL
(let ((p1 (make-pitch 'C4))
      (p2 (make-pitch 'D4)))
    (pitch= p1 p2))
```

=> NIL

```
;; Comparison of enharmonically equivalent pitch objects returns NIL by default
;; Comparison of equal pitch objects created using note-name symbols returns T
(let ((p1 (make-pitch 'CS4))
      (p2 (make-pitch 'DF4)))
    (pitch= p1 p2))
```

=> NIL

```
;; Comparison of enharmonically equivalent pitch objects return T when the
;; optional argument is set to T
;; Comparison of equal pitch objects created using note-name symbols returns T
(let ((p1 (make-pitch 'C4))
```

```

      (p2 (make-pitch 'C4)))
      (pitch= p1 p2 t))

=> T

;; Comparison of pitch objects created using frequencies with those created
;; using note-name symbols return NIL
(let ((p1 (make-pitch 'C4))
      (p2 (make-pitch 261.63)))
  (pitch= p1 p2))

=> NIL

```

**SYNOPSIS:**

```

(defmethod pitch= ((p1 pitch) (p2 pitch) &optional enharmonics-are-equal
                  (frequency-tolerance 0.01)) ; (src-tolerance 0.0001))

```

**20.2.58 pitch/pitch>**

[ *pitch* ] [ *Methods* ]

**DESCRIPTION:**

Test to see if the frequency value of one specified pitch object is greater than that of a second.

NB: Due to the fact that a given note-name may encompass several fractionally different frequencies (e.g. both 261.626 and 261.627 are both considered to be C4), this method is not suitable for comparing pitch objects of which one was created using a frequency and the other was created using a note-name symbol.

**ARGUMENTS:**

- A pitch object.
- A second pitch object.

**RETURN VALUE:**

Returns T if the frequency value of the first pitch object is greater than that of the second, otherwise NIL.

**EXAMPLE:**

```
;; T is returned when the frequency of the first pitch is greater than that of
;; the second
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (pitch> p1 p2))
```

=> T

```
;; NIL is returned when the frequency of the first pitch is not greater than
;; that of the second
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (pitch> p2 p1))
```

=> NIL

```
;; Equivalent pitches return NIL
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'd4)))
  (pitch> p2 p1))
```

=> NIL

```
;; This method can be effectively used to compare the frequency values of two
;; pitch objects that were both created using frequency numbers
(let ((p1 (make-pitch 293.66))
      (p2 (make-pitch 261.63)))
  (pitch> p1 p2))
```

=> T

```
;; Due to sc's numerical accuracy, this method is not suitable for comparing
;; pitch objects of which one was created using a note-name symbol and the
;; other was created using a numerical frequency value. Such comparisons may
;; return misleading results.
(let ((p1 (make-pitch 261.63))
      (p2 (make-pitch 'c4)))
  (pitch> p1 p2))
```

=> T

## SYNOPSIS:

```
(defmethod pitch> ((p1 pitch) (p2 pitch))
```

**20.2.59 pitch/pitch>=***[ pitch ] [ Methods ]***DESCRIPTION:**

Test to see if the frequency value of one specified pitch object is greater than or equal to that of a second.

NB: Due to the fact that a given note-name may encompass several fractionally different frequencies (e.g. both 261.626 and 261.627 are both considered to be C4), this method is not suitable for comparing pitch objects of which one was created using a frequency and the other was created using a note-name symbol.

**ARGUMENTS:**

- A pitch object.
- A second pitch object.

**RETURN VALUE:**

Returns T if the frequency value of the first pitch object is greater than or equal to that of the second, otherwise NIL.

**EXAMPLE:**

```
;; T is returned when the frequency of the first pitch is greater than or equal
;; to that of the second
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (pitch>= p1 p2))
```

=> T

```
;; NIL is returned when the frequency of the first pitch is not greater than or
;; equal to that of the second
(let ((p1 (make-pitch 'd4))
      (p2 (make-pitch 'c4)))
  (pitch>= p2 p1))
```

=> NIL

```
;; Equivalent pitches return T
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 'c4)))
```

```

    (pitch>= p2 p1))

=> T

;; This method can be effectively used to compare the frequency values of two
;; pitch objects that were both created using frequency numbers
(let ((p1 (make-pitch 293.66))
      (p2 (make-pitch 261.63)))
    (pitch>= p1 p2))

=> T

;; Due to sc's numerical accuracy, this method is not suitable for comparing
;; pitch objects of which one was created using a note-name symbol and the
;; other was created using a numerical frequency value. Such comparisons may
;; return misleading results.
(let ((p1 (make-pitch 'c4))
      (p2 (make-pitch 261.63)))
    (pitch>= p1 p2))

=> NIL

```

**SYNOPSIS:**

```
(defmethod pitch>= ((p1 pitch) (p2 pitch))
```

**20.2.60 pitch/print-simple-pitch-list**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Print the data symbols of a list of pitch objects.

**DATE:**

April 10th 2012

**ARGUMENTS:**

- A simple list of pitch objects.

**OPTIONAL ARGUMENTS:**

- The stream to print to (e.g. an open file). Default: the Lisp Terminal (REPL).

**RETURN VALUE:**

The list of pitch data symbols.

**EXAMPLE:**

```
(print-simple-pitch-list (init-pitch-list '(c4 d4 e4)))
=>
(C4 D4 E4)
(C4 D4 E4)
```

**SYNOPSIS:**

```
(defun print-simple-pitch-list (pitch-list &optional stream)
```

**20.2.61 pitch/remove-octaves**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Removes all but one of any pitch items in a given list that have the same pitch-class but different octaves, keeping the lowest instance only.

The list of pitch items may be a list of pitch objects or a list of note-name symbols.

**ARGUMENTS:**

- A list of pitch items. These may be pitch objects or note-name symbols.

**OPTIONAL ARGUMENTS:**

keyword arguments

- :as-symbol. T or NIL indicating whether the object is to return a list of pitch objects or a list of note-name symbols. T = return pitch objects. Default = NIL.
- :package. Used to identify a separate Lisp package in which to intern result. This is really only applicable in combination with :as-symbol set to T. Default = :sc.
- :allow. T or NIL to indicate whether pitch objects of certain, specified octave-doublings are to be kept even if they are not the lowest. This argument takes the form of either a single number or a list of numbers. NB: This number does not indicate the octave in which the pitch object is found, but rather pitch objects that are the specified number

of octaves above the lowest instance of the pitch class. Thus, `:allow 2` indicates keeping the lowest pitch plus any instances of the same pitch class two octaves above that lowest pitch (i.e., double-octaves). However, it is important to note that the function first removes any octave doublings that are not excepted by the `:allow` argument, which may produce confusing results. Given a list of consecutive octaves, such as `'(C1 C2 C3 C4)` and an `:allow` value of 2, the function will first remove any equal pitch classes that are not 2 octaves apart, resulting in C2, C3, and C4 being removed as they are one octave distant from C1, C2 and C3. The result of the function using these values would therefore be `'(C1)`.

#### RETURN VALUE:

Returns a list of pitch objects by default. If the keyword argument `:as-symbol` is set to T, the method returns a list of note-name symbols instead.

If the first element of the pitch list is a number (i.e. a frequency), the method returns a list of frequencies.

#### EXAMPLE:

```
;; The method returns a list of pitch objects by default
(remove-octaves '(c1 c2 c3 g3))
```

```
=> (
PITCH: frequency: 32.703, midi-note: 24, midi-channel: 0
[...]
data: C1
[...]
PITCH: frequency: 195.998, midi-note: 55, midi-channel: 0
[...]
data: G3
[...]
)
```

```
;; If the first element of the pitch list is a frequency, the method returns a
;; list of frequencies
(remove-octaves '(261.63 523.26 1046.52 196.00))
```

```
=> (261.63 196.0)
```

```
;; Setting keyword argument :as-symbol to T returns a list of note-name symbols
;; instead
(remove-octaves '(261.63 523.26 1046.52 196.00) :as-symbol t)
```



=> (C4 G3)

## SYNOPSIS:

```
(defun remove-octaves (pitch-list &key as-symbol allow (package :sc))
```

### 20.2.62 pitch/remove-pitches

[ *pitch* ] [ *Functions* ]

## DESCRIPTION:

Remove a list of specified pitch items from a given list of pitch items. Even if only one pitch item is to be removed it should be stated as a list.

The pitch items can be in the form of pitch objects, note-name symbols or numerical frequency values.

## ARGUMENTS:

- A list of pitch items from which the specified list of pitches is to be removed. These can take the form of pitch objects, note-name symbols or numerical frequency values.
- A list of pitch items to remove from the given list. These can take the form of pitch objects, note-name symbols or numerical frequency values. Even if only one pitch is to be removed it must be stated as a list.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :enharmonics-are-equal. Set to T or NIL to indicate whether or not enharmonically equivalent pitches are to be considered the same pitch. T = enharmonically equivalent pitches are equal. Default = T.
- :return-symbols. Set to T or NIL to indicate whether the function is to return a list of pitch objects or note-name symbols. T = note-name symbols. Default = NIL.

## RETURN VALUE:

Returns a list of pitch objects by default. When the keyword argument :return-symbols is set to T, the function will return a list of note-names instead.

If the specified list of pitches to be removed are not found in the given list, the entire list is returned.

#### EXAMPLE:

```
;; By default the function returns a list of pitch objects
```

```
(let ((pl '(c4 d4 e4)))
  (remove-pitches pl '(d4 e4)))
```

```
=> (
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
[...]
)
```

```
;; Setting the keyword argument :return-symbols to T causes the function to
;; return a list of note-name symbols instead. Note in this example too that
;; even when only one pitch item is being removed, it must be stated as a list.
```

```
(let ((pl '(261.62 293.66 329.62)))
  (remove-pitches pl '(293.66) :return-symbols t))
```

```
=> (C4 E4)
```

```
;; The function will also accept pitch objects
```

```
(let ((pl (loop for n in '(c4 d4 e4) collect (make-pitch n))))
  (remove-pitches pl '(, (make-pitch 'e4)) :return-symbols t))
```

```
=> (C4 D4)
```

```
;; By default the function considers enharmonically equivalent pitches to be
;; equal
```

```
(let ((pl (loop for n in '(c4 ds4 e4) collect (make-pitch n))))
  (remove-pitches pl '(ef4) :return-symbols t))
```

```
=> (C4 E4)
```

```
;; This feature can be turned off by setting the :enharmonics-are-equal keyword
;; argument to NIL. In this case here, the specified pitch is therefore not
;; found in the given list and the entire original list is returned.
```

```
(let ((pl (loop for n in '(c4 ds4 e4) collect (make-pitch n))))
  (remove-pitches pl '(ef4)
    :return-symbols t
    :enharmonics-are-equal nil))
```

=> (C4 DS4 E4)

### SYNOPSIS:

```
(defun remove-pitches (pitch-list remove
                      &key (enharmonics-are-equal t)
                      (return-symbols nil))
```

### 20.2.63 pitch/set-midi-channel

[ *pitch* ] [ *Methods* ]

### DESCRIPTION:

Set the MIDI-CHANNEL slot of the given pitch object.

The method takes two mandatory arguments in addition to the given pitch object, the first being the MIDI-channel used for non-microtonal pitch objects, the second that used for microtonal pitch objects.

NB: The pitch object only has one MIDI-CHANNEL slot, and determines whether that slot is set to the specified non-microtonal or microtonal midi-channel argument based on whether or not the pitch of the given pitch object is determined to be a microtone or not.

### ARGUMENTS:

- A pitch object.
- A number indicating the MIDI channel which is to be used to play back non-microtonal pitches.
- A number indicating the MIDI channel which is to be used to play back microtonal pitches. NB: See `player.lsp/make-player` for details on microtones in MIDI output.

### RETURN VALUE:

A number indicating which value has been set to the given pitch object's MIDI-CHANNEL slot.

### EXAMPLE:

```
;; When the pitch of the given pitch object is non-microtonal, the method sets
;; that pitch object's MIDI-CHANNEL slot to the first value specified.
(let ((p (make-pitch 'c4)))
  (set-midi-channel p 11 12))
```

```

(midi-channel p))

=> 11

;; When the pitch of the given pitch object is microtonal, the method sets
;; that pitch object's MIDI-CHANNEL slot to the second value specified.
(let ((p (make-pitch 'cqs4)))
  (set-midi-channel p 11 12))

=> 12

```

**SYNOPSIS:**

```
(defmethod set-midi-channel ((p pitch) midi-channel microtones-midi-channel)
```

**20.2.64 pitch/sort-pitch-list**

[ *pitch* ] [ *Functions* ]

**DESCRIPTION:**

Sort a list of pitch objects from low to high based on their frequency value.

**ARGUMENTS:**

- A list of pitch objects.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the method is to return a list of pitch objects or a list of note-name symbols.
- The package in which the operation is to be performed. Default = :sc.

**RETURN VALUE:**

Returns a list of pitch objects by default. When the first optional argument is set to T, the method returns a list of note-name symbols instead.

**EXAMPLE:**

```

;; Create a list of pitch objects by passing downward through a series of MIDI
;; values and print the result. Then apply the sort-pitch-list method and print

```

```
;; the result of that to see the list now ordered from low to high.
```

```
(let ((pl))
  (setf pl (loop for m from 64 downto 60
                 collect (make-pitch (midi-to-note m)))))
(print (loop for p in pl collect (data p)))
(print (sort-pitch-list pl)))

=>
(E4 EF4 D4 CS4 C4)
(
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
[...]
PITCH: frequency: 277.183, midi-note: 61, midi-channel: 0
[...]
data: CS4
[...]
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
[...]
data: D4
[...]
PITCH: frequency: 311.127, midi-note: 63, midi-channel: 0
[...]
data: EF4
[...]
PITCH: frequency: 329.628, midi-note: 64, midi-channel: 0
[...]
data: E4
)
```

```
;; Setting the first optional argument to T causes the method to return a list
;; of note-name symbols instead
```

```
(let ((pl))
  (setf pl (loop for m from 64 downto 60
                 collect (make-pitch (midi-to-note m)))))
  (sort-pitch-list pl t))
```

```
=> (C4 CS4 D4 EF4 E4)
```

## SYNOPSIS:

```
(defun sort-pitch-list (pitch-list &optional
                        (return-symbols nil)
                        (package :sc))
```

**20.2.65 pitch/transpose***[ pitch ] [ Methods ]***DESCRIPTION:**

Transpose the pitch information (frequency, note-name, midi-note etc.) of a given pitch object by a specified number of semitones. The number of semitones specified can be fractional; however, all fractional values will be rounded to the nearest quarter-tone frequency.

NB: This method returns a new pitch object rather than altering the values of the current pitch object.

**ARGUMENTS:**

- A pitch object.
- A number representing the number of semitones to be transposed, and which can be fractional.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :as-symbol. T or NIL to indicate whether the method is to return an entire pitch object or just a note-name symbol of the new pitch. NIL = a new pitch object. Default = NIL.
- :package. Used to identify a separate Lisp package in which to process the result. This is really only applicable in combination with :as-symbol set to T. Default = :sc.

**RETURN VALUE:**

A pitch object by default.

If the :as-symbol argument is set to T, then a note-name symbol is returned instead.

**EXAMPLE:**

```
;; By default the method returns a pitch object
(let ((p (make-pitch 'c4)))
  (transpose p 2))
```

=>

PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0

```

pitch-bend: 0.0
degree: 124, data-consistent: T, white-note: D4
nearest-chromatic: D4
src: 1.1224620342254639, src-ref-pitch: C4, score-note: D4
qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
micro-tone: NIL,
sharp: NIL, flat: NIL, natural: T,
octave: 4, c5ths: 0, no-8ve: D, no-8ve-no-acc: D
show-accidental: T, white-degree: 29,
accidental: N,
accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: D4, tag: NIL,
data: D4

```

```

;; Setting the :as-symbol keyword argument to T returns just the note-name
;; symbol of the new pitch instead
(let ((p (make-pitch 'c4)))
  (transpose p 2 :as-symbol t))

```

```
=> D4
```

```

;; The semitones argument can be set to a decimal-point fraction, which may
;; result in quarter-tone pitch values being returned
(let ((p (make-pitch 'c4)))
  (transpose p 2.5))

```

```
=>
```

```

PITCH: frequency: 302.270, midi-note: 62, midi-channel: 0
pitch-bend: 0.5
degree: 125, data-consistent: T, white-note: D4
nearest-chromatic: D4
src: 1.1553527116775513, src-ref-pitch: C4, score-note: DS4
qtr-sharp: 1, qtr-flat: NIL, qtr-tone: 1,
micro-tone: T,
sharp: NIL, flat: NIL, natural: NIL,
octave: 4, c5ths: 0, no-8ve: DQS, no-8ve-no-acc: D
show-accidental: T, white-degree: 29,
accidental: QS,
accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: DQS4, tag: NIL,
data: DQS4

```

```

;; Fractional semitone arguments are automatically rounded to the nearest
;; quarter-tone, causing x.5 and x.7, for example, to return the same result,

```

```
;; while x.3 and x.1 will return the same value as the given integer
(let ((p (make-pitch 'c4)))
  (print (transpose p 2 :as-symbol t))
  (print (loop for s from 0 to 4
                collect (transpose p (+ 2 (* s .1)) :as-symbol t))))
(print (loop for s from 5 to 9
              collect (transpose p (+ 2 (* s .1)) :as-symbol t))))
```

```
=>
```

```
D4
```

```
(D4 D4 D4 D4 D4)
```

```
(DQS4 DQS4 DQS4 DQS4 DQS4)
```

### SYNOPSIS:

```
(defmethod transpose ((p pitch) semitones &key (as-symbol nil) (package :sc)
                     ignore)
```

#### 20.2.66 pitch/transpose-pitch-list

[ *pitch* ] [ *Functions* ]

### DESCRIPTION:

Transpose the values of a list of pitch objects by a specified number of semitones.

### ARGUMENTS:

- A list of pitch objects.
- A number indicating the number of semitones by which the list is to be transposed.

### OPTIONAL ARGUMENTS:

- T or NIL indicating whether the method is to return a list of pitch objects or a list of note-name symbols for those pitch objects. T = note-name symbols. Default = NIL.
- The name of the package to perform the transpositions. Default = :sc.

### RETURN VALUE:

By default, the method returns a list of pitch objects. When the first optional argument is set to T, a list of note-name symbols is returned instead.



**EXAMPLE:**

```
;; Create a list of pitch objects and apply the transpose-pitch-list method
;; with the semitones argument set to 2
(let ((pl))
  (setf pl (loop for m from 60 to 71 collect (make-pitch (midi-to-note m))))
  (transpose-pitch-list pl 2))

=>
(
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
[...]
PITCH: frequency: 311.127, midi-note: 63, midi-channel: 0
[...]
PITCH: frequency: 329.628, midi-note: 64, midi-channel: 0
[...]
PITCH: frequency: 349.228, midi-note: 65, midi-channel: 0
[...]
PITCH: frequency: 369.994, midi-note: 66, midi-channel: 0
[...]
PITCH: frequency: 391.995, midi-note: 67, midi-channel: 0
[...]
PITCH: frequency: 415.305, midi-note: 68, midi-channel: 0
[...]
PITCH: frequency: 440.000, midi-note: 69, midi-channel: 0
[...]
PITCH: frequency: 466.164, midi-note: 70, midi-channel: 0
[...]
PITCH: frequency: 493.883, midi-note: 71, midi-channel: 0
[...]
PITCH: frequency: 523.251, midi-note: 72, midi-channel: 0
[...]
PITCH: frequency: 554.365, midi-note: 73, midi-channel: 0
[...]
)

;; Perform the same action with the return-symbols optional argument set to T
(let ((pl))
  (setf pl (loop for m from 60 to 71 collect (make-pitch (midi-to-note m))))
  (print (transpose-pitch-list pl 2 t)))

=> (D4 EF4 E4 F4 FS4 G4 AF4 A4 BF4 B4 C5 CS5)
```

**SYNOPSIS:**

```
(defun transpose-pitch-list (pitch-list semitones &optional
```

```
(return-symbols nil)
(package :sc))
```

### 20.2.67 pitch/transpose-pitch-list-to-octave

[ *pitch* ] [ *Functions* ]

#### DESCRIPTION:

Transpose the pitch values of a list of pitch objects into a specified octave. The individual initial pitch objects can have initial pitch values of different octaves.

#### ARGUMENTS:

- A list of pitch objects.
- A number indicating the octave in which the resulting list should be.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :as-symbols. Set to T or NIL to indicate whether the method is to return a list of pitch objects or a list of the note-name symbols from those pitch objects. T = return as symbols. Default = NIL.
- :package. Used to identify a separate Lisp package in which to intern result. This is really only applicable in combination with :as-symbol set to T. Default = :sc.
- :remove-duplicates. Set to T or NIL to indicate whether any duplicate pitch objects are to be removed from the resulting list. T = remove duplicates. Default = T.

#### RETURN VALUE:

Returns a list of pitch objects by default. When the keyword argument :as-symbols is set to T, the method returns a list of note-name symbols instead.

#### EXAMPLE:

```
;; Create a list of four pitch objects from random MIDI numbers and print it,
;; then apply transpose-pitch-list-to-octave, setting the octave argument to 4,
;; and print the result
(let ((pl))
  (setf pl (loop repeat 4 collect (make-pitch (midi-to-note (random 128)))))
  (print (loop for p in pl collect (data p)))
```

```

(print (transpose-pitch-list-to-octave pl 4)))

=>
(CS7 F7 B0 D4)
(
PITCH: frequency: 493.883, midi-note: 71, midi-channel: 0
[...]
data: B4
[...]
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
[...]
data: D4
[...]
PITCH: frequency: 277.183, midi-note: 61, midi-channel: 0
[...]
data: CS4
[...]
PITCH: frequency: 349.228, midi-note: 65, midi-channel: 0
[...]
data: F4
)

;; Setting the keyword argument :as-symbols to T return a list of note-names
;; instead
(let ((pl))
  (setf pl (loop repeat 4 collect (make-pitch (midi-to-note (random 128))))))
  (print (loop for p in pl collect (data p)))
  (print (transpose-pitch-list-to-octave pl 4 :as-symbols t)))

=>
(D5 E1 C7 AF1)
(E4 AF4 D4 C4)

;; The method removes duplicate pitch objects from the resulting list by
;; default
(let ((pl))
  (setf pl (loop repeat 4 collect (make-pitch (midi-to-note (random 128))))))
  (print (loop for p in pl collect (data p)))
  (print (transpose-pitch-list-to-octave pl 4 :as-symbols t)))

=>
(B7 AF1 AF7 G1)
(G4 AF4 B4)

```

**SYNOPSIS:**

```
(defun transpose-pitch-list-to-octave (pitch-list octave
                                     &key
                                     as-symbols
                                     (package :sc)
                                     (remove-duplicates t))
```

### 20.2.68 pitch/transpose-to-octave

[ *pitch* ] [ *Methods* ]

#### DESCRIPTION:

Transpose the values of a given pitch object to a specified octave.

NB: This method creates a new pitch object rather than replacing the values of the original.

#### ARGUMENTS:

- A pitch object.
- A number indicating the new octave.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :as-symbol. T or NIL to indicate whether the method is to return an entire pitch object or just a note-name symbol of the new pitch. NIL = a new pitch object. Default = NIL.
- :package. Used to identify a separate Lisp package in which to process the result. This is really only applicable in combination with :as-symbol set to T. Default = :sc.

#### RETURN VALUE:

A pitch object by default.

If the :as-symbol argument is set to T, then a note-name symbol is returned instead.

#### EXAMPLE:

```
;; Transpose the values of a pitch object containing middle-C (octave 4) to the
;;; C of the treble clef (octave 5)
(let ((p (make-pitch 'c4)))
  (transpose-to-octave p 5))
```

```
=>
PITCH: frequency: 523.251, midi-note: 72, midi-channel: 0
      pitch-bend: 0.0
      degree: 144, data-consistent: T, white-note: C5
      nearest-chromatic: C5
      src: 2.0, src-ref-pitch: C4, score-note: C5
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 5, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
      show-accidental: T, white-degree: 35,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C5, tag: NIL,
data: C5
```

```
;; Setting the :as-symbol argument to T returns a note-name symbol instead of a
;; pitch object
(let ((p (make-pitch 'c4)))
  (transpose-to-octave p 5 :as-symbol t))
```

```
=> C5
```

## SYNOPSIS:

```
(defmethod transpose-to-octave ((p pitch) new-octave
                                &key
                                (as-symbol nil)
                                (package :sc))
```

### 20.2.69 linked-named-object/player

[ *linked-named-object* ] [ *Classes* ]

#### NAME:

player

File:                    player.lsp

Class Hierarchy:    named-object -> linked-named-object -> player

Version:             1.0.4

Project:               slippery chicken (algorithmic composition)

Purpose:               Implementation of the player class which holds an  
instrument or a assoc-list of instruments in it's data  
slot.

Author:               Michael Edwards: m@michael-edwards.org

Creation date:        7th September 2001

\$\$ Last modified: 10:35:29 Thu Dec 19 2013 WIT

SVN ID: \$Id: player.lsp 4343 2013-12-25 05:19:16Z medward2 \$

### 20.2.70 player/make-player

[ *player* ] [ *Functions* ]

#### DESCRIPTION:

Create a player object from a specified instrument-palette object and a specified instrument or list of instruments which that player plays.

The player object is separate from the instrument object as on player in an ensemble may perform more than one instrument ("double"), such as flute and piccolo, clarinet and bass clarinet, or sax, flute and clarinet.

#### ARGUMENTS:

- A symbol which will be the ID of the resulting player object.
- An instrument-palette object.
- A symbol or a list of symbols that are the instruments from the specified instrument-palette object that the given player will play, as spelled and defined within the instrument-palette object. NB: If only one instrument is to be assigned to the given player, it should be stated as symbol rather than a list, to avoid errors in the DOUBLES slot.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :midi-channel. An integer that indicates the MIDI channel on which any non-microtonal pitch material for this player is to be played back. Default = 1.
- :microtones-midi-channel. An integer that indicates the MIDI channel on

which any microtonal pitch material for this player is to be played back. slippery chicken uses this channel to add MIDI pitch-bends via CM so that microtonal chords are possible, but due to a current glitch these tracks contain no pitch-bend data. A work-around for this is to simply open the MIDI file in a sequencer and shift the entire channel by the desired pitch-bend value. Default = -1.

- :cmn-staff-args. A list of pairs that indicate any additional arguments to the call to cmn::staff for this player, such as staff size, number of lines etc. Instead of being real cmn function calls, as they would be in normal cmn, this is a simple list of pairs; e.g. '(staff-size .8 staff-lines 3). Defaults = NIL.

### RETURN VALUE:

Returns a player object.

### EXAMPLE:

```
;; Create a player object with just one instrument object
(let ((ip (make-instrument-palette
  'inst-pal
  '((picc (:transposition-semitones 12 :lowest-written d4
    :highest-written c6))
    (flute (:lowest-written c4 :highest-written d7))
    (clar (:transposition-semitones -2 :lowest-written e3
    :highest-written c6))
    (horn (:transposition-semitones -7
    :lowest-written f2 :highest-written c5))
    (vln (:lowest-written g3 :highest-written c7 :chords t))
    (vla (:lowest-written c3 :highest-written f6 :chords t))))))
  (make-player 'player-one ip 'flute))
```

=>

```
PLAYER: (id instrument-palette): INST-PAL
doubles: NIL, cmn-staff-args: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: PLAYER-ONE, tag: NIL,
data:
INSTRUMENT: lowest-written:
[...]
NAMED-OBJECT: id: FLUTE, tag: NIL,
data: NIL
```

```
;; Create a player object with two instruments, setting the midi channels using
;; the keyword arguments, then print the corresponding slots to see the changes
(let* ((ip (make-instrument-palette
```

```

      'inst-pal
      '((picc (:transposition-semitones 12 :lowest-written d4
               :highest-written c6))
        (flute (:lowest-written c4 :highest-written d7))
        (clar (:transposition-semitones -2 :lowest-written e3
               :highest-written c6))
        (horn (:transposition f :transposition-semitones -7
                :lowest-written f2 :highest-written c5))
        (vln (:lowest-written g3 :highest-written c7 :chords t))
        (vla (:lowest-written c3 :highest-written f6 :chords t))))))
    (plr (make-player 'player-one ip '(flute picc)
                     :midi-channel 1
                     :microtones-midi-channel 2)))
  (print (loop for i in (data (data plr)) collect (id i)))
  (print (midi-channel plr))
  (print (microtones-midi-channel plr)))

=>
(FLUTE PICC)
1
2

;;; With specified cmn-staff-args
(let ((ip (make-instrument-palette
          'inst-pal
          '((picc (:transposition-semitones 12 :lowest-written d4
                   :highest-written c6))
            (flute (:lowest-written c4 :highest-written d7))
            (clar (:transposition-semitones -2 :lowest-written e3
                   :highest-written c6))
            (horn (:transposition f :transposition-semitones -7
                   :lowest-written f2 :highest-written c5))
            (vln (:lowest-written g3 :highest-written c7 :chords t))
            (vla (:lowest-written c3 :highest-written f6 :chords t))))))
      (make-player 'player-one ip '(flute picc)
                   :midi-channel 1
                   :microtones-midi-channel 2
                   :cmn-staff-args '(staff-size .8 staff-lines 3)))

=>
PLAYER: (id instrument-palette): INST-PAL
doubles: T, cmn-staff-args: (#<SELF-ACTING {10097B6E73}>
                             #<SELF-ACTING {10097B6EE3}>), total-notes: 0, total-degrees: 0,
total-duration: 0.000, total-bars: 0, tessitura: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: PLAYER-ONE, tag: NIL,

```



```
data:
[...]
```

**SYNOPSIS:**

```
(defun make-player (id instrument-palette instruments
                    &key (cmn-staff-args nil)
                      (microtones-midi-channel -1) (midi-channel 1))
```

**20.2.71 player/microtonal-chords-p**

```
[ player ] [ Methods ]
```

**DESCRIPTION:**

Determines whether the MICROTONES-MIDI-CHANNEL slot of the given player object is set to a value greater than 0, indicating that the player and its instrument are capable of performing microtonal chords.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

Returns T if the value stored in the MICROTONES-MIDI-CHANNEL slot of the given player object is greater than 0, otherwise returns NIL.

**EXAMPLE:**

```
;; Returns T
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'vln ip 'violin :microtones-midi-channel 2)))
  (microtonal-chords-p plr))
```

```
=> T
```

```
;; Returns NIL
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'pno ip 'piano)))
  (microtonal-chords-p plr))
```

```
=> NIL
```

**SYNOPSIS:**

```

(defmethod microtonal-chords-p ((p player))
  (> (microtones-midi-channel p) 0))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(defmethod score-write-bar-line ((p player))
  (let* ((data (data p))
        (ins (if (typep data 'assoc-list)
                  (first (data data))
                  data)))
    (score-write-bar-line ins)))

```

### 20.2.72 player/player-get-instrument

[ *player* ] [ *Methods* ]

#### DESCRIPTION:

Get the instrument object assigned to a single-instrument player object or get the specified instrument object assigned to a multiple-instrument player object.

NB: This method will drop into the debugger with an error if no optional argument is supplied when applying the method to a multiple-instrument player object. It will also print a warning when supplying an optional argument to a player object that contains only one instrument object.

#### ARGUMENTS:

- A player object.

#### OPTIONAL ARGUMENTS:

- Actually a required object for multiple-instrument player objects: The symbol that is the ID of the sought-after instrument object, as it appears in the instrument-palette with which the player object which made. If the given player object consists of only one instrument object, this argument is disregarded and a warning is printed.

#### RETURN VALUE:

Returns an instrument object.

#### EXAMPLE:

```
;; Returns an instrument object. Needs no optional argument when applied to a
;; player object that contains only one instrument object
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'pno ip 'piano)))
  (player-get-instrument plr))

=>
INSTRUMENT:
[...]
NAMED-OBJECT: id: PIANO, tag: NIL,
data: NIL

;; Returns the only existing instrument object and prints a warning if using
;; the optional argument when applying to a single-instrument player object
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'pno ip 'piano)))
  (id (player-get-instrument plr 'piano)))

=> PIANO
WARNING:
  player::player-get-instrument: player PNO has only 1 instrument so optional
argument PIANO is being ignored

;; Asking for a non-existent instrument object from a single-instrument player
;; object returns the only existing instrument object instead
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'pno ip 'piano)))
  (id (player-get-instrument plr 'marimba)))

=> PIANO
WARNING:
  player::player-get-instrument: player PNO has only 1 instrument so optional
argument PIANO is being ignored

;; The ID desired instrument object must be specified when applying the method
;; to a multiple-instrument player object
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'percussion ip '(marimba vibraphone))))
  (id (player-get-instrument plr 'marimba)))

=> MARIMBA

;; Interrupts and drops into the debugger when the optional argument is omitted
;; in applying the method to a multiple-instrument player object
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'percussion ip '(marimba vibraphone))))
```

```
(player-get-instrument plr))

=>
player::player-get-instrument: PERCUSSION doubles so you need to pass the ID of
the instrument you want.
[Condition of type SIMPLE-ERROR]
```

**SYNOPSIS:**

```
(defmethod player-get-instrument ((p player) &optional ins (warn t))
```

**20.2.73 player/plays-transposing-instrument**

```
[ player ] [ Methods ]
```

**DESCRIPTION:**

Determine whether a given player object has one or more transposing instrument objects assigned to it.

**ARGUMENTS:**

- A player object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether instruments that transpose at the octave are to be considered transposing instruments. T = instruments that transpose at the octave are not considered transposing instruments. Default = T.

**RETURN VALUE:**

Returns T if one or more of the instrument objects assigned to the given player object has a transposition value other than C or a transposition-semitones value other than 0.

**EXAMPLE:**

```
;; Create a player object using the 'b-flat-clarinet instrument object
;; definition from the default +slippery-chicken-standard-instrument-palette+,
;; then apply the method.
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'cl ip 'b-flat-clarinet)))
  (plays-transposing-instrument plr))
```

=> T

```
;; Create a player object using the 'flute instrument object definition from
;; the default +slippery-chicken-standard-instrument-palette+, then apply the
;; method.
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'fl ip 'flute)))
  (plays-transposing-instrument plr))
```

=> NIL

```
;; Although the intended procedure is to list single instruments as once-off
;; symbols (as in the previous example), single instruments can also be added
;; as a one-item list
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'fl ip '(flute))))
  (doubles plr))
```

=> NIL

```
;; Create a player object using a list that consists of the 'flute and
;; 'alto-sax instrument object definitions from the default
;; +slippery-chicken-standard-instrument-palette+, then apply the method to see
;; that it returns T even when only one of the instruments is transposing.
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'fl ip '(flute alto-sax))))
  (plays-transposing-instrument plr))
```

=> T

```
;; Setting the optional argument to NIL causes instruments that transpose at
;; the octave to return T.
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'db ip 'double-bass)))
  (plays-transposing-instrument plr))
```

=> NIL

```
(let* ((ip +slippery-chicken-standard-instrument-palette+)
      (plr (make-player 'db ip 'double-bass)))
  (plays-transposing-instrument plr nil))
```

=> T

SYNOPSIS:

```
(defmethod plays-transposing-instrument ((p player)
                                         &optional (ignore-octaves t) ignore)
```

#### 20.2.74 player/reset-instrument-stats

[ *player* ] [ *Methods* ]

##### DATE:

23rd August 2013

##### DESCRIPTION:

Reset the statistics slots for each instrument the player plays.

##### ARGUMENTS:

- The player object

##### OPTIONAL ARGUMENTS:

- just-total-duration. If NIL update all statistics slots, otherwise just the total-duration slot of each instrument

##### RETURN VALUE:

T if the player has instruments, NIL if not.

##### SYNOPSIS:

```
(defmethod reset-instrument-stats ((p player) &optional just-total-duration)
```

#### 20.2.75 player/tessitura-degree

[ *player* ] [ *Methods* ]

##### DESCRIPTION:

Return a number that represents the average pitch for a specified instrument over the course of a piece. The number returned will be degrees in the current scale.

##### ARGUMENTS:

- A player object.

**RETURN VALUE:**

A number that is the tessitura-degree; i.e., average pitch of the given instrument for the entirety of the given musical data.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((vn (violin :midi-channel 1))
                          (va (violin :midi-channel 2))
                          (vc (cello :midi-channel 3))))
        :set-palette '((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
        :set-map '((1 (1 1 1 1 1)))
        :rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                                :pitch-seq-palette ((1 2 3))))
        :rthm-seq-map '((1 ((vn (1 1 1 1 1))
                              (va (1 1 1 1 1))
                              (vc (1 1 1 1 1)))))))
      (tessitura-degree (get-data 'vc (ensemble mini))))

=> 136
```

**SYNOPSIS:**

```
(defmethod tessitura-degree ((p player))
```

**20.2.76 player/tessitura-note**

[ *player* ] [ *Methods* ]

**DESCRIPTION:**

Return the value of the TESSITURA-DEGREE slot of a specified player object as a note-name symbol.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

- A note-name symbol.

**EXAMPLE:**

```
(in-scale :chromatic)

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (va (violin :midi-channel 2))
                        (vc (cello :midi-channel 3))))
       :set-palette '((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                                :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vn (1 1 1 1 1))
                              (va (1 1 1 1 1))
                              (vc (1 1 1 1 1)))))))
      (tessitura-note (first (data (ensemble mini))))))

=> BF3
```

**SYNOPSIS:**

```
(defmethod tessitura-note ((p player))
```

**20.2.77 player/total-bars**

[ *player* ] [ *Methods* ]

**DESCRIPTION:**

Return the number of bars in a specified player object.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

- An integer.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
```



```

'+mini+
:ensemble '(((vn (violin :midi-channel 1))
              (va (violin :midi-channel 2))
              (vc (cello :midi-channel 3))))
:set-palette '((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                        :pitch-seq-palette ((1 2 3))))
:rthm-seq-map '((1 ((vn (1 1 1 1 1))
                      (va (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(total-bars (first (data (ensemble mini))))

=> 5

```

**SYNOPSIS:**

```
(defmethod total-bars ((p player))
```

**20.2.78 player/total-degrees**

[ *player* ] [ *Methods* ]

**DESCRIPTION:**

Return a number that reflects the mean note (tessitura) of a player's part. This is calculated by incrementing the TOTAL-DEGREES slot of the corresponding instrument object for each attacked note in the player's part by the degree of that note (in the scale of the piece), and then dividing the sum by the total number of notes in the player's part.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

- An integer.

**EXAMPLE:**

```

(in-scale :chromatic)

(let ((mini
      (make-slippery-chicken

```

```

'+mini+
:ensemble '(((vn (violin :midi-channel 1))
              (va (violin :midi-channel 2))
              (vc (cello :midi-channel 3))))
:set-palette '((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                        :pitch-seq-palette ((1 2 3)))))
:rthm-seq-map '((1 ((vn (1 1 1 1 1))
                      (va (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(total-degrees (first (data (ensemble mini))))

=> 865

```

**SYNOPSIS:**

```
(defmethod total-degrees ((p player))
```

**20.2.79 player/total-duration**

[ *player* ] [ *Methods* ]

**DESCRIPTION:**

Get the total duration of played notes for a given player over the span of a piece.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

A number that is the total duration in seconds of played notes.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                         (va (violin :midi-channel 2))
                         (vc (cello :midi-channel 3))))
       :set-palette '((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))))

```

```

:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                        :pitch-seq-palette ((1 2 3))))
                (2 (((2 4) (q) e (s) 32 32))
                  :pitch-seq-palette ((1 2 3))))
:rthm-seq-map '((1 ((vn (1 1 1 1 1))
                     (va (2 2 2 2 2))
                     (vc (1 2 1 2 1))))))
(print (total-duration (get-data 'vn (ensemble mini))))
(print (total-duration (get-data 'va (ensemble mini))))
(print (total-duration (get-data 'vc (ensemble mini))))

=>
6.875
3.75
5.625

```

**SYNOPSIS:**

```
(defmethod total-duration ((p player))
```

**20.2.80 player/total-notes**

[ *player* ] [ *Methods* ]

**DESCRIPTION:**

Get the total number of notes (actually events) played by a specified player (not rests or tied notes, but midi-notes) in the piece which this instrument plays. A chord counts as 1 note/event.

**ARGUMENTS:**

- A player object.

**RETURN VALUE:**

- An integer that is the number of notes for that player.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))

```

```

                (va (violin :midi-channel 2))
                (vc (cello :midi-channel 3))))
:~set-palette '~((1 ((gs3 as3 b3 cs4 ds4 e4 fs4 gs4 as4 b4 cs5))))
:~set-map '~((1 (1 1 1 1 1)))
:rthm-seq-palette '~((1 (((2 4) q (e) s (32) 32))
                        :pitch-seq-palette ((1 2 3)))))
:rthm-seq-map '~((1 ((vn (1 1 1 1 1))
                      (va (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(print (total-notes (get-data 'vc (ensemble mini))))

=> 15

```

**SYNOPSIS:**

```
(defmethod total-notes ((p player))
```

**20.2.81 linked-named-object/rhythm**

[ *linked-named-object* ] [ *Classes* ]

**NAME:**

rhythm

File: rhythm.lsp

Class Hierarchy: named-object -> linked-named-object -> rhythm

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the rhythm class for parsing and storing the properties of rhythms.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 11th February 2001

\$\$ Last modified: 15:12:15 Thu Dec 26 2013 WIT

SVN ID: \$Id: rhythm.lsp 4345 2013-12-28 13:11:39Z medward2 \$

**20.2.82 rhythm/accented-p***[ rhythm ] [ Methods ]***DATE:**

05 Apr 2011

**DESCRIPTION:**

Check the MARKS slot of a given rhythm object to determine if it possesses an accent mark. The rhythm object may also possess other marks as well.

**ARGUMENTS:**

- A rhythm object.

**RETURN VALUE:**

If the accent mark ('a) is indeed found in the MARKS slot of the given rhythm object, the tail of the list of marks contained in that slot is returned; otherwise NIL is returned.

**EXAMPLE:**

```
;; Make a rhythm object, add an accent, and test for the presence of the accent
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'a)
  (accented-p r))

=> (A)
```

```
;; Check if an accent mark is among all marks in the MARKS slot
(let ((r (make-rhythm 'q)))
  (add-mark-once r 's)
  (add-mark-once r 'a)
  (accented-p r))

=> (A S)
```

```
;; Add an accent and staccato, then remove the accent and test for it
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'a)
  (add-mark-once r 's)
  (rm-marks r 'a)
```

```
(accented-p r))

=> NIL
```

**SYNOPSIS:**

```
(defmethod accented-p ((r rhythm))
```

**20.2.83 rhythm/add**

```
[ rhythm ] [ Methods ]
```

**DESCRIPTION:**

Create a new rhythm object with a duration that is equal to the sum of the duration of two other given rhythm objects.

NB: This method only returns a single rhythm rather than a list with ties. Thus q+s, for example, returns TQ...

If the resulting duration cannot be presented as a single, notatable rhythm, the DATA slot of the resulting rhythm object is set to NIL, though the VALUE and DURATION slots are still set with the corresponding numeric values.

**ARGUMENTS:**

- A first rhythm object.
- A second rhythm object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether a warning is printed when a rhythm cannot be made because the resulting value is 0 or a negative duration. Default = NIL (no warning issued).

**RETURN VALUE:**

A rhythm object. Returns NIL when the object cannot be made.

**EXAMPLE:**

```
;; A quarter plus an eighth makes a dotted quarter
(let ((r1 (make-rhythm 'q))
```

```

      (r2 (make-rhythm 'e)))
    (add r1 r2))

=>
RHYTHM: value: 2.6666666666666665, duration: 1.5, rq: 3/2, is-rest: NIL, score-rthm: 4.0f0.,
undotted-value: 4, num-flags: 0, num-dots: 1, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 1.5, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 4,
tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q., tag: NIL,
data: Q.

```

```

;; A quarter plus a triplet-eighth is presented as a triplet-half
(let ((r1 (make-rhythm 'q))
      (r2 (make-rhythm 'te)))
  (data (add r1 r2)))

```

```

=> TH

```

```

;; A quarter plus a septuplet-16th cannot be represented as a single, notatable
;; rhythm and therefore produces an object with a VALUE and DURATION but no
;; DATA
(let ((r1 (make-rhythm 4))
      (r2 (make-rhythm 28)))
  (print (value (add r1 r2)))
  (print (duration (add r1 r2)))
  (print (data (add r1 r2))))

```

```

=>
3.5
1.1428571428571428
NIL

```

## SYNOPSIS:

```

(defmethod add ((r1 rhythm) (r2 rhythm) &optional warn)

```

### 20.2.84 rhythm/add-mark

```

[ rhythm ] [ Methods ]

```

## DESCRIPTION:

Add an articulation, dynamic, slur or any other mark to a rhythm (also

useful in the event subclass for changing note heads etc.) Multiple marks can be added separately and consecutively to the same rhythm object.

A warning is printed if the same mark is added to the same rhythm object more than once.

NB: This method checks to see if the mark added is a valid mark and will warn if it doesn't exist (but it will still add it, in case you have your own processing logic for it).

#### ARGUMENTS:

- A rhythm object.
- A mark.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicated whether to issue a warning when trying to add marks to a rest. Default = NIL.

#### RETURN VALUE:

Always T.

#### EXAMPLE:

```
(let ((r (make-rhythm 'q)))
  (marks r))
```

=> NIL

```
(let ((r (make-rhythm 'q)))
  (add-mark r 'a))
```

=> T

```
(let ((r (make-rhythm 'q)))
  (add-mark r 's)
  (marks r))
```

=> (S)

```
(let ((r (make-rhythm 'q)))
  (add-mark r 'col-legno)
  (add-mark r 'as))
```



```

      (add-mark r 'x-head)
      (marks r))

=> (X-HEAD AS COL-LEGNO)

(let ((r (make-rhythm 'q)))
  (add-mark r 's)
  (add-mark r 's))

=> T
WARNING: rhythm::add-mark: S already present but adding again!:

(let ((r (make-rhythm 'e :is-rest t)))
  (add-mark r 'at)
  (print (is-rest r))
  (print (marks r)))

=>
T
(AT)

(let ((r (make-rhythm 'e :is-rest t)))
  (add-mark r 'at t))

=> T
WARNING:
[...]
rhythm::add-mark: add AT to rest?

```

**SYNOPSIS:**

```
(defmethod add-mark ((r rhythm) mark &optional warn-rest)
```

**20.2.85 rhythm/add-mark-once**

[ *rhythm* ] [ *Methods* ]

**DATE:**

26 Jul 2011 (Pula)

**DESCRIPTION:**

Apply the given mark to the given rhythm object, but do so only if the given rhythm object does not yet have the mark.

**ARGUMENTS:**

- A rhythm object.
- A mark.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not to print a warning when attempting to apply a mark to a rest.

**RETURN VALUE:**

Returns T if the mark is successfully applied (if the rhythm object did not already possess the mark), otherwise NIL if the mark was not applied because the rhythm object already had it.

**EXAMPLE:**

```
(let ((r (make-rhythm 'q)))  
  (add-mark-once r 'a))
```

=> T

```
(let ((r (make-rhythm 'q)))  
  (add-mark-once r 'a)  
  (marks r))
```

=> (A)

```
(let ((r (make-rhythm 'q)))  
  (add-mark-once r 'a)  
  (add-mark-once r 'a))
```

=> NIL

```
(let ((r (make-rhythm 'q)))  
  (add-mark-once r 'a)  
  (add-mark-once r 'a)  
  (marks r))
```

=> (A)

**SYNOPSIS:**

```
(defmethod add-mark-once ((r rhythm) mark &optional warn-rest)
```

**20.2.86 rhythm/begin-slur-p***[ rhythm ] [ Methods ]***DESCRIPTION:**

Check to see if the MARKS slot of a given rhythm object contains a mark for the beginning of a slur ('beg-sl). The rhythm object may also possess other marks as well.

**ARGUMENTS:**

- A rhythm object.

**RETURN VALUE:**

If the 'beg-sl mark is indeed found in the MARKS slot of the given rhythm object, the tail of the list of marks contained in that slot is returned; otherwise NIL is returned.

**EXAMPLE:**

```
;; Create a rhythm object, add a 'beg-sl mark and check for it
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'beg-sl)
  (begin-slur-p r))
```

```
=> (BEG-SL)
```

```
;; Add several marks to a rhythm object and check for 'beg-sl
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s beg-sl) do (add-mark-once r m))
  (begin-slur-p r))
```

```
=> (BEG-SL S A)
```

```
;; Add a 'beg-sl mark to a rhythm object, then delete it and check for it
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'beg-sl)
  (rm-marks r 'beg-sl)
  (begin-slur-p r))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod begin-slur-p ((r rhythm))
```

**20.2.87 rhythm/delete-beam***[ rhythm ] [ Methods ]***DESCRIPTION:**

Removes indication for the start (1) or end (0) of a beam from the BEAM slot of a given rhythm object, replacing them with NIL.

**ARGUMENTS:**

- A rhythm object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Manually set the beam of a rhythm object and delete it to see result NIL
(let ((r (make-rhythm 'e)))
  (setf (beam r) 1)
  (delete-beam r))
```

=> NIL

```
;; Make a rthm-seq-bar object with beam indications, then check the BEAM slot
;; of each rhythm object in the rthm-seq-bar object.
(let ((rsb (make-rthm-seq-bar '((2 4) - s s e - q))))
  (loop for r in (rhythms rsb) collect (beam r)))
```

=> (1 NIL 0 NIL)

```
;; Make a rthm-seq-bar object with beam indications, delete them all, then
;; check the beam slot of each rhythm object in the rthm-seq-bar object.
(let ((rsb (make-rthm-seq-bar '((2 4) - s s e - q))))
  (loop for r in (rhythms rsb) do (delete-beam r))
  (loop for r in (rhythms rsb) collect (beam r)))
```

=> (NIL NIL NIL NIL)

**SYNOPSIS:**

```
(defmethod delete-beam ((r rhythm))
```

**20.2.88 rhythm/delete-marks***[ rhythm ] [ Methods ]***DESCRIPTION:**

Delete any marks in the MARKS slot of an event object created within a rhythm object, replacing the entire list of the MARKS slot with NIL.

**ARGUMENTS:**

- A rhythm object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; The method returns NIL
(let ((r (make-rhythm (make-event 'c4 'q))))
  (loop for m in '(a s pizz) do (add-mark-once r m))
  (delete-marks r))
```

=> NIL

```
;; Create a rhythm object consisting of an event object and print the default
;; contents of the MARKS slot. Set the MARKS slot to contain three marks and
;; print the result. Apply the delete-marks method and print the result.
(let ((r (make-rhythm (make-event 'c4 'q))))
  (print (marks r))
  (loop for m in '(a s pizz) do (add-mark-once r m))
  (print (marks r))
  (delete-marks r)
  (print (marks r)))
```

=>

NIL

(PIZZ S A)

NI

**SYNOPSIS:**

```
(defmethod delete-marks ((r rhythm))
```

**20.2.89 rhythm/duration-secs***[ rhythm ] [ Methods ]***DESCRIPTION:**

Determine the absolute duration in seconds of a given rhythm object at a given quarter-note tempo. If no tempo is specified, a tempo of 60 is assumed.

**ARGUMENTS:**

- A rhythm object.

**OPTIONAL ARGUMENTS:**

- A numerical tempo value based on quarter-note beats per minute.

**RETURN VALUE:**

A real number (floating point) representing the absolute duration of the given rhythm object in seconds.

**EXAMPLE:**

```
;; Determine the duration in seconds of a quarter note with a default tempo of
;;; quarter = 60
(let ((r (make-rhythm 'q)))
  (duration-secs r))
```

```
=> 1.0
```

```
;; Specifying a different tempo results in a different duration in seconds
(let ((r (make-rhythm 'q)))
  (duration-secs r 96))
```

```
=> 0.625
```

**SYNOPSIS:**

```
(defmethod duration-secs ((r rhythm) &optional (tempo 60))
```

**20.2.90 rhythm/end-slur-p***[ rhythm ] [ Methods ]***DESCRIPTION:**

Check to see if the MARKS slot of a given rhythm object contains a mark for the ending of a slur ('end-sl). The rhythm object may also possess other marks as well.

#### ARGUMENTS:

- A rhythm object.

#### RETURN VALUE:

If the 'end-sl mark is indeed found in the MARKS slot of the given rhythm object, the tail of the list of marks contained in that slot is returned; otherwise NIL is returned.

#### EXAMPLE:

```
;; Create a rhythm object, add a 'end-sl mark and check for it
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'end-sl)
  (end-slur-p r))
```

=> (END-SL)

```
;; Add several marks to a rhythm object and check for 'end-sl
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s end-sl) do (add-mark-once r m))
  (end-slur-p r))
```

=> (END-SL S A)

```
;; Add an 'end-sl mark to a rhythm object, then delete it and check for it
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'end-sl)
  (rm-marks r 'end-sl)
  (end-slur-p r))
```

=> NIL

#### SYNOPSIS:

```
(defmethod end-slur-p ((r rhythm))
```

#### 20.2.91 rhythm/event

[ *rhythm* ] [ *Classes* ]

**NAME:**

event

File: event.lsp

Class Hierarchy: named-object -&gt; linked-named-object -&gt; rhythm -&gt; event

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the event class which holds data for the construction of an audible event, be it a midi note, a sample (with corresponding sampling-rate conversion factor) or chord of these types.

It is generally assumed that event instances will be created from (copies of) rhythm instances by promotion through the sc-change-class function, hence this class is derived from rhythm.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 19th 2001

\$\$ Last modified: 08:52:18 Thu Jan 9 2014 GMT

SVN ID: \$Id: event.lsp 4351 2014-01-09 09:35:31Z medward2 \$

**20.2.92 event/add-arrow**

[ event ] [ Methods ]

**DATE:**

25 Jun 2011

**DESCRIPTION:**

Adds a start-arrow mark to the given event object and stores text that is to be attached to the start and end of the given arrow for LilyPond output. This is a little more complex than the usual mark adding process, hence this separate method and it not being possible to add arrows to rthm-seq objects. Not available for CMN.



NB: A separate end-arrow mark should be attached to the note where the end text is to appear. Use end-arrow for this or (add-mark e 'end-arrow).

#### ARGUMENTS:

- An event object.
- A start-text string.
- An end-text string.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether or not to print a warning when trying to attach an arrow and accompanying marks to a rest. Default = NIL.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
;; Create an event object and see that the MARKS-BEFORE and MARKS slots are set
;;; to NIL by default
(let ((e (make-event 'c4 'q)))
  (print (marks-before e))
  (print (marks e)))
```

```
=>
NIL
NIL
```

```
;; Create an event object, apply the add-arrow method, and print the
;;; corresponding slots to see the changes.
```

```
(let ((e (make-event 'c4 'q)))
  (add-arrow e "start here" "end here")
  (print (marks-before e))
  (print (marks e)))
```

```
=>
((ARROW "start here" "end here"))
(START-ARROW)
```

```
;; Create an event object that is a rest and apply the add-arrow method with
;;; the optional argument set to T to see the warning printed.
```

```
(let ((e (make-event nil 'q)))
```

```
(add-arrow e "start here" "end here" t))

=> T
event::add-arrow: add arrow to rest?
```

**SYNOPSIS:**

```
(defmethod add-arrow ((e event) start-text end-text &optional warn-rest)
```

**20.2.93 event/add-clef**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Add a clef indication to the MARKS-BEFORE slot of the given event object.

NB: This method does not check that the clef-name added is indeed a clef, nor does it check to see if other clefs have already been attached to the same event object.

**ARGUMENTS:**

- An event object.
- A clef name (symbol).

**OPTIONAL ARGUMENTS:**

- (Internal "ignore" arguments only; not needed by the user).

**RETURN VALUE:**

Returns the contents (list) of the MARKS-BEFORE slot if successful.

Returns NIL if the clef name is already present in the MARKS-BEFORE slot and is therefore not added.

**EXAMPLE:**

```
;; Successfully adding a clef returns the contents of the MARKS-BEFORE slot
(let ((e (make-event 'c4 'q)))
  (add-clef e 'treble))

=> ((CLEF TREBLE))
```

```
;; Returns NIL if the clef name is already present
(let ((e (make-event 'c4 'q)))
  (add-clef e 'treble)
  (add-clef e 'treble))
```

```
=> NIL
```

```
;; Add a clef name to the marks-before slot and check that it's there
(let ((e (make-event 'c4 'q)))
  (add-clef e 'bass)
  (marks-before e))
```

```
=> ((CLEF BASS))
```

## SYNOPSIS:

```
(defmethod add-clef ((e event) clef &optional (delete-others t) ignore1 ignore2)
```

### 20.2.94 event/add-pitches

[ *event* ] [ *Methods* ]

## DESCRIPTION:

Add pitches to a non-rest event. This works whether the event is a single pitch or a chord. NB This adds to the sounding pitches, not written pitches of transposing instruments. The midi-channel of the pitch is presumed to be correct before this method is called.

## ARGUMENTS:

- The event object
- &rest: an arbitrary number of pitches: either pitch objects or symbols.

## RETURN VALUE:

The same event but with the new pitches added.

## EXAMPLE:

```
(let ((e1 (make-event 'c4 'q))
      (e2 (make-event '(c4 e4 g4) 'e)))
  (add-pitches e1 'cs3 'd5)
  (add-pitches e2 'cs2)))
```

**SYNOPSIS:**

```
(defmethod add-pitches ((e event) &rest pitches)
```

**20.2.95 event/add-trill**

```
[ event ] [ Methods ]
```

**DATE:**

24 Sep 2011

**DESCRIPTION:**

Used for adding pitched trills to printed score output. Adds the necessary values to the MARKS and MARKS-BEFORE slots of a given event object.

NB: The main interface for adding trills by hand is `slippery-chicken::trill`, which is the class-method combination that should be accessed for this purpose.

NB: This method will check to see if the specified trill marks are already present in the MARKS and MARKS-BEFORE slots. If they are, the method will print a warning but will add the specified trill marks anyway.

**ARGUMENTS:**

- An event object.
- A pitch-symbol for the trill note.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not to print a warning when attaching trill information to a rest. Default = NIL.

**RETURN VALUE:**

Always returns T.

NB: At the moment the method will also print the reminder warning that this is a LilyPond-only mark.

**EXAMPLE:**

```
;; Create an event object and print the contents of the MARKS-BEFORE and MARKS
;; slots to see that they're empty by default.
(let ((e (make-event 'c4 'q)))
  (print (marks-before e))
  (print (marks e)))
```

```
=>
NIL
NIL
```

```
;; Create an event object, add a trill to the note 'D4, and print the
;; corresponding slots to see the changes
(let ((e (make-event 'c4 'q)))
  (add-trill e 'd4)
  (print (marks-before e))
  (print (marks e)))
```

```
=>
WARNING:
rhythm::validate-mark: no CMN mark for BEG-TRILL-A (but adding anyway).
```

```
(BEG-TRILL-A)
((TRILL-NOTE D4))
```

```
;; By default the method adds prints no warning when adding a mark to a rest
;; (though it still prints the warning that there is no CMN mark)
(let ((e (make-event nil 'q)))
  (add-trill e 'd4)
  (print (marks-before e))
  (print (marks e)))
```

```
=>
WARNING:
rhythm::validate-mark: no CMN mark for BEG-TRILL-A (but adding anyway).
```

```
(BEG-TRILL-A)
((TRILL-NOTE D4))
```

```
;; Set the optional argument to T to have the method print a warning when
;; attaching a mark to a rest
(let ((e (make-event nil 'q)))
  (add-trill e 'd4 t)
  (print (marks-before e))
  (print (marks e)))
```

```
=>
```

```

event::add-trill: add trill to rest?
WARNING:
rhythm::validate-mark: no CMN mark for BEG-TRILL-A (but adding anyway).

(BEG-TRILL-A)
((TRILL-NOTE D4))

;; Adding a trill that is already there will result in a warning being printed
;; but will add the mark anyway
(let ((e (make-event 'c4 'q)))
  (loop repeat 4 do (add-trill e 'd4))
  (print (marks-before e))
  (print (marks e)))

=>
WARNING:
  rhythm::add-mark: (TRILL-NOTE D4) already present but adding again!:
[...]
(BEG-TRILL-A BEG-TRILL-A BEG-TRILL-A BEG-TRILL-A)
((TRILL-NOTE D4) (TRILL-NOTE D4) (TRILL-NOTE D4) (TRILL-NOTE D4))

```

**SYNOPSIS:**

```
(defmethod add-trill ((e event) trill-note &optional warn-rest)
```

**20.2.96 event/delete-clefs**

[ event ] [ Methods ]

**DESCRIPTION:**

Delete any clef names found in the MARKS-BEFORE slot of a given event object.

**ARGUMENTS:**

- An event object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not to print a warning when there are no clef marks to delete.
- (Other internal "ignore" arguments only; not needed by the user).

**RETURN VALUE:**

Always NIL.

#### EXAMPLE:

```
;; Returns NIL when no clef marks are found to delete, and prints a warning by
;; default.
(let ((e (make-event 'c4 'q)))
  (delete-clefs e))
```

=> NIL

```
WARNING: event::delete-clefs: no clef to delete:
[...]
```

```
;; Setting the optional WARN argument to T suppresses the warning when no clefs
;; are found.
```

```
(let ((e (make-event 'c4 'q)))
  (delete-clefs e nil))
```

=> NIL

```
;; Also returns NIL when successful
```

```
(let ((e (make-event 'c4 'q)))
  (add-clef e 'treble)
  (delete-clefs e))
```

=> NIL

```
;; Create an event, add a clef, print the MARKS-BEFORE slot, delete the event,
;; print MARKS-BEFORE again to make sure it's gone
```

```
(let ((e (make-event 'c4 'q)))
  (add-clef e 'treble)
  (print (marks-before e))
  (delete-clefs e)
  (print (marks-before e)))
```

=>

```
((CLEF TREBLE))
NIL
```

#### SYNOPSIS:

```
(defmethod delete-clefs ((e event) &optional (warn t) ignore1 ignore2)
```

#### 20.2.97 event/delete-written

[ event ] [ Methods ]

**DESCRIPTION:**

Delete the contents of the WRITTEN-PITCH-OR-CHORD slot of a given event object and reset to NIL.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Create an event object, print the contents of the written-pitch-or-chord
;; slot to see it's set to NIL, set-written to -2, print the contents of the
;; corresponding slot to see the data of the newly created pitch object,
;; delete-written, print the contents of the written-pitch-or-chord slot to see
;; it's empty.
(let ((e (make-event 'c4 'q)))
  (print (written-pitch-or-chord e))
  (set-written e -2)
  (print (data (written-pitch-or-chord e)))
  (delete-written e)
  (print (written-pitch-or-chord e)))

=>
NIL
BF3
NIL
```

**SYNOPSIS:**

```
(defmethod delete-written ((e event))
```

**20.2.98 event/end-arrow**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Adds an end-arrow mark to the given event object.

NB: This method works for LilyPond only. When used with CMN, output will still be generated, but no mark will be added. The method prints a corresponding warning when applied.



**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
;; Returns T
(let ((e (make-event 'c4 'q)))
  (end-arrow e))
```

=> T

WARNING:

rhythm::validate-mark: no CMN mark for END-ARROW (but adding anyway).

```
;; Create an event object, add end-arrow, and print the MARKS and MARKS-SLOTS
;; to see the result
(let ((e (make-event 'c4 'q)))
  (end-arrow e)
  (print (marks-before e))
  (print (marks e)))
```

=>

NIL

(END-ARROW)

**SYNOPSIS:**

```
(defmethod end-arrow ((e event))
```

**20.2.99 event/end-trill**

[ event ] [ Methods ]

**DATE:**

24 Sep 2011

**DESCRIPTION:**

Adds an 'end-trill-a mark to the MARKS slot of the given event object.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

T

**EXAMPLE:**

```
;; The end-trill method returns T
(let ((e (make-event 'c4 'q)))
  (end-trill e))
```

=> T

```
;; Add an 'end-trill-a and check the MARKS slot to see that it's there
(let ((e (make-event 'c4 'q)))
  (end-trill e)
  (marks e))
```

=> (END-TRILL-A)

**SYNOPSIS:**

```
(defmethod end-trill ((e event))
```

**20.2.100 event/enharmonic**

[ *event* ] [ *Methods* ]

**DESCRIPTION:**

Change the pitch of the pitch object within the given event object to its enharmonic equivalent.

In its default form, this method only applies to note names that already contain an indication for an accidental (such as DF4 or BS3), while "white-key" note names (such as B3 or C4) will not produce an enharmonic equivalent. In order to change white-key pitches to their enharmonic equivalents, set the `:force-naturals` argument to T.

NB: Doesn't work on chords.

**ARGUMENTS:**

- An event object.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :written. T or NIL to indicate whether the test is to handle the written or sounding pitch in the event. T = written. Default = NIL.
- :force-naturals. T or NIL to indicate whether to force "natural" note names that contain no F or S in their name to convert to their enharmonic equivalent (ie, B3 = CF4). NB double-flats/sharps are not implemented so this will only work on F/E B/C.

### RETURN VALUE:

An event object.

### EXAMPLE:

```
;; The method alone returns an event object
(let ((e (make-event 'cs4 'q)))
  (enharmonic e))
```

=>

```
EVENT: start-time: NIL, end-time: NIL,
[...]
```

```
;; Create an event, change it's note to the enharmonic equivalent, and print
;; it.
```

```
(let ((e (make-event 'cs4 'q)))
  (enharmonic e)
  (data (pitch-or-chord e)))
```

=> DF4

```
;; Without the :force-naturals keyword, no "white-key" note names convert to
;; enharmonic equivalents
```

```
(let ((e (make-event 'b3 'q)))
  (enharmonic e)
  (data (pitch-or-chord e)))
```

=> B3

```
;; Set the :force-naturals keyword argument to T to enable switching white-key
;; note-names to enharmonic equivalents
```

```
(let ((e (make-event 'b3 'q)))
```

```
(enharmonic e :force-naturals t)
(data (pitch-or-chord e))
```

=> CF4

### SYNOPSIS:

```
(defmethod enharmonic ((e event) &key written force-naturals
                        ;; 1-based
                        chord-note-ref)
```

#### 20.2.101 event/event-distance

[ *event* ] [ *Methods* ]

### DESCRIPTION:

Get the distance (interval) in semitones between the pitch level of one event object and a second. Negative numbers indicate direction interval directionality. An optional argument allows distances to be always printed as absolute values (positive).

Event-distance can also be determined between chords, in which case the distance is measured between the highest pitch of one event object and the lowest of the other.

### ARGUMENTS:

- A first event object.
- A second event object.

### OPTIONAL ARGUMENTS:

- T or NIL for whether the value should be returned as an absolute value (i.e., always positive). Default = NIL.

### RETURN VALUE:

A number.

### EXAMPLE:

```
;; The semitone distance between two single pitches in ascending direction
(let ((e1 (make-event 'c4 'q)))
```

```

      (e2 (make-event 'e4 'q)))
    (event-distance e1 e2))

=> 4.0

;; The semitone distance between two single pitches in descending direction
(let ((e1 (make-event 'c4 'q))
      (e2 (make-event 'e4 'q)))
    (event-distance e2 e1))

=> -4.0

;; Set the optional argument to T to get the absolute distance (positive
;; number)
(let ((e1 (make-event 'c4 'q))
      (e2 (make-event 'e4 'q)))
    (event-distance e2 e1 t))

=> 4.0

;; The semitone distance between two chords in ascending direction
(let ((e1 (make-event '(c4 e4 g4) 'q))
      (e2 (make-event '(d4 f4 a4) 'q)))
    (event-distance e1 e2))

=> 9.0

```

**SYNOPSIS:**

```
(defmethod event-distance ((e1 event) (e2 event) &optional absolute)
```

**20.2.102 event/event-p**

[ event ] [ Functions ]

**DESCRIPTION:**

Test to confirm that a given object is an event object.

**ARGUMENTS:**

- An object.

**RETURN VALUE:**

T if the tested object is indeed an event object, otherwise NIL.

**EXAMPLE:**

```
;; Create an event and then test whether it is an event object
(let ((e (make-event 'c4 'q)))
  (event-p e))
```

```
=> T
```

```
;; Create a non-event object and test whether it is an event object
(let ((e (make-rhythm 4)))
  (event-p e))
```

```
=> NIL
```

```
;; The make-rest function also creates an event
(let ((e (make-rest 4)))
  (event-p e))
```

```
=> T
```

```
;; The make-punctuation-events, make-events and make-events2 functions create
;; lists of events, not events themselves.
(let ((e (make-events '((g4 q) e s))))
  (event-p e))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defun event-p (thing)
```

**20.2.103 event/flat-p**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Determine whether the pitch of a given event object has a flat.

**ARGUMENTS:**

- An event object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the test is to handle the written or sounding pitch in the event. T = written. Default = NIL.

**RETURN VALUE:**

Returns T if the note tested has a flat, otherwise NIL (ie, is natural or has a sharp).

**EXAMPLE:**

```
;; Returns T when the note is flat
(let ((e (make-event 'df4 'q)))
  (flat-p e))
```

=> T

```
;; Returns NIL when the note is not flat (ie, is sharp or natural)
(let ((e (make-event 'c4 'q)))
  (flat-p e))
```

=> NIL

```
(let ((e (make-event 'cs4 'q)))
  (flat-p e))
```

=> NIL

**SYNOPSIS:**

```
(defmethod flat-p ((e event) &optional written)
```

**20.2.104 event/force-artificial-harmonic**

[ event ] [ Methods ]

**DESCRIPTION:**

Change the pitch-or-chord content of a given event object such that the existing pitch will be notated as an artificial harmonic.

The method creates pitch data for an artificial harmonic that will result in the specified pitch, rather than adding an artificial harmonic to the specified pitch. Thus, the method changes the existing pitch content by transposing the specified pitch down two octaves and adding a new pitch one perfect fourth above it (changing the given pitch object to a chord

object). It then also adds the mark 'flag-head to the MARKS slot of the upper pitch for printing layout so that the upper pitch is printed as a diamond.

#### ARGUMENTS:

- An event object.

#### RETURN VALUE:

The chord object which creates the harmonic.

#### EXAMPLE:

```
;; The method returns NIL.
(let ((e (make-event 'c7 'q)))
  (force-artificial-harmonic e))

=> NIL

;; Create an event object, apply force-artificial-harmonic, then get the new
;; pitch material
(let ((e (make-event 'c7 'q)))
  (force-artificial-harmonic e)
  (loop for p in (data (pitch-or-chord e)) collect (data p)))

=> (C5 F5)

;; Create an event object, apply force-artificial-harmonic, then get the marks
;; attached to each note in the object to see the 'flag-head
(let ((e (make-event 'c7 'q)))
  (force-artificial-harmonic e)
  (loop for p in (data (pitch-or-chord e)) collect (marks p)))

=> (NIL (FLAG-HEAD))
```

#### SYNOPSIS:

```
(defmethod force-artificial-harmonic ((e event) &optional instrument)
```

#### 20.2.105 event/force-rest

[ event ] [ Methods ]

#### DESCRIPTION:



Changes a given event object to a rest by setting both the PITCH-OR-CHORD and WRITTEN-PITCH-OR-CHORD slots to NIL and the IS-REST slot to T.

#### ARGUMENTS:

- An event object.

#### RETURN VALUE:

- An event object

#### EXAMPLE:

;; The method returns an event object.

```
(let ((e (make-event 'c4 'q)))
  (force-rest e))
```

=>

```
EVENT: start-time: NIL, end-time: NIL,
[...]
```

;; Create an event object, apply force-rest, then print the corresponding slots  
;; to see the effectiveness of the method

```
(let ((e (make-event 'c4 'q)))
  (force-rest e)
  (print (pitch-or-chord e))
  (print (written-pitch-or-chord e))
  (print (is-rest e)))
```

=>

```
NIL
NIL
T
```

#### SYNOPSIS:

```
(defmethod force-rest :after ((e event))
```

#### 20.2.106 event/get-amplitude

[ event ] [ Methods ]

#### DESCRIPTION:

Return the amplitude attached to a given event object.

An optional argument allows the amplitude to be converted to and returned as a MIDI value.

#### ARGUMENTS:

- An event object.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether the amplitude value is to be returned as a standard digital amplitude (a number between 0.0 and 1.0) or as a standard MIDI velocity value (a whole number between 0 and 127). T = MIDI value. Default = NIL.

#### RETURN VALUE:

If the optional argument is set to NIL, returns a real number.

If the optional argument is set to T, returns a whole number (and a remainder).

#### EXAMPLE:

```
;; Get the amplitude as a decimal value. (Each new event object has a default
;; amplitude of 0.7).
(let ((e (make-event 'c4 'q)))
  (get-amplitude e))
```

```
=> 0.7
```

```
;; Get the amplitude as a rounded MIDI value.
(let ((e (make-event 'c4 'q)))
  (get-amplitude e t))
```

```
=> 89, -0.100000000000000853
```

#### SYNOPSIS:

```
(defmethod get-amplitude ((e event) &optional (midi nil))
```

#### 20.2.107 event/get-clef

```
[ event ] [ Methods ]
```

#### DESCRIPTION:

Return the symbol associated with the key CLEF in the MARKS-BEFORE slot of the given event object.

#### ARGUMENTS:

- An event object.

#### OPTIONAL ARGUMENTS:

- (Internal "ignore" arguments only; not needed by the user).

#### RETURN VALUE:

Returns the given clef name as a symbol if successful.

Returns NIL if there is no clef name found in the MARKS-BEFORE slot of the given event object.

#### EXAMPLE:

```
;; Returns NIL when no clef is found
(let ((e (make-event 'c4 'q)))
  (get-clef e))
```

=> NIL

```
;; Returns the clef name as symbol when successful.
(let ((e (make-event 'c4 'q)))
  (add-clef e 'treble)
  (get-clef e))
```

=> TREBLE

#### SYNOPSIS:

```
(defmethod get-clef ((e event) &optional ignore1 ignore2 ignore3)
```

#### 20.2.108 event/get-degree

[ event ] [ Methods ]

#### DESCRIPTION:

Get the degree of the event, summing or averaging for chords.

**ARGUMENTS:**

- an event object

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :written. T or NIL to indicate whether to use the written (in the case of transposing instruments) or sounding pitches. T = written. Default = NIL.
- :sum. T or NIL to indicate whether to return the sum of the degrees instead of a list (see below). T = degrees. Default = NIL.
- :average: sim. to sum but T or NIL to indicate whether to return the average instead of sum.

**RETURN VALUE:**

By default this returns a list (even if it's a single pitch), unless :sum T whereupon it will return a single value: the sum of the degrees if a chord, otherwise just the degree. :average T will return the average of the sum. A rest would return '(0) or 0.

**EXAMPLE:**

```
;;; NB This uses the quarter-tone scale so degrees are double what they would
;;; be in the chromatic-scale.
(let ((event (make-event '(cs4 d4) 'e))
      (rest (make-rest 'e)))
  (print (get-degree event))
  (print (get-degree rest))
  (print (get-degree event :average t))
  (get-degree event :sum t))
(122 124)
(0)
123.0
246
```

**SYNOPSIS:**

```
(defmethod get-degree ((e event) &key written sum average)
```

**20.2.109 event/get-dynamic**

[ event ] [ Methods ]

**DESCRIPTION:**

Gets the dynamic marking attached to a given event object.

NB: This method is similar to the `event::get-dynamics` method, but assumes that there is only one dynamic and returns that dynamic as a single symbol rather than a list. If the user suspects that multiple dynamics may have somehow have been added to the MARKS slot of the event class, use `get-dynamics` to obtain a list of all dynamics in that slot; otherwise, this is the method that should be generally used.

#### ARGUMENTS:

- An event object.

#### RETURN VALUE:

The symbol representing the dynamic if there is one attached to that event, otherwise NIL.

#### EXAMPLE:

```
;; The method returns just the dynamic marking from the MARKS list, as a symbol
(let ((e (make-event 'c4 'q)))
  (add-mark-once e 'ppp)
  (add-mark-once e 'pizz)
  (get-dynamic e))
```

=> PPP

```
;; The method returns NIL if there is no dynamic in the MARKS list
(let ((e (make-event 'c4 'q)))
  (add-mark-once e 'pizz)
  (get-dynamic e))
```

=> NIL

#### SYNOPSIS:

```
(defmethod get-dynamic ((e event))
```

#### 20.2.110 event/get-dynamics

[ event ] [ Methods ]

#### DESCRIPTION:

Get the list of dynamic marks from a given event object, assuming there are multiple dynamics present. If other non-dynamic events are also contained in the MARKS slot of the rhythm object within the given event object, these are disregarded and only the dynamic marks are returned.

NB: This method is similar to the `event::get-dynamic`, but is intended for use should multiple dynamics have somehow become attached to the same event. The method `event::get-dynamic` is the method that should generally be used.

#### ARGUMENTS:

- An event object.

#### RETURN VALUE:

A list containing the dynamics stored in the MARKS slot of the rhythm object within the given event object. NIL is returned if no dynamic marks are attached to the given event object.

#### EXAMPLE:

```
;; Create an event object and get the dynamics attached to that object. These
;; are NIL by default (unless otherwise specified).
(let ((e (make-event 'c4 'q)))
  (get-dynamics e))
```

=> NIL

```
;; Create an event object, add one dynamic and one non-dynamic mark, print all
;; marks, then retrieve only the dynamics.
(let ((e (make-event 'c4 'q)))
  (add-mark-once e 'ppp)
  (add-mark-once e 'pizz)
  (print (marks e))
  (get-dynamics e))
```

=>

```
(PIZZ PPP)
(PPP)
```

```
;; Should multiple dynamics have become attached to the same event object,
;; get-dynamics will return all dynamics present in the MARKS slot
(let ((e (make-event 'c4 'q)))
  (add-mark-once e 'pizz)
```

```

    (add-mark-once e 'ppp)
    (push 'fff (marks e))
    (print (marks e))
    (get-dynamics e))

=> (FFF PPP)

```

**SYNOPSIS:**

```
(defmethod get-dynamics ((e event))
```

**20.2.111 event/get-midi-channel**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Retrieve the value set for the midi-channel slot of the pitch object within a given event object.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

An integer representing the given midi-channel value.

**EXAMPLE:**

```

;; The default midi-channel value for a newly created event-object is NIL
;;; unless otherwise specified.
(let ((e (make-event 'c4 'q)))
  (get-midi-channel e))

```

```
=> NIL
```

```

;; Create an event object, set its MIDI-channel and retrieve it
(let ((e (make-event 'c4 'q)))
  (set-midi-channel e 11 12)
  (get-midi-channel e))

```

```
=> 11
```

**SYNOPSIS:**

```
(defmethod get-midi-channel ((e event))
```

**20.2.112 event/get-pitch-symbol***[ event ] [ Methods ]***DESCRIPTION:**

Retrieve the pitch symbol (CM/CMN note-name notation) of a given event object. Returns a single symbol if the given event object consists of a single pitch; otherwise, returns a list of pitch symbols if the given event object consists of a chord.

**ARGUMENTS:**

- An event object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the test is to handle the event's written or sounding pitch. T = written. Default = T.

**RETURN VALUE:**

A symbol, if the event object consists of only a single pitch, otherwise a list of pitch symbols if the event object consists of a chord.

**EXAMPLE:**

```
;; Get the pitch symbol of an event object with a single pitch
(let ((e (make-event 'c4 'q)))
  (get-pitch-symbol e))
```

```
=> C4
```

```
;; Getting the pitch symbol of an event object that consists of a chord returns
;; a list of pitch symbols
(let ((e (make-event '(c4 e4 g4) 'q)))
  (get-pitch-symbol e))
```

```
=> (C4 E4 G4)
```

**SYNOPSIS:**

```
(defmethod get-pitch-symbol ((e event) &optional (written t))
```



**20.2.113 event/has-hairpin**

[ event ] [ Methods ]

**DESCRIPTION:**

Return T or NIL depending on whether the event has a beginning or ending hairpin (cresc. or dim. line).

**ARGUMENTS:**

- an event object

**RETURN VALUE:**

The hairpin mark the event has, as a list, or NIL if it has none.

**SYNOPSIS:**

```
(defmethod has-hairpin ((e event))
```

**20.2.114 event/has-mark-before**

[ event ] [ Methods ]

**DESCRIPTION:**

Determine whether a specified event object has a specified mark in its MARKS-BEFORE slot.

**ARGUMENTS:**

- An event object.
- A mark.

**RETURN VALUE:**

Returns the specified mark if the mark exists in the MARKS-BEFORE slot, otherwise returns NIL

**EXAMPLE:**

```
;;; Returns the specified mark if that mark is present
(let ((e (make-event 'c4 4)))
  (add-mark-before e 'ppp)
```

```

    (has-mark-before e 'ppp))

=> (PPP)

;;; Returns NIL if the specified mark is not present
(let ((e (make-event 'c4 4)))
  (add-mark-before e 'ppp)
  (has-mark-before e 'fff))

=> NIL

```

**SYNOPSIS:**

```
(defmethod has-mark-before ((e event) mark &optional (test #'equal))
```

**20.2.115 event/highest**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Get the highest pitch (of a chord) in a given event object. If the given event object contains a single pitch only, that pitch is returned.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

A pitch object.

**EXAMPLE:**

```

;;; Returns a pitch object
(let ((e (make-event 'c4 'q)))
  (highest e))

=>
PITCH: frequency: 261.6255569458008, midi-note: 60, midi-channel: NIL
      pitch-bend: 0.0
      degree: 120, data-consistent: T, white-note: C4
      nearest-chromatic: C4
      src: 1.0, src-ref-pitch: C4, score-note: C4
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,

```

```

    micro-tone: NIL,
    sharp: NIL, flat: NIL, natural: T,
    octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
    show-accidental: T, white-degree: 28,
    accidental: N,
    accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4

```

```

;; Returns the highest note of a chord object within an event object
(let ((e (make-event '(d4 fs4 a4) 'q)))
  (data (highest e)))

```

```
=> A4
```

## SYNOPSIS:

```
(defmethod highest ((e event))
```

### 20.2.116 event/inc-duration

```
[ event ] [ Methods ]
```

## DESCRIPTION:

Increase the duration of a given event object by a specified time in seconds. This will result in new values for the end-time, duration-in-tempo, and compound-duration-in-tempo slots.

NB: Changing this value directly could result in incorrect timing info in a bar.

## ARGUMENTS:

- An event object.
- A value that is the increment in seconds by which the duration is to be extended.

## RETURN VALUE:

The new duration in seconds.

## EXAMPLE:

```
;;; Create a slippery-chicken object, assign a variable to one of the event
;;; objects it contains, print the corresponding duration slots; apply
;;; inc-duration and print the corresponding duration slots again to see the
;;; change.
```

```
(let* ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :set-palette '((1 ((gs3 as3 b3))))
       :set-map '((1 (1)))
       :rthm-seq-palette '((1 (((2 4) q (e) s (32) 32))
                               :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vc (1))))))
      (e (get-event mini 1 3 'vc)))
  (print (end-time e))
  (print (duration-in-tempo e))
  (print (compound-duration-in-tempo e))
  (inc-duration e 7.0)
  (print (end-time e))
  (print (duration-in-tempo e))
  (print (compound-duration-in-tempo e)))
```

```
=>
```

```
1.75
0.25
0.25
8.75
7.25
7.25
```

## SYNOPSIS:

```
(defmethod inc-duration ((e event) inc)
```

### 20.2.117 event/is-chord

```
[ event ] [ Methods ]
```

## DESCRIPTION:

Test to determine whether a given event object consists of a chord (as opposed to a single pitch or a rest).

## ARGUMENTS:

- An event object.

**RETURN VALUE:**

- If the given event object is a chord, the method returns a number that is the number of notes in the chord.
- Returns NIL if the given event object is not a chord.

**EXAMPLE:**

```
;; Returns NIL if not a chord
(let ((e (make-event 'c4 'q)))
  (is-chord e))
```

```
=> NIL
```

```
;; If a chord, returns the number of notes in the chord
(let ((e (make-event '(c4 e4 g4) 'q)))
  (is-chord e))
```

```
=> 3
```

```
;; A rest is not a chord
(let ((e (make-rest 'q)))
  (is-chord e))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod is-chord ((e event))
```

**20.2.118 event/is-dynamic**

[ *event* ] [ *Functions* ]

**DESCRIPTION:**

Determine whether a specified symbol belongs to the list of predefined dynamic marks.

**ARGUMENTS:**

- A symbol.

**RETURN VALUE:**

NIL if the specified mark is not found on the predefined list of possible dynamic marks, otherwise the tail of the list of possible dynamics starting with the given dynamic.

**EXAMPLE:**

```
(is-dynamic 'pizz)
```

```
=> NIL
```

```
(is-dynamic 'f)
```

```
=> (F FF FFF FFFF)
```

**SYNOPSIS:**

```
(defun is-dynamic (mark)
```

**20.2.119 event/is-single-pitch**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Test to see if an event object consists of a single pitch (as opposed to a chord or a rest).

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

Returns T if the given event object consists of a single pitch, otherwise returns NIL.

**EXAMPLE:**

```
; Returns T if the event object consists of a single pitch
```

```
(let ((e (make-event 'c4 'q)))
  (is-single-pitch e))
```

```
=> T
```

```
;; Returns NIL if the event object is a chord
(let ((e (make-event '(c4 e4 g4) 'q)))
  (is-single-pitch e))
```

```
=> NIL
```

```
;; Also returns NIL if the event object is a rest
(let ((e (make-rest 'q)))
  (is-single-pitch e))
```

```
=> NIL
```

### SYNOPSIS:

```
(defmethod is-single-pitch ((e event))
```

#### 20.2.120 event/lowest

```
[ event ] [ Methods ]
```

### DESCRIPTION:

Get the lowest pitch (of a chord) in a given event object. If the given event object contains a single pitch only, that pitch is returned.

### ARGUMENTS:

- An event object.

### RETURN VALUE:

A pitch object.

### EXAMPLE:

```
;; Returns a pitch object
(let ((e (make-event 'c4 'q)))
  (lowest e))
```

```
=>
```

```
PITCH: frequency: 261.6255569458008, midi-note: 60, midi-channel: NIL
       pitch-bend: 0.0
       degree: 120, data-consistent: T, white-note: C4
       nearest-chromatic: C4
       src: 1.0, src-ref-pitch: C4, score-note: C4
```

```

    qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
    micro-tone: NIL,
    sharp: NIL, flat: NIL, natural: T,
    octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
    show-accidental: T, white-degree: 28,
    accidental: N,
    accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4

```

```

;; Returns the lowest note of a chord object within an event object
(let ((e (make-event '(d4 fs4 a4) 'q)))
  (data (lowest e)))

```

```
=> D4
```

## SYNOPSIS:

```
(defmethod lowest ((e event))
```

### 20.2.121 event/make-event

[ *event* ] [ *Functions* ]

## DESCRIPTION:

Create an event object for holding rhythm, pitch, and timing data.

## ARGUMENTS:

- A pitch or chord. This can be one of those objects (will be added to the pitch-or-chord slot without cloning), or a pitch symbol or list of pitch symbols (for a chord).
- The event's rhythm (e.g. 'e). If this is a number, its interpretation is dependent on the value of duration (see below). NB if this is a rhythm object, it will be cloned.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :start-time. The start time of the event in seconds. Default = NIL.
- :is-rest. Set to T or NIL to indicate whether or not the given event is a rest. Default = NIL. NB: The make-rest method is better suited to making rests; however, if using make-event to do so, the pitch-or-chord slot



must be set to NIL.

- :is-tied-to. This argument is for score output and playing purposes. Set to T or NIL to indicate whether this event is tied to the previous event (i.e. it won't sound independently). Default = NIL.
- :duration. T or NIL to indicate whether the specified duration of the event has been stated in absolute seconds, not a known rhythm like 'e. Thus (make-event 'c4 4 :duration nil) indicates a quarter note with duration 1, but (make-event '(c4 d4) 4 :duration t) indicates a whole note with an absolute duration of 4 seconds (both assuming a tempo of 60). Default = NIL.
- :amplitude sets the amplitude of the event. Possible values span from 0.0 (silent) to maximum of 1.0. Default = (get-sc-config 'default-amplitude).
- :tempo. A number to indicate the tempo of the event as a normal bpm value. Default = 60. This argument is only used when creating the rhythm slots (e.g. duration) not for setting duration-in-tempo.
- :midi-channel. A number from 0 to 127 indicating the MIDI channel on which the event should be played back. Default = NIL.
- :microtones-midi-channel. If the event is microtonal, this argument indicates the MIDI-channel to be used for the playback of the microtonal notes. Default = NIL. NB: See player.lsp/make-player for details on microtones in MIDI output.
- :transposition. A number in semitones that indicates the transposition of the instrument that this event is being created for. E.g. -2 would be for a B-flat clarinet.
- :written. The given pitch or chord is the written value. In this case the sounding value will be set according to the (required) transposition argument. Default = NIL.

#### RETURN VALUE:

- An event object.

#### EXAMPLE:

```
;; A quarter-note (crotchet) C
(make-event 'c4 4)
```

=>

```
EVENT: start-time: NIL, end-time: NIL,
       duration-in-tempo: 0.0,
       compound-duration-in-tempo: 0.0,
       amplitude: 0.7,
       bar-num: -1, marks-before: NIL,
       tempo-change: NIL
       instrument-change: NIL
       display-tempo: NIL, start-time-qtrs: -1,
```

```

      midi-time-sig: NIL, midi-program-changes: NIL,
      8va: 0
      pitch-or-chord:
PITCH: frequency: 261.6255569458008, midi-note: 60, midi-channel: NIL
      pitch-bend: 0.0
      degree: 120, data-consistent: T, white-note: C4
      nearest-chromatic: C4
      src: 1.0, src-ref-pitch: C4, score-note: C4
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
      show-accidental: T, white-degree: 28,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4
      written-pitch-or-chord: NIL
RHYTHM: value: 4.0, duration: 1.0, rq: 1, is-rest: NIL, score-rthm: 4.0f0,
      undotted-value: 4, num-flags: 0, num-dots: 0, is-tied-to: NIL,
      is-tied-from: NIL, compound-duration: 1.0, is-grace-note: NIL,
      needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
      rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 4,
      triplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: 4, tag: NIL,
data: 4

```

```

;; Create a whole-note (semi-breve) chord, then print its data, value, duration
;; and pitch content

```

```

(let ((e (make-event '(c4 e4 g4) 4 :duration t)))
  (print (data e))
  (print (value e))
  (print (duration e))
  (print (loop for p in (data (pitch-or-chord e)) collect (data p))))

```

```
=>
```

```

W
1.0f0
4.0
(C4 E4 G4)

```

```

;; Create a single-pitch quarter-note event which is tied to, plays back on
;; MIDI channel 1 and has an amplitude of 0.5, then print these values by
;; accessing the corresponding slots.

```

```
(let ((e (make-event 'c4 4
                    :is-tied-to t
                    :midi-channel 1
                    :amplitude 0.5)))
  (print (is-tied-to e))
  (print (midi-channel (pitch-or-chord e)))
  (print (amplitude e)))
```

```
=>
```

```
T
```

```
1
```

```
0.5
```

```
;; Create an event object that consists of a quarter-note rest and print the
;; contents of the corresponding slots
```

```
(let ((e (make-event nil 'q :is-rest t)))
  (print (pitch-or-chord e))
  (print (data e))
  (print (is-rest e)))
```

```
=>
```

```
NIL
```

```
Q
```

```
T
```

## SYNOPSIS:

```
(defun make-event (pitch-or-chord rthm &key
                  start-time
                  is-rest
                  is-tied-to
                  duration
                  midi-channel
                  microtones-midi-channel
                  ;; MDE Thu May 31 19:03:59 2012 -- allow us to auto-set the
                  ;; written-pitch-or-chord slot
                  transposition
                  ;; MDE Sat Apr 20 15:13:41 2013 -- allow us to create
                  ;; written pitch events and auto-set sounding
                  written
                  (amplitude (get-sc-config 'default-amplitude))
                  (tempo 60))
```

**20.2.122 event/make-events***[ event ] [ Functions ]***DESCRIPTION:**

Make a list of events using the specified data, whereby a list indicates a note (or chord) and its rhythm and a single datum is the rhythm of a rest.

**ARGUMENTS:**

- A list.

**OPTIONAL ARGUMENTS:**

- A whole number indicating the MIDI channel on which the event is to be played.
- A whole number indicating the MIDI channel on which microtonal pitches of the event are to be played. NB: See `player.lsp/make-player` for details on microtones in MIDI output.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; Create a list of events including a quarter note, two rests, and a chord,
;; then print-simple its contents
(let ((e (make-events '((g4 q) e s ((d4 fs4 a4) s))))))
  (loop for i in e do (print-simple i)))
```

=>

G4 Q, rest E, rest S, (D4 FS4 A4) S,

```
;; Create a list of events to be played on MIDI-channel 3, then check the MIDI
;; channels of each sounding note
(let ((e (make-events '((g4 q) e s (a4 s) q e (b4 s)) 3)))
  (loop for i in e
        when (not (is-rest i))
        collect (midi-channel (pitch-or-chord i))))
```

=> (3 3 3)

**SYNOPSIS:**

```
(defun make-events (data-list &optional midi-channel microtones-midi-channel)
```

**20.2.123 event/make-events2***[ event ] [ Functions ]***DESCRIPTION:**

Like make-events, but rhythms and pitches are given in separate lists to allow for rhythms with ties using "+" etc. "Nil" or "r" given in the pitch list indicates a rest; otherwise, a single note name will set a single pitch while a list of note names will set a chord. Pitches for tied notes only have to be given once.

**ARGUMENTS:**

- A list of rhythms.
- A list of note names (including NIL or R for rests).

**OPTIONAL ARGUMENTS:**

- A whole number value to indicate the MIDI channel on which to play back the event.
- A whole number value to indicate the MIDI channel on which to play back microtonal pitch material for the event. NB: See player.lsp/make-player for details on microtones in MIDI output.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; Create a make-events2 list and use the print-simple function to retrieve its
;; contents.
```

```
(let ((e (make-events2 '(q e e. h+s 32 q+te) '(cs4 d4 (e4 g4 b5) nil a3 r))))
  (loop for i in e do (print-simple i)))
```

```
=>
```

```
CS4 Q, D4 E, (E4 G4 B5) E., rest H, rest S, A3 32, rest Q, rest TE,
```

```
;; Create a list of events using make-events2, indicating they be played back
;; on MIDI-channel 3, then print the corresponding slots to check it
```

```
(let ((e (make-events2 '(q e. h+s 32 q+te) '(cs4 b5 nil a3 r) 3)))
  (loop for i in e
        when (not (is-rest i))
        collect (midi-channel (pitch-or-chord i)))))
```

```
=>
(3 3 3)
```

**SYNOPSIS:**

```
(defun make-events2 (rhythms pitches
                    &optional midi-channel microtones-midi-channel)
```

**20.2.124 event/make-punctuation-events**

[ *event* ] [ *Functions* ]

**DESCRIPTION:**

Given a list of numbers, a rhythm, and a note name or list of note names, create a new list of single events separated by rests.

The rhythm specified serves as the basis for the new list. The numbers specified represent groupings in the new list that are each made up of one rhythm followed by rests. Each consecutive grouping in the new list has the length of each consecutive number in the numbers list multiplied by the rhythm specified.

Notes can be a single note or a list of notes. If the latter, they'll be used one after the other, repeating the final note once reached.

**ARGUMENTS:**

- A list of grouping lengths.
- A rhythm.
- A note name or list of note names.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; Create a list of three groups that are 2, 3, and 5 16th-notes long, with the
;; first note of each grouping being a C4, then print-simple it's contents.
(let ((pe (make-punctuation-events '(2 3 5) 's 'c4)))
  (loop for e in pe do (print-simple e)))
```

```
=>
```

```

C4 S, rest S, C4 S, rest S, rest S, C4 S, rest S, rest S, rest S, rest S,

;; Create a list of "punctuated" events using a list of note names. Once the
;; final note name is reached, it is repeated for all remaining non-rest
;; rhythms.
(let ((pe (make-punctuation-events '(2 3 5 8) 'q '(c4 e4))))
  (loop for e in pe do (print-simple e)))

=>
C4 Q, rest Q, E4 Q, rest Q, rest Q, E4 Q, rest Q, rest Q, rest Q, rest Q, E4 Q,
rest Q, rest Q, rest Q, rest Q, rest Q, rest Q, rest Q,

```

**SYNOPSIS:**

```
(defun make-punctuation-events (distances rhythm notes)
```

**20.2.125 event/make-rest**

[ *event* ] [ *Functions* ]

**DESCRIPTION:**

Create an event object that consists of a rest.

**ARGUMENTS:**

- A rhythm (duration).

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :start-time. A number that is the start-time of the event in seconds.
- :duration. T or NIL. T indicates that the duration given is a value of absolute seconds rather than a known rhythm (e.g. 'e). Default = NIL.
- :tempo. Beats per minute. Default = 60.

**RETURN VALUE:**

- An event object.

**EXAMPLE:**

```

;; Make an event object consisting of a quarter rest
(make-rest 4)

```

```
=>
EVENT: start-time: NIL, end-time: NIL,
       duration-in-tempo: 0.0,
       compound-duration-in-tempo: 0.0,
       amplitude: 0.7,
       bar-num: -1, marks-before: NIL,
       tempo-change: NIL
       instrument-change: NIL
       display-tempo: NIL, start-time-qtrs: -1,
       midi-time-sig: NIL, midi-program-changes: NIL,
       8va: 0
       pitch-or-chord: NIL
       written-pitch-or-chord: NIL
RHYTHM: value: 4.0, duration: 1.0, rq: 1, is-rest: T, score-rthm: 4.0f0,
        undotted-value: 4, num-flags: 0, num-dots: 0, is-tied-to: NIL,
        is-tied-from: NIL, compound-duration: 1.0, is-grace-note: NIL,
        needs-new-note: NIL, beam: NIL, bracket: NIL, rqq-note: NIL,
        rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 4,
        tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: 4, tag: NIL,
data: 4
```

```
;; Make an event object consisting of 4 seconds of rest (rather than a quarter;
;; indicated by the :duration t) starting at time-point 13.7 seconds, then
;; print the corresponding slot values.
```

```
(let ((e (make-rest 4 :start-time 13.7 :duration t)))
  (print (is-rest e))
  (print (data e))
  (print (duration e))
  (print (value e))
  (print (start-time e)))
```

```
=>
T
W
4.0
1.0f0
13.7
```

## SYNOPSIS:

```
(defun make-rest (rthm &key start-time duration (tempo 60))
```



**20.2.126 event/natural-p**

[ event ] [ Methods ]

**DESCRIPTION:**

Determine whether the pitch of a given event object is a natural note (no sharps or flats).

**ARGUMENTS:**

- An event object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the test is to handle the written or sounding pitch in the event. T = written. Default = NIL.

**RETURN VALUE:**

Returns T if the note tested is natural, otherwise NIL (ie, has a flat or has a sharp).

**EXAMPLE:**

```
;; Returns T when the note is natural
(let ((e (make-event 'c4 'q)))
  (natural-p e))
```

=> T

```
;; Returns NIL when the note is not natural (ie, is sharp or flat)
(let ((e (make-event 'cs4 'q)))
  (natural-p e))
```

=> NIL

```
(let ((e (make-event 'df4 'q)))
  (natural-p e))
```

=> NIL

**SYNOPSIS:**

```
(defmethod natural-p ((e event) &optional written)
```

**20.2.127 event/no-accidental***[ event ] [ Methods ]***DESCRIPTION:**

Sets the SHOW-ACCIDENTAL and ACCIDENTAL-IN-PARENTHESES slots of the given event object to NIL.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; The SHOW-ACCIDENTAL slot is automatically set to T on new event objects
;; that consist of a sharp or flat note.
```

```
(let ((e (make-event 'cs4 'q)))
  (show-accidental (pitch-or-chord e)))
```

```
=> T
```

```
;; The method no-accidental sets the SHOW-ACCIDENTAL slot to NIL (and the
;; ACCIDENTAL-IN-PARENTHESES if not already).
```

```
(let ((e (make-event 'cs4 'q)))
  (no-accidental e)
  (show-accidental (pitch-or-chord e)))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod no-accidental ((e event))
```

**20.2.128 event/output-midi***[ event ] [ Methods ]***DESCRIPTION:**

Generate the data necessary for MIDI output for a given event object.

NB: The given event object must contain data for start-time and midi-channel.

#### ARGUMENTS:

- An event object.

#### OPTIONAL ARGUMENTS:

- A decimal number that is the number of seconds to offset the timing of the MIDI output.
- A decimal number that is to override any other existing event object data for amplitude.

#### RETURN VALUE:

Returns the data required for MIDI output.

#### EXAMPLE:

```
;; Simple use
(let ((e (make-event 'c4 'q
                    :start-time 0.0
                    :midi-channel 1)))
  (output-midi e))

=> (#i(midi time 0.0 keynum 60 duration 1.0 amplitude 0.7 channel 0))

;; Specifying time offset and forced amplitude value
(let ((e (make-event 'c4 'q
                    :start-time 0.0
                    :midi-channel 1)))
  (output-midi e 0.736 0.3))

=> (#i(midi time 0.736 keynum 60 duration 1.0 amplitude 0.3 channel 0))
```

#### SYNOPSIS:

```
(defmethod output-midi ((e event) &optional (time-offset 0.0) force-velocity)
```

#### 20.2.129 event/pitch-

[ event ] [ Methods ]

#### DESCRIPTION:

Determine the interval in half-steps between two pitches.

NB: This is determined by subtracting the MIDI note value of one event from the other. Negative numbers may result if the greater MIDI note value is subtracted from the lesser.

#### ARGUMENTS:

- A first event object.
- A second event object.

#### RETURN VALUE:

A number.

#### EXAMPLE:

```
(let ((e1 (make-event 'c4 'q))
      (e2 (make-event 'a3 'q)))
  (pitch- e1 e2))
```

=> 3.0

;; Subtracting the upper from the lower note returns a negative number

```
(let ((e1 (make-event 'a3 'q))
      (e2 (make-event 'c4 'q)))
  (pitch- e1 e2))
```

=> -3.0

#### SYNOPSIS:

```
(defmethod pitch- ((e1 event) (e2 event))
```

#### 20.2.130 event/remove-dynamics

[ event ] [ Methods ]

#### DESCRIPTION:

Remove all dynamic symbols from the list of marks attached to a given event object.

NB: This doesn't change the amplitude.

**ARGUMENTS:**

- An event object.

**RETURN VALUE:**

Returns the modified list of marks attached to the given event object if the specified dynamic was initially present in that list and successfully removed, otherwise returns NIL.

**EXAMPLE:**

```
;; Create an event object, add one dynamic mark and one non-dynamic mark, print
;; all marks attached to the object, and remove just the dynamics from that
;; list of all marks.
```

```
(let ((e (make-event 'c4 'q)))
  (add-mark-once e 'ppp)
  (add-mark-once e 'pizz)
  (print (marks e))
  (remove-dynamics e))
```

```
=>
```

```
(PIZZ PPP)
(PIZZ)
```

```
;; Attempting to remove dynamics when none are present returns NIL.
```

```
(let ((e (make-event 'c4 'q)))
  (remove-dynamics e))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod remove-dynamics ((e event))
```

**20.2.131 event/replace-mark**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Replace a specified mark of a given event object with a second specified mark. If an event object contains more than one mark, individual marks can be changed without modifying the remaining marks.

**ARGUMENTS:**

- An event object.
- The mark to be replaced.
- The new mark.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the mark to be replaced is in the MARKS-BEFORE slot. T = it is in the MARKS-BEFORE slot. Default = NIL.

**RETURN VALUE:**

Returns the new value of the MARKS/MARKS-BEFORE slot of the given object.

**EXAMPLE:**

```
;; Add marks to the MARKS slot and replace 'a with 'batt
(let ((e (make-event 'c4 'q)))
  (loop for m in '(a s pizz)
    do (add-mark e m))
  (replace-mark e 'a 'batt))
```

```
=> (PIZZ S BATT)
```

```
;; Add marks to the MARKS-BEFORE slot and replace 'arco with 'at
(let ((e (make-event 'c4 'q)))
  (loop for m in '(arco col-legno)
    do (add-mark-before e m))
  (replace-mark e 'arco 'at t))
```

```
=> (COL-LEGNO AT)
```

```
|#
(defmethod replace-mark ((e event) what with &optional before)
```

**20.2.132 event/set-midi-channel**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Set the MIDI-channel and microtonal MIDI-channel for the pitch object within a given event object.

**ARGUMENTS:**

- An event object.
- A whole number indicating the MIDI-channel to be used for playback of this event object.
- A whole number indicating the MIDI-channel to be used for playback of the microtonal pitch material of this event.

**RETURN VALUE:**

Returns the value of the MIDI-channel setting (a whole number) if the MIDI-channel slot has been set, otherwise NIL.

**EXAMPLE:**

```
;; Unless specified the MIDI channel of a newly created event object defaults
;;; to NIL.
(let ((e (make-event 'c4 'q)))
  (midi-channel (pitch-or-chord e)))
```

=> NIL

```
(let ((e (make-event 'c4 'q)))
  (set-midi-channel e 7 8)
  (midi-channel (pitch-or-chord e)))
```

=> 7

**SYNOPSIS:**

```
(defmethod set-midi-channel ((e event) midi-channel microtonal-midi-channel)
```

**20.2.133 event/set-midi-time-sig**

[ *event* ] [ *Methods* ]

**DESCRIPTION:**

Sets a MIDI time signature for the given event object. This must be a time-sig object, not just a time signature list.

**ARGUMENTS:**

- An event object.
- A time-sig object.

**RETURN VALUE:**

Returns a time-sig object.

**EXAMPLE:**

```
;; Creating a new event object sets the midi-time-sig slot to NIL by default
(let ((e (make-event 'c4 'q)))
  (midi-time-sig e))
```

=> NIL

```
;; The set-midi-time-sig method returns a time-sig object
(let ((e (make-event 'c4 'q)))
  (set-midi-time-sig e (make-time-sig '(3 4))))
```

=>

```
TIME-SIG: num: 3, denom: 4, duration: 3.0, compound: NIL, midi-clocks: 24,
num-beats: 3
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0304", tag: NIL,
data: (3 4)
```

```
;; Set the midi-time-sig slot and read the data of the given time-sig object
(let ((e (make-event 'c4 'q)))
  (set-midi-time-sig e (make-time-sig '(3 4)))
  (data (midi-time-sig e)))
```

=> (3 4)

**SYNOPSIS:**

```
(defmethod set-midi-time-sig ((e event) time-sig)
```

**20.2.134 event/set-written**

[ *event* ] [ *Methods* ]

**DESCRIPTION:**

Set the written pitch (as opposed to sounding; i.e., for transposing instruments) of a given event object. The sounding pitch remains unchanged as a pitch object in the PITCH-OR-CHORD slot, while the written pitch is added as a pitch object to the WRITTEN-PITCH-OR-CHORD slot.



**ARGUMENTS:**

- An event object.
- A number indicating the difference in semitones (positive or negative) between the written and sounding pitches. E.g. to set the written-note for a B-flat Clarinet, this would be 2, for an E-flat Clarinet, it would be -3.

**RETURN VALUE:**

The 'written' pitch object.

**EXAMPLE:**

```
;; Returns a pitch object (here for example for a D Trumpet or Clarinet)
(let ((e (make-event 'c4 'q)))
  (set-written e -2))
```

=>

```
PITCH: frequency: 233.08186975464196, midi-note: 58, midi-channel: NIL
       pitch-bend: 0.0
       degree: 116, data-consistent: T, white-note: B3
       nearest-chromatic: BF3
       src: 0.8908987045288086, src-ref-pitch: C4, score-note: BF3
       qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
       micro-tone: NIL,
       sharp: NIL, flat: T, natural: NIL,
       octave: 3, c5ths: 1, no-8ve: BF, no-8ve-no-acc: B
       show-accidental: T, white-degree: 27,
       accidental: F,
       accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: BF3, tag: NIL,
data: BF3
```

```
;; Create a single-pitch event object, set it's written pitch to two half-steps
;; lower, and print the corresponding data slots
(let ((e (make-event 'c4 'q)))
  (set-written e -2)
  (print (data (pitch-or-chord e)))
  (print (data (written-pitch-or-chord e))))
```

=>

```
C4
BF3
```

**SYNOPSIS:**

```
(defmethod set-written ((e event) transposition)
```

**20.2.135 event/setf amplitude**

```
[ event ] [ Methods ]
```

**DESCRIPTION:**

Change the amplitude slot of a given event object and automatically add a mark to set a corresponding dynamic.

Numbers greater than 1.0 and less than 0.0 will also be stored in the amplitude slot of the given event object without printing a warning, though corresponding dynamic marks are only available for values between 0.0 and 1.0. Any value above 1.0 or below 0.0 will result in a dynamic marking of FFFF and NIENTE respectively.

**ARGUMENTS:**

- An amplitude value (real number).
- An event object.

**RETURN VALUE:**

Returns the specified amplitude value.

**EXAMPLE:**

```
;; When no amplitude is specified, new event objects are created with a default
;; amplitude of 0.7.
```

```
(let ((e (make-event 'c4 'q)))
  (amplitude e))
```

```
=> 0.7
```

```
;; Setting an amplitude returns the amplitude set
```

```
(let ((e (make-event 'c4 'q)))
  (setf (amplitude e) .3))
```

```
=> 0.3
```

```
;; Create an event object, set its amplitude, then print the contents of the
;; amplitude and marks slots to see the dynamic setting.
```

```
(let ((e (make-event 'c4 'q)))
  (setf (amplitude e) .3)
  (print (amplitude e))
  (print (marks e)))
```

```
=>
0.3
(PP)
```

```
;; Setting an amplitude greater than 1.0 or less than 0.0 sets the amplitude
;; correspondingly and sets the dynamic mark to FFFF or NIENTE respectively.
```

```
(let ((e1 (make-event 'c4 'q))
      (e2 (make-event 'c4 'q)))
  (setf (amplitude e1) 1.3)
  (setf (amplitude e2) -1.3)
  (print (marks e1))
  (print (marks e2)))
```

```
=>
(FFFF)
(NIENTE)
```

#### SYNOPSIS:

```
(defmethod (setf amplitude) :after (value (e event))
```

#### 20.2.136 event/setf tempo-change

[ event ] [ Methods ]

#### DESCRIPTION:

Store the tempo when a change is made.

NB: This creates a full tempo object, not just a number representing bpm.

#### ARGUMENTS:

- An event object.
- A number indicating the new tempo bpm.

#### RETURN VALUE:

Returns a tempo object.

#### EXAMPLE:

```
;; Creation of a new event object sets the tempo-change slot to NIL by default,
;; unless otherwise specified.
(let ((e (make-event 'c4 'q)))
  (tempo-change e))
```

=> NIL

```
;; The tempo-change method returns a tempo object
(let ((e (make-event 'c4 'q)))
  (setf (tempo-change e) 132))
```

=>

```
TEMPO: bpm: 132, beat: 4, beat-value: 4.0, qtr-dur: 0.45454545454545453
      qtr-bpm: 132.0, usecs: 454545, description: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: 132
```

```
;; The new tempo object is stored in the event object's tempo-change slot.
(let ((e (make-event 'c4 'q)))
  (setf (tempo-change e) 132)
  e)
```

=>

```
EVENT: start-time: NIL, end-time: NIL,
      duration-in-tempo: 0.0,
      compound-duration-in-tempo: 0.0,
      amplitude: 0.7, score-marks: NIL,
      bar-num: -1, cmn-objects-before: NIL,
      tempo-change:
TEMPO: bpm: 132, beat: 4, beat-value: 4.0, qtr-dur: 0.45454545454545453
      qtr-bpm: 132.0, usecs: 454545, description: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: 132
[...]
```

## SYNOPSIS:

```
(defmethod (setf tempo-change) (value (e event))
```

### 20.2.137 event/sharp-p

[ event ] [ Methods ]

## DESCRIPTION:

Determine whether the pitch of a given event object has a sharp.

#### ARGUMENTS:

- An event object.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether the test is to handle the written or sounding pitch in the event. T = written. Default = NIL.

#### RETURN VALUE:

Returns T if the note tested has a sharp, otherwise NIL (ie, is natural or has a flat).

#### EXAMPLE:

```
;; Returns T when the note is sharp
(let ((e (make-event 'cs4 'q)))
  (sharp-p e))
```

=> T

```
;; Returns NIL when the note is not sharp (ie, is flat or natural)
(let ((e (make-event 'c4 'q)))
  (sharp-p e))
```

=> NIL

```
(let ((e (make-event 'df4 'q)))
  (sharp-p e))
```

=> NIL

#### SYNOPSIS:

```
(defmethod sharp-p ((e event) &optional written)
```

#### 20.2.138 event/sort-event-list

[ event ] [ Functions ]

#### DESCRIPTION:

Sort a list of event objects by start time from lowest to highest.

#### ARGUMENTS:

- A list of event objects.

#### RETURN VALUE:

A list of event objects.

#### EXAMPLE:

```
;; Create a list of event object with non-sequential start-times, sort them,
;; and return the pitches and start times of the newly ordered list.
```

```
(let ((e-list (loop repeat 8
                    for nn in '(c4 d4 e4 f4 g4 a4 b4 c5)
                    for st in '(1.0 3.0 2.0 5.0 8.0 4.0 7.0 6.0)
                    collect (make-event nn 'e :start-time st))))
  (sort-event-list e-list)
  (loop for e in e-list
        collect (get-pitch-symbol e)
        collect (start-time e)))
```

```
=> (C4 1.0 E4 2.0 D4 3.0 A4 4.0 F4 5.0 C5 6.0 B4 7.0 G4 8.0)
```

#### SYNOPSIS:

```
(defun sort-event-list (event-list)
```

#### 20.2.139 event/transpose

```
[ event ] [ Methods ]
```

#### DESCRIPTION:

Transpose the pitch content of a given event object by a specified number of semitones. This method can be applied to chords or single-pitches.

If functions are given, these will be used for the note or chord in the event, whereby semitones may or may not be NIL in that case (transposition could be dependent on the note or chord rather than being a fixed shift).

NB: By default this method returns a modified clone of the original rather than changing the values of the original itself. The user can choose to replace the values of the original by setting the keyword argument :destructively to T.

**ARGUMENTS:**

- An event object.
- A number (can be positive or negative).

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :destructively. T or NIL to indicate whether the method is to replace the pitch values of the original event object (T) or return a new event object with the new pitches (NIL). Default = NIL.
- :chord-function. A function to be used for the transposition of chords. Default = #'transpose.
- :pitch-function. A function to be used for the transposition of pitches. Default = #'transpose.

**RETURN VALUE:**

An event object.

**EXAMPLE:**

```
;; Transpose returns an event object
(let ((e (make-event 'c4 'q)))
  (transpose e 1))
```

=>

```
EVENT: start-time: NIL, end-time: NIL,
       duration-in-tempo: 0.0,
[...]
```

```
;; By default transpose returns a modified clone, leaving the original event
;; object untouched.
```

```
(let ((e (make-event 'c4 'q)))
  (print (data (pitch-or-chord (transpose e 1))))
  (print (data (pitch-or-chord e))))
```

=>

```
CS4
C4
```

```
;; When the keyword argument :destructively is set to T, the data of the
;; original event object is replaced
```

```
(let ((e (make-event 'c4 'q)))
  (transpose e 1 :destructively t))
```

```

      (data (pitch-or-chord e)))

=> CS4

;; Can transpose by 0 as well (effectively no transposition)
(let ((e (make-event 'c4 'q)))
  (transpose e 0 :destructively t)
  (data (pitch-or-chord e)))

=> C4

;; ...or by negative intervals
(let ((e (make-event 'c4 'q)))
  (transpose e -3 :destructively t)
  (data (pitch-or-chord e)))

=> A3

;; Can transpose chords too
(let ((e (make-event '(c4 e4 g4) 'q)))
  (transpose e -3 :destructively t)
  (loop for p in (data (pitch-or-chord e)) collect (data p)))

=> (A3 CS4 E4)

```

**SYNOPSIS:**

```

(defmethod transpose ((e event) semitones
  &key
  destructively
  ;; the default functions are the class methods for pitch
  ;; or chord.
  (chord-function #'transpose)
  (pitch-function #'transpose))

```

**20.2.140 event/wrap-events-list**

[ *event* ] [ *Functions* ]

**DESCRIPTION:**

Given a list of time-ascending event objects, rotate their start-times by moving the lowest start time to a specified point in the list (determined either by time or by nth position), assigning the subsequent start times sequentially through the remainder of events in the list, and wrapping



around to the head of the list again to assign the final remaining start times. If the first event doesn't start at 0, its start time will be conserved.

#### ARGUMENTS:

- A flat list of event objects.
- An integer that is the number of the event object with which to start (nth position), or a decimal time in seconds.

#### OPTIONAL ARGUMENTS:

keyword argument:

- :time. T or NIL to indicate whether the second argument is a time in seconds or an nth index. If a time in seconds, the method skips to the closest event object in the list. T = time in seconds. Default = NIL.

#### RETURN VALUE:

Returns a flat list of event objects with adjust start-times.

#### EXAMPLE:

```
;;; Create a list of events of eighth-note durations, specifying start-times at
;;; 0.5-second intervals and print the pitches and start-times. Then apply the
;;; function and print the pitches and start-times again to see the change.
```

```
(let ((e-list (loop for st from 1.0 by 0.5
                    for nn in '(c4 d4 e4 f4 g4 a4 b4 c5)
                    collect (make-event nn 'e :start-time st))))
  (print
   (loop for e in e-list
         collect (get-pitch-symbol e)
         collect (start-time e)))
  (wrap-events-list e-list 3)
  (print
   (loop for e in e-list
         collect (get-pitch-symbol e)
         collect (start-time e))))
```

=>

```
(C4 1.0 D4 1.5 E4 2.0 F4 2.5 G4 3.0 A4 3.5 B4 4.0 C5 4.5)
(C4 3.5 D4 4.0 E4 4.5 F4 1.0 G4 1.5 A4 2.0 B4 2.5 C5 3.0)
```

#### SYNOPSIS:

```
(defun wrap-events-list (events start-at &key (time nil))
```

**20.2.141** `rhythm/force-rest`*[ rhythm ] [ Methods ]***DESCRIPTION:**

Force the given rhythm object to be a rest.

**ARGUMENTS:**

- A rhythm object.

**RETURN VALUE:**

A rhythm object.

**EXAMPLE:**

```
(let ((r (make-rhythm 8)))  
  (force-rest r)  
  (is-rest r))
```

=> T

**SYNOPSIS:**

```
(defmethod force-rest ((r rhythm))
```

**20.2.142** `rhythm/has-mark`*[ rhythm ] [ Methods ]***DESCRIPTION:**

Check to see if a given rhythm object possesses a specified mark.

**ARGUMENTS:**

- A rhythm object.
- A mark.

**RETURN VALUE:**

If the specified mark is indeed found in the MARKS slot of the given rhythm object, the tail of the list of marks contained in that slot is returned; otherwise NIL is returned.

**EXAMPLE:**

```
;; Add a specific mark and check to see if the rhythm object has it.
(let ((r (make-rhythm 'q)))
  (add-mark r 'a)
  (has-mark r 'a))
```

```
=> (A)
```

```
;; Check to see if the given rhythm object possess a mark we know it doesn't.
(let ((r (make-rhythm 'q)))
  (add-mark r 'a)
  (has-mark r 's))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod has-mark ((r rhythm) mark &optional (test #'equal))
```

**20.2.143 rhythm/is-multiple**

```
[ rhythm ] [ Methods ]
```

**DESCRIPTION:**

Determines if the value of one rhythm object is a multiple of the value of a second rhythm object. This is established by dividing the one by the other and checking to see if the quotient is a whole number.

**ARGUMENTS:**

- A first rhythm object.
- A second rhythm object.

**RETURN VALUE:**

Returns T if true and NIL if not. Always also returns the quotient.

**EXAMPLE:**

```
(let ((r1 (make-rhythm 'q))
      (r2 (make-rhythm 'e)))
  (is-multiple r1 r2))
```

=> T, 2.0

```
(let ((r1 (make-rhythm 'q))
      (r2 (make-rhythm 'e.)))
  (is-multiple r1 r2))
```

=> NIL, 1.3333333333333333

## SYNOPSIS:

```
(defmethod is-multiple ((r1 rhythm) (r2 rhythm))
```

### 20.2.144 rhythm/make-rhythm

[ *rhythm* ] [ *Functions* ]

## DESCRIPTION:

Make a rhythm object.

## ARGUMENTS:

- A duration either as a numeric representation of a rhythm (subdivision of a whole note; 2 = half note, 4 = quarter, 8 = eighth etc), a quoted alphabetic shorthand for a duration (ie, 'h, 'q, 'e etc.), or an absolute duration in seconds.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :is-rest. T or NIL to denote whether the given duration is a rest or not. T = rest. Default = NIL.
- :is-tied-to. T or NIL to denote whether the given duration is tied later to the next duration in a given rthm-seq-bar/rthm-seq object. T = tied. Default = NIL.
- :duration. Indicates whether the duration argument has been given as a duration in seconds, not a known rhythm like 'e or 8. T indicates that the duration is a duration in seconds. Default = NIL.
- :tempo. Indicates the tempo for the given rhythm and is used only when :duration is set to figure out the rhythm type (1/8, 1/4 etc.) from the two values. So this is not related to any tempi applied, rather one that is reflected in the duration-in-tempo slot of event.

## RETURN VALUE:

A rhythm object.

#### EXAMPLE:

```
(make-rhythm 16)
```

```
=>
```

```
RHYTHM: value: 16.0, duration: 0.25, rq: 1/4, is-rest: NIL, score-rthm: 16.0,
undotted-value: 16, num-flags: 2, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.25, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 16,
tuplet-scaler: 1, grace-note-duration: 0.05
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: 16, tag: NIL,
```

```
data: 16
```

```
(make-rhythm 16 :is-rest t :is-tied-to t)
```

```
=>
```

```
RHYTHM: value: 16.0, duration: 0.25, rq: 1/4, is-rest: T, score-rthm: 16.0,
undotted-value: 16, num-flags: 2, num-dots: 0, is-tied-to: T,
is-tied-from: NIL, compound-duration: 0.25, is-grace-note: NIL,
needs-new-note: NIL, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 16,
tuplet-scaler: 1, grace-note-duration: 0.05
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: 16, tag: NIL,
```

```
data: 16
```

```
(make-rhythm .23 :duration t)
```

```
=>
```

```
RHYTHM: value: 17.391304, duration: 0.23, rq: 23/100, is-rest: NIL, score-rthm: NIL,
undotted-value: -1.0, num-flags: 0, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.23, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: -1,
tuplet-scaler: 1, grace-note-duration: 0.05
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: NIL, tag: NIL,
```

```
data: NIL
```

#### SYNOPSIS:

```
(defun make-rhythm (rthm &key (is-rest nil) (is-tied-to nil) (duration nil))
```

```
(tempo 60.0))
```

### 20.2.145 rhythm/replace-mark

[ *rhythm* ] [ *Methods* ]

#### DESCRIPTION:

Replace a specified mark of a given rhythm object with a second specified mark. If a rhythm object contains more than one mark, individual marks can be changed without modifying the remaining marks.

#### ARGUMENTS:

- A rhythm object.
- The mark to be replaced.
- The new mark.

#### RETURN VALUE:

Returns the new value of the MARKS slot of the given object.

#### EXAMPLE:

```
;; Make a rhythm object, add the mark 'a, then replace 'a with 's
(let ((r (make-rhythm 'q)))
  (add-mark r 'a)
  (replace-mark r 'a 's))
```

```
=> (S)
```

```
;; Make a rhythm object, add a list of marks, replace just the 'pizz mark with
;; a 'batt mark
```

```
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s pizz col-legno) do (add-mark-once r m))
  (replace-mark r 'pizz 'batt))
```

```
=> (COL-LEGNO BATT S A)
```

#### SYNOPSIS:

```
(defmethod replace-mark ((r rhythm) what with &optional ignore)
```

**20.2.146 rhythm/rhythm-equal***[ rhythm ] [ Methods ]***DESCRIPTION:**

Compares the values of two rhythm objects to determine if they are equal.

NB `rhythm-equal` compares the values only, so rhythms with the same values will still be considered equal even if their other attributes (such as `:is-rest` and `:is-tied-to` etc.) are different.

**ARGUMENTS:**

- A first rhythm object.
- A second rhythm object.

**RETURN VALUE:**

T if the values of the given rhythm objects are equal, else NIL.

**EXAMPLE:**

```
(let ((r1 (make-rhythm 4))
      (r2 (make-rhythm 4)))
  (rhythm-equal r1 r2))
```

=> T

```
(let ((r1 (make-rhythm 4))
      (r2 (make-rhythm 8)))
  (rhythm-equal r1 r2))
```

=> NIL

```
(let ((r1 (make-rhythm 4 :is-rest T))
      (r2 (make-rhythm 4 :is-rest NIL)))
  (rhythm-equal r1 r2))
```

=> T

```
(let ((r1 (make-rhythm 4 :is-tied-to T))
      (r2 (make-rhythm 4 :is-tied-to NIL)))
  (rhythm-equal r1 r2))
```

=> T

**SYNOPSIS:**

```
(defmethod rhythm-equal ((r1 rhythm) (r2 rhythm))
```

**20.2.147 rhythm/rhythm-list**

[ *rhythm* ] [ *Functions* ]

**DESCRIPTION:**

Create a list of rhythms from symbols, possibly involving ties and not needing meters etc. (i.e. not as strict as `rthm-seq`).

**ARGUMENTS:**

- The list of rhythm symbols.

**OPTIONAL ARGUMENTS:**

- T or NIL indicates whether to create a circular-sclist from the result. If NIL, a simple list will be returned (default = NIL).

**RETURN VALUE:**

A list or circular-sclist of the rhythm objects.

**EXAMPLE:**

```
;; Create a list of rhythm objects
(rhythm-list '(q w+e q. h.+s e.+ts))

=>(
RHYTHM: value: 4.0f0, duration: 1.0
[...]
RHYTHM: value: 1.0f0, duration: 4.0
[...]
RHYTHM: value: 8.0f0, duration: 0.5
[...]
RHYTHM: value: 2.6666666666666665, duration: 1.5
[...]
RHYTHM: value: 1.3333333333333333, duration: 3.0
[...]
RHYTHM: value: 16.0f0, duration: 0.25
[...]
RHYTHM: value: 5.333333333333333, duration: 0.75
```



```

[...]
RHYTHM: value: 24.0f0, duration: 0.16666666666666666
)

;; Collect the data from each of the individual rhythm objects in the list.
(let ((rl (rhythm-list '(q w+e q. h.+s e.+ts))))
  (print (loop for r in rl collect (data r))))

=> (Q "W" "E" Q. "H." "S" "E." "TS")

;; Set the optional argument to T to create a circular-sclist instead
(rhythm-list '(q w+e q. h.+s e.+ts) t)

=>
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 8, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
[...]
)

;; Create a circular-sclist and check that it's a circular-sclist using cscl-p
(let ((rl (rhythm-list '(q w+e q. h.+s e.+ts) t)))
  (cscl-p rl))

=> T

```

**SYNOPSIS:**

```
(defun rhythm-list (rthms &optional circular)
```

**20.2.148 rhythm/rhythm/**

[ *rhythm* ] [ *Methods* ]

**DESCRIPTION:**

Determines the ratio of one rhythm object's duration to that of a second rhythm object by use of division.

**ARGUMENTS:**

- A rhythm object.
- A second rhythm object.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
(let ((r1 (make-rhythm 'q))
      (r2 (make-rhythm 'e)))
  (rhythm/ r1 r2))
```

=> 2.0

```
(let ((r1 (make-rhythm 'q))
      (r3 (make-rhythm 's.)))
  (rhythm/ r1 r3))
```

=> 2.6666667

**SYNOPSIS:**

```
(defmethod rhythm/ ((r1 rhythm) (r2 rhythm))
```

**20.2.149 rhythm/rm-marks**

[ *rhythm* ] [ *Methods* ]

**DESCRIPTION:**

Remove a specified mark (or a list of specified marks) from the MARKS slot of a given rhythm object. If the mark specified is not present in the given rhythm object's MARKS slot, a warning is printed. If some marks of a list of specified marks are present in the rhythm object's MARKS slot and other aren't, those that are will be removed and a warning will be printed for the rest.

**ARGUMENTS:**

- A rhythm object.
- A mark or list of marks.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether a warning is to be printed if the specified mark is not present in the given rhythm object's MARKS slot.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; The method itself returns NIL
(let ((r (make-rhythm 'q)))
  (add-mark-once r 'a)
  (rm-marks r 'a))
```

=> NIL

```
;; Adding a list of marks to r, then removing only 's
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s pizz col-legno x-head) do
    (add-mark-once r m))
  (rm-marks r 's)
  (marks r))
```

=> (X-HEAD COL-LEGNO PIZZ A)

```
;; Removing a list of marks from r
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s pizz col-legno x-head) do
    (add-mark-once r m))
  (rm-marks r '(s a))
  (marks r))
```

=> (X-HEAD COL-LEGNO PIZZ)

```
;; Attempting to remove a mark that isn't present results in a warning
;; being printed by default
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s pizz col-legno x-head) do
    (add-mark-once r m))
  (rm-marks r 'zippy))
```

=> NIL

WARNING: rhythm::rm-marks: no mark ZIPPY in (X-HEAD COL-LEGNO PIZZ S A)

```
;; Suppress printing the warning when the specified mark isn't present
(let ((r (make-rhythm 'q)))
  (loop for m in '(a s pizz col-legno x-head) do
    (add-mark-once r m))
  (rm-marks r 'zippy nil))
```

=> NIL

**SYNOPSIS:**

```
(defmethod rm-marks ((r rhythm) marks &optional (warn t))
```

**20.2.150 rhythm/scale**

[ *rhythm* ] [ *Methods* ]

**DESCRIPTION:**

Change the value of a rhythm object's duration value by a specified scaling factor.

**ARGUMENTS:**

- A rhythm object.
- A scaling factor.

**OPTIONAL ARGUMENTS:**

- <clone>. This argument determines whether a new rhythm object is made or the duration value of the old object is replaced. When set to T, a new object is made based on the duration value of the original. When set to NIL, the original duration value is replaced (see example). Default = T.

**RETURN VALUE:**

A rhythm object.

**EXAMPLE:**

```
(let ((r (make-rhythm 4)))  
  (data (scale r 2)))
```

=> H

```
(let ((r (make-rhythm 4)))  
  (data (scale r 3)))
```

=> H.

```
(let ((r (make-rhythm 4)))
  (data (scale r .5)))
```

=> E

```
(let ((r (make-rhythm 4)))
  (dotimes (i 5)
    (print (value (scale r .5))))))
```

=>

```
8.0
8.0
8.0
8.0
8.0
```

```
(let ((r (make-rhythm 4)))
  (dotimes (i 5)
    (print (value (scale r .5 nil))))))
```

=>

```
8.0
16.0
32.0
64.0
128.0
```

## SYNOPSIS:

```
(defmethod scale ((r rhythm) scaler &optional (clone t) ignore1 ignore2)
```

### 20.2.151 rhythm/subtract

[ *rhythm* ] [ *Methods* ]

#### DESCRIPTION:

Create a new rhythm object with a duration that is equal to the difference between the duration of two other given rhythm objects.

NB: This method only returns a single rhythm rather than a list with ties. Thus `h - e.`, for example, returns `TQ...`

If the resulting duration cannot be presented as a single rhythm, the DATA slot of the resulting rhythm object is set to NIL, though the VALUE and

DURATION slots are still set with the corresponding numeric values.

If the resulting duration is equal to or less than 0, NIL is returned and an optional warning may be printed.

#### ARGUMENTS:

- A first rhythm object.
- A second rhythm object.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether a warning is to be printed when the resulting duration is less than or equal to 0. Default = 0.

#### RETURN VALUE:

A rhythm object if the resulting duration is greater than 0, else NIL and the optional warning.

#### EXAMPLE:

```
;; Make a new rhythm object with a duration equal to one quarter minus one
;; eighth.
(let ((r1 (make-rhythm 'q))
      (r2 (make-rhythm 'e)))
  (subtract r1 r2))

=>
RHYTHM: value: 8.0f0, duration: 0.5, rq: 1/2, is-rest: NIL, score-rthm: 8.0f0,
undotted-value: 8, num-flags: 1, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.5, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 8,
tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E

;; A half minus a dotted eighth is represented as a triplet half
(let ((r1 (make-rhythm 'h))
      (r2 (make-rhythm 'e.)))
  (data (subtract r1 r2)))

=> TQ...
```

```
;; If the resulting duration is 0 or less, return NIL, with no warning by
;; default
(let ((r1 (make-rhythm 'e))
      (r2 (make-rhythm 'q)))
  (subtract r1 r2))

=> NIL

;; Setting the optional argument to t returns a warning when the resulting
;; duration is less than 0
(let ((r1 (make-rhythm 'e))
      (r2 (make-rhythm 'q)))
  (subtract r1 r2 t))

=> NIL
WARNING: rhythm::arithmetic: new duration is -0.5; can't create rhythm

;; Subtracting a septuplet-16th from a quarter results in a duration that
;; cannot be represented as a single rhythm, therefore setting the DATA to NIL
;; while VALUE and DURATION are still set.
(let ((r1 (make-rhythm 4))
      (r2 (make-rhythm 28)))
  (print (value (subtract r1 r2)))
  (print (duration (subtract r1 r2)))
  (print (data (subtract r1 r2))))

=>
4.666666666666666
0.8571428571428572
NIL
```

**SYNOPSIS:**

```
(defmethod subtract ((r1 rhythm) (r2 rhythm) &optional warn)
```

**20.2.152 linked-named-object/sclist**

[ *linked-named-object* ] [ *Classes* ]

**NAME:**

player

File:                   sclist.lsp

Class Hierarchy: `named-object -> linked-named-object -> sclist`

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of a simple but self-checking (hence `sclist`) list class.

Author: Michael Edwards: `m@michael-edwards.org`

Creation date: February 11th 2001

\$\$ Last modified: 21:07:47 Sun Dec 1 2013 GMT

SVN ID: \$Id: `sclist.lsp` 4334 2013-12-02 20:24:57Z medward2 \$

### 20.2.153 `sclist/change-data`

[ `sclist` ] [ *Classes* ]

#### NAME:

`change-data`

File: `change-data.lsp`

Class Hierarchy: `named-object -> linked-named-object -> sclist -> change-data`

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the `change-data` class. Holds data regarding parameter changes for a whole section (e.g. tempo). For use in `change-map`. The data in the `<changes>` slot is a three-element list: the sequence number, the bar number of the sequence where the change takes place (defaults to 1) and the new data (e.g. a tempo value).

When giving this data, the sequence number and bar numbers are always integers  $> 0$ , unlike sequences themselves which may be given any kind of id. Therefore



it's OK to sort the given data according to integer precedence and perform numeric tests on them too.

No public interface envisaged (so no robodoc entries).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 2nd April 2001

\$\$ Last modified: 20:31:51 Mon May 14 2012 BST

SVN ID: \$Id: change-data.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.154 change-data/get-change-data

[ *change-data* ] [ *Methods* ]

#### DESCRIPTION:

Get the change data (for example, from an instrument-change-map object) for a specified sequence.

#### ARGUMENTS:

- A change-data object.
- An integer that is the number of the sequence within the given change-data object for which to retrieve the data.

#### OPTIONAL ARGUMENTS:

- An integer that is the number of the bar within the specified sequence for which to return the change data.

#### RETURN VALUE:

The change data of the specified sequence (and bar).

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
                        (db (double-bass :midi-channel 2))))
       :instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax)))))))
```

```

:set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s)
                        (w))
                      :pitch-seq-palette ((1 2 3 4 5 6)))))
:rthm-seq-map '((1 ((sax (1 1 1 1 1))
                    (db (1 1 1 1 1))))))
(get-change-data
 (get-data '(1 sax) (instrument-change-map mini) 2 2))
=> ALTO-SAX, NIL

```

**SYNOPSIS:**

```
(defmethod get-change-data ((cd change-data) sequence &optional (bar 1))
```

**20.2.155 change-data/make-change-data**

[ *change-data* ] [ *Functions* ]

**DESCRIPTION:**

Create a change-data object, which holds data for use by a change-map object. The data stored in change-data object will be that of parameter changes for a whole section, such as tempo values.

The data is passed to the make-change-data function as a list of three-element lists, each consisting of the number of the sequence, the number of the bar within that sequence, and the new data.

**ARGUMENTS:**

- An ID for the change-data object to be created.
- A list of three-item lists, each consisting of the number of the sequence in which the data is to change, the number of the bar within that sequence in which the data is to change, and the data value itself. The sequence number and bar number are always integers > 0. If no bar-number is given, it will default to 1.

**RETURN VALUE:**

A change-data object.

**EXAMPLE:**

```
(make-change-data 'cd-test '((1 1 23) (6 1 28) (18 1 35)))
```

```
=>
```

```
CHANGE-DATA:
```

```
    previous-data: NIL,
```

```
    last-data: 35
```

```
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: CD-TEST, tag: NIL,
```

```
data: ((1 1 23) (6 1 28) (18 1 35))
```

### SYNOPSIS:

```
(defun make-change-data (id data)
```

#### 20.2.156 sclist/chord

[ *sclist* ] [ *Classes* ]

##### NAME:

chord

File: chord.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> chord

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the chord class that is simply an  
sclist whose data is a list of pitch instances.

Author: Michael Edwards: m@michael-edwards.org

Creation date: July 28th 2001

\$\$ Last modified: 09:00:22 Tue Jan 14 2014 GMT

SVN ID: \$Id: chord.lsp 4353 2014-01-14 09:50:34Z medward2 \$

#### 20.2.157 chord/add-harmonics

[ *chord* ] [ *Methods* ]

**DESCRIPTION:**

Adds pitches to the set which are harmonically related to the existing pitches. The keywords are the same as for the `get-harmonics` function. See also `sc-set` method of the same name and `get-pitch-list-harmonics`.  
 NB This will automatically sort all pitches from high to low.

**ARGUMENTS:**

- a chord object

keyword arguments:  
 see `get-harmonics` function

**RETURN VALUE:**

the same set object as the first argument but with new pitches added.

**SYNOPSIS:**

```
(defmethod add-harmonics ((c chord) &rest keywords)
```

**20.2.158 chord/add-mark**

[ chord ] [ Methods ]

**DESCRIPTION:**

Add the specified mark to the MARKS slot of the given chord object.

**ARGUMENTS:**

- A chord object.
- A mark.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to print a warning when attempting to add a mark to a rest.

**RETURN VALUE:**

Returns the full contents of the MARKS slot of the given chord object

**EXAMPLE:**

```
;;; Returns the complete contents of the MARKS slot
(let ((chrd (make-chord '(cs4 e4 fs4 af4 bf4))))
  (add-mark chrd 'fff)
  (add-mark chrd 'pizz))
```

```
=> (PIZZ FFF)
```

#### SYNOPSIS:

```
(defmethod add-mark ((c chord) mark &optional warn-rest)
```

#### 20.2.159 chord/add-pitches

```
[ chord ] [ Methods ]
```

#### DESCRIPTION:

Add the specified pitches to the given chord object.

#### ARGUMENTS:

- A chord object.
- The pitches to add to that object. These can be pitch objects or any data that can be passed to `make-pitch`, or indeed lists of these, as they will be flattened.

#### RETURN VALUE:

- A chord object.

#### EXAMPLE:

```
(let ((ch (make-chord '(c4 e4 g4))))
  (print (get-pitch-symbols ch))
  (add-pitches ch 'bf3)
  (print (get-pitch-symbols ch))
  (add-pitches ch 'af3 'a4 'b4)
  (print (get-pitch-symbols ch))
  (add-pitches ch '(cs5 ds5 fs5))
  (print (get-pitch-symbols ch)))
```

```
=>
```

```
(C4 E4 G4)
(BF3 C4 E4 G4)
(AF3 BF3 C4 E4 G4 A4 B4)
(AF3 BF3 C4 E4 G4 A4 B4 CS5 DS5 FS5)
```

**SYNOPSIS:**

```
(defmethod add-pitches ((c chord) &rest pitches)
```

**20.2.160 chord/chord-equal**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Test to see if two chords are equal.

NB: Two unsorted chord objects that contain the exact same pitch objects in a different order will not be considered equal and will return NIL.

NB: Equality is tested on pitch content only, not on, for example, the values of the MIDI slots of those pitch objects etc.

**ARGUMENTS:**

- A first chord object.
- A second chord object.

**RETURN VALUE:**

T or NIL. T if the pitch content of the chords is equal, otherwise NIL.

**EXAMPLE:**

```
;; Two chords are equal
(let ((chrd1 (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12))
      (chrd2 (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (chord-equal chrd1 chrd2))

=> T

;; Chord objects with the same pitch objects in a different order are unequal
(let ((chrd1 (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12))
      (chrd2 (make-chord '(e4 c4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (chord-equal chrd1 chrd2))

=> NIL
```

```

        :midi-channel 11
        :microtones-midi-channel 12
        :auto-sort nil)))
(chord-equal chrd1 chrd2))

=> NIL

;; Only the pitch content is compared. Content of other slots is irrelevant.
(let ((chrd1 (make-chord '(e4 c4 gqs4 bqf4 d5 f5)
        :midi-channel 11
        :microtones-midi-channel 12))
      (chrd2 (make-chord '(e4 c4 gqs4 bqf4 d5 f5)
        :midi-channel 7
        :microtones-midi-channel 8)))
(chord-equal chrd1 chrd2))

=> T

```

**SYNOPSIS:**

```
(defmethod chord-equal ((c1 chord) (c2 chord))
```

**20.2.161 chord/chord-member**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Test whether a specified pitch object is a member of a given chord object.

**ARGUMENTS:**

- A chord object.
- A pitch object. This must be a pitch object, not just a note-name symbol, but the pitch object can be made with either a note-name symbol or a numerical hertz frequency value.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not the method should consider enharmonically equivalent pitches to be equal. T = enharmonics are equal. Default = T.

**RETURN VALUE:**

Similar to Lisp's "member" function, this method returns the tail of the data (list of pitch objects) of the tested chord object starting with the specified pitch object if that pitch is indeed a member of that list, otherwise returns NIL.

NB: Since the method returns the tail of the given chord (the "rest" of the pitches after the given pitch), the result may be different depending on whether that chord has been auto-sorted or not.

#### EXAMPLE:

```
;; Returns the tail of pitch objects contained starting with the tested pitch
(let ((chrd (make-chord '(c4 e4 gqs4 a4 d5 f5 bqf5)
                        :midi-channel 11
                        :microtones-midi-channel 12))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'a4))))
```

=> (A4 D5 F5 BQF5)

```
;; The chord object's default auto-sort feature might appear to affect outcome
(let ((chrd (make-chord '(d5 c4 gqs4 a4 bqf5 f5 e4)
                        :midi-channel 11
                        :microtones-midi-channel 12))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'a4))))
```

=> (A4 D5 F5 BQF5)

```
;; Returns NIL if the pitch is not present in the tested chord object. This
;; example uses the "pitch-list-to-symbols" function to simplify the
;; pitch-object output.
(let ((chrd (make-chord '(d5 c4 gqs4 a4 bqf5 f5 e4)
                        :midi-channel 11
                        :microtones-midi-channel 12))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'b4))))
```

=> NIL

```
;; The optional <enharmonics-are-equal> argument is set to NIL by default
(let ((chrd (make-chord '(c4 e4 a4 d5 f5))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'ds4))))
```

=> NIL

```
;; Setting the optional <enharmonics-are-equal> argument to T
(let ((chrd (make-chord '(c4 ef4 a4 d5 f5))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'ds4) t)))
```



```
=> (EF4 A4 D5 F5)
```

```
;; The optional <octaves-are-true> argument is NIL by default
```

```
(let ((chrd (make-chord '(c4 ef4 a4 d5 ef5 f5))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'c5))))
```

```
=> NIL
```

```
;; If optional <octaves-are-true> argument is set to T, any occurrence of the
;; same pitch class in a different octave will be considered part of the chord
;; and return a positive result.
```

```
(let ((chrd (make-chord '(c4 ef4 a4 d5 ef5 f5))))
  (pitch-list-to-symbols (chord-member chrd (make-pitch 'c5) nil t)))
```

```
=> (C4 EF4 A4 D5 EF5 F5)
```

#### SYNOPSIS:

```
(defmethod chord-member ((c chord) (p pitch)
                          &optional (enharmonics-are-equal t)
                          (octaves-are-true nil))
```

#### 20.2.162 chord/chord=

[ chord ] [ Methods ]

#### DATE:

November 11th 2013

#### DESCRIPTION:

Test whether the pitch objects of the two chords are pitch=. Assumes both chords are sorted by pitch height. See pitch= in the pitch class for details of comparing pitches.

#### RETURN VALUE:

T or NIL

#### SYNOPSIS:

```
(defmethod chord= ((c1 chord) (c2 chord) &optional enharmonics-are-equal
                  (frequency-tolerance 0.01)) ; (src-tolerance 0.0001))
```

**20.2.163 chord/common-notes***[ chord ] [ Methods ]***DESCRIPTION:**

Return the integer number of pitches common to two chord objects.

**ARGUMENTS:**

- A first chord object.
- A second chord object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether enharmonically equivalent pitches are to be considered the same pitch. T = enharmonically equivalent pitches are considered the same pitch. Default = T.
- T or NIL to indicate whether the same pitch class in different octaves is to be considered the same pitch. T = consider the same pitch class from octaves to be the same pitch. Default = NIL.

**RETURN VALUE:**

Returns an integer that is the number of pitches common to the two chords objects.

**EXAMPLE:**

```
;; The following two chord objects have 3 pitches in common
(let ((chrd-1 (make-chord '(c4 e4 g4 b4 d5 f5)))
      (chrd-2 (make-chord '(d3 f3 a3 c4 e4 g4))))
  (common-notes chrd-1 chrd-2))
```

```
=> 3
```

```
;; By default, enharmonically equivalent pitches are considered to be the same
;; pitch
(let ((chrd-1 (make-chord '(c4 e4 g4 b4 d5 f5)))
      (chrd-2 (make-chord '(d3 f3 a3 c4 ff4 g4))))
  (common-notes chrd-1 chrd-2))
```

```
=> 3
```

```
;; Setting the first optional argument to NIL causes enharmonically equivalent
```

```
;; pitches to be considered separate pitches
(let ((chrd-1 (make-chord '(c4 e4 g4 b4 d5 f5)))
      (chrd-2 (make-chord '(d3 f3 a3 c4 ff4 g4))))
  (common-notes chrd-1 chrd-2 nil))
```

=> 2

```
;; By default, the same pitch class in different octaves is considered to be a
;; separate pitch
(let ((chrd-1 (make-chord '(c4 e4 g4 b4 d5 f5)))
      (chrd-2 (make-chord '(d3 f3 a3 ff4 g4 c5))))
  (common-notes chrd-1 chrd-2 t))
```

=> 2

```
;; Setting the second optional argument to T causes all pitches of the same
;; pitch class to be considered equal regardless of their octave
(let ((chrd-1 (make-chord '(c4 e4 g4 b4 d5 f5)))
      (chrd-2 (make-chord '(d3 f3 a3 ff4 g4 c5))))
  (common-notes chrd-1 chrd-2 t t))
```

=> 5

#### SYNOPSIS:

```
(defmethod common-notes ((c1 chord) (c2 chord)
                          &optional (enharmonics-are-equal t)
                          (octaves-are-true nil))
```

#### 20.2.164 chord/delete-marks

[ chord ] [ Methods ]

#### DESCRIPTION:

Delete all marks from the MARKS slot of the given chord object.

#### ARGUMENTS:

- A chord object.

#### RETURN VALUE:

Returns NIL.

#### EXAMPLE:

```

;;; Make a chord object, add two marks, and print the MARKS slot to see them;
;;; apply delete-marks and print the MARKS slot again to see the change
(let ((chrd (make-chord '(cs4 e4 fs4 af4 bf4))))
  (add-mark chrd 'fff)
  (add-mark chrd 'pizz)
  (print (marks chrd))
  (delete-marks chrd)
  (print (marks chrd)))

=>
(PIZZ FFF)
NIL

```

**SYNOPSIS:**

```
(defmethod delete-marks ((c chord))
```

**20.2.165 chord/get-midi-channel**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Get the MIDI channel of the first pitch object contained in a given chord object.

NB: This method returns only the midi-channel of the first pitch object in the chord object's data list.

**ARGUMENTS:**

- A chord object.

**RETURN VALUE:**

An integer.

**EXAMPLE:**

```

(let ((chrd (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (get-midi-channel chrd))

=> 11

```

**SYNOPSIS:**

```
(defmethod get-midi-channel ((c chord))
```

**20.2.166 chord/get-pitch**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Get the pitch object located at the specified index within the given chord object. The <ref> argument is 1-based.

**ARGUMENTS:**

- A chord object.
- An integer that is the index of the pitch object sought within the data list of the given chord object.

**RETURN VALUE:**

A pitch object.

**EXAMPLE:**

```
(let ((chrd (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (get-pitch chrd 3))
```

=>

```
PITCH: frequency: 403.482, midi-note: 67, midi-channel: 12
       pitch-bend: 0.5
       degree: 135, data-consistent: T, white-note: G4
       nearest-chromatic: G4
       src: 1.5422108173370361, src-ref-pitch: C4, score-note: GS4
       qtr-sharp: 1, qtr-flat: NIL, qtr-tone: 1,
       micro-tone: T,
       sharp: NIL, flat: NIL, natural: NIL,
       octave: 4, c5ths: 0, no-8ve: GQS, no-8ve-no-acc: G
       show-accidental: T, white-degree: 32,
       accidental: QS,
       accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: GQS4, tag: NIL,
data: GQS4
```

**SYNOPSIS:**

```
(defmethod get-pitch ((c chord) ref)
```

**20.2.167 chord/get-pitch-symbols**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Return the data of the pitch objects from a given chord object as a list of note-name symbols.

**ARGUMENTS:**

- A chord object.

**RETURN VALUE:**

A list of note-name symbols.

**EXAMPLE:**

```
(let ((chrd (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (get-pitch-symbols chrd))

=> (C4 E4 GQS4 BQF4 D5 F5)
```

**SYNOPSIS:**

```
(defmethod get-pitch-symbols ((c chord) &optional ignore)
```

**20.2.168 chord/has-notes**

```
[ chord ] [ Methods ]
```

**DATE:**

16-Aug-2010

**DESCRIPTION:**

Tests whether a given chord object contains at least one pitch object.

(make-chord nil) is a valid function call and creates a chord object with no notes.

#### ARGUMENTS:

- A chord object.

#### RETURN VALUE:

Returns T if the given chord object contains at least one pitch object, otherwise returns NIL.

#### EXAMPLE:

```
;; Returns T if the given chord object contains at least one pitch object
(let ((chrd (make-chord '(c4))))
  (has-notes chrd))
```

=> T

```
(let ((chrd (make-chord '(c4 e4 g4))))
  (has-notes chrd))
```

=> T

```
;; Otherwise returns NIL
(let ((chrd (make-chord nil)))
  (has-notes chrd))
```

=> NIL

#### SYNOPSIS:

```
(defmethod has-notes ((c chord))
```

#### 20.2.169 chord/highest

[ chord ] [ Methods ]

#### DESCRIPTION:

Return the pitch object from the given chord object that has the highest

pitch data.

NB: As opposed to the "lowest" method, this method cannot handle chord objects whose pitches have not been auto-sorted from low to high.

#### ARGUMENTS:

- A chord object.

#### RETURN VALUE:

A pitch object

#### EXAMPLE:

```
;; Returns the last pitch object of a chord object
(let ((chrd (make-chord '(e4 c4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12))))
  (highest chrd))

=>
PITCH: frequency: 698.456, midi-note: 77, midi-channel: 11
      pitch-bend: 0.0
      degree: 154, data-consistent: T, white-note: F5
      nearest-chromatic: F5
      src: 2.669679641723633, src-ref-pitch: C4, score-note: F5
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 5, c5ths: 0, no-8ve: F, no-8ve-no-acc: F
      show-accidental: T, white-degree: 38,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: F5, tag: NIL,
data: F5
```

```
;; Is not capable of returning the highest pitch object from chord objects that
;; have not been auto-sorted
(let ((chrd (make-chord '(e4 c4 gqs4 bqf4 f5 d5)
                        :midi-channel 11
                        :microtones-midi-channel 12
                        :auto-sort nil))))
  (data (highest chrd)))
```



=> D5

## SYNOPSIS:

```
(defmethod highest ((c chord))
```

### 20.2.170 chord/lowest

[ chord ] [ Methods ]

## DESCRIPTION:

Return the pitch object from the given chord object that has the lowest pitch data. The method can handle chord objects whose pitches have not been auto-sorted from low to high.

## ARGUMENTS:

- A chord object.

## RETURN VALUE:

A pitch object.

## EXAMPLE:

```
;; Returns the pitch object of the lowest pitch despite not being sorted
(let ((chrd (make-chord '(e4 c4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12
                        :auto-sort nil))))
  (lowest chrd))
```

=>

```
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 11
       pitch-bend: 0.0
       degree: 120, data-consistent: T, white-note: C4
       nearest-chromatic: C4
       src: 1.0, src-ref-pitch: C4, score-note: C4
       qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
       micro-tone: NIL,
       sharp: NIL, flat: NIL, natural: T,
       octave: 4, c5ths: 0, no-8ve: C, no-8ve-no-acc: C
       show-accidental: T, white-degree: 28,
```

```

    accidental: N,
    accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4

```

**SYNOPSIS:**

```
(defmethod lowest ((c chord))
```

**20.2.171 chord/make-chord**

```
[ chord ] [ Functions ]
```

**DESCRIPTION:**

Create a chord object from a list of note-name symbols.

**ARGUMENTS:**

- A list of note-name symbols.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. An element of any type that is to be the ID of the chord object created.
- :auto-sort. T or NIL to indicate whether the method should first sort the individual pitch objects created from low to high before returning the new chord object. T = sort. Default = T.
- :midi-channel. An integer that is to be the MIDI channel value to which all of the chromatic pitch objects in the given chord object are to be set for playback. Default = 1.
- :microtones-midi-channel. An integer that is to be the MIDI channel value to which all of the microtonal pitch objects in the given chord object are to be set for playback. Default = 1. NB: See `player.lsp/make-player` for details on microtones in MIDI output.
- :force-midi-channel. T or NIL to indicate whether to force a given value to the MIDI-CHANNEL slot, even if the notes passed to the method are already pitch objects with non-zero MIDI-CHANNEL values.

**RETURN VALUE:**

A chord object.

**EXAMPLE:**

```
;; Simple usage with default values for keyword arguments
(make-chord '(c4 e4 g4 b4 d5 f5))
```

```
=>
```

```
CHORD: auto-sort: T, marks: NIL, micro-tone: NIL
SCLIST: sclist-length: 6, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
PITCH: frequency: 329.628, midi-note: 64, midi-channel: 0
[...]
data: E4
[...]
PITCH: frequency: 391.995, midi-note: 67, midi-channel: 0
[...]
data: G4
[...]
PITCH: frequency: 493.883, midi-note: 71, midi-channel: 0
[...]
data: B4
[...]
PITCH: frequency: 587.330, midi-note: 74, midi-channel: 0
[...]
data: D5
[...]
PITCH: frequency: 698.456, midi-note: 77, midi-channel: 0
[...]
data: F5
)
```

```
;; By default the pitches are first sorted low to high
(let ((mc (make-chord '(e4 c4 g4 b4 f5 d5))))
  (loop for p in (data mc) collect (data p)))
```

```
=> (C4 E4 G4 B4 D5 F5)
```

```
;; Setting the :midi-channel and :microtones-midi-channel arguments results in
;; the MIDI-CHANNEL slot of each of the contained pitch objects being set
;; accordingly, depending on whether it is a chromatic or microtonal pitch
(let ((mc (make-chord '(cqs4 e4 gqf4 b4 dqf5 f5)
                      :midi-channel 11
```

```

                                :microtones-midi-channel 12)))
  (loop for p in (data mc) collect (midi-channel p)))

=> (12 11 12 11 12 11)

```

**SYNOPSIS:**

```

(defun make-chord (note-list &key (id nil) (auto-sort t) (midi-channel 1)
                  (microtones-midi-channel 1) (force-midi-channel t))

```

**20.2.172 chord/no-accidental**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Set the SHOW-ACCIDENTAL slot of all pitch objects within a given chord object to NIL. This results in no accidentals for the given chord being printed when written to a score, and also excludes the writing of any accidentals for that chord in parentheses.

**ARGUMENTS:**

- A chord object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```

;;; Make a chord, print the SHOW-ACCIDENTAL slots of the pitch objects it
;;; contains; then call the method and print the same slots again to see the
;;; change.

```

```

(let ((chrd (make-chord '(cs4 e4 fs4 af4 bf4))))
  (print (loop for p in (data chrd) collect (show-accidental p)))
  (no-accidental chrd)
  (print (loop for p in (data chrd) collect (show-accidental p))))

```

```

=>
(T T T T T)
(NIL NIL NIL NIL NIL)

```

**SYNOPSIS:**

```

(defmethod no-accidental ((c chord))

```

**20.2.173 chord/output-midi-note***[ chord ] [ Methods ]***DESCRIPTION:**

Generate the MIDI-related data for each pitch in a given chord object.

**ARGUMENTS:**

- A chord object.
- A number that is the start time in seconds of the given chord within the output MIDI file.
- A decimal number between 0.0 and 1.0 that is the amplitude of the given chord in the output MIDI file.
- A number that is the duration in seconds of the given chord in the output MIDI file.

**RETURN VALUE:**

The corresponding data in list form.

**EXAMPLE:**

```
;; Generate the MIDI-related data required for a 5-note chord that starts 100
;; seconds into the output MIDI file, with an amplitude of 0.5 and a duration
;; of 13.0 seconds.
(let ((chrd (make-chord '(cs4 e4 fs4 af4 bf4))))
  (output-midi-note chrd 100.0 0.5 13.0))

=> (#i(midi time 100.0 keynum 61 duration 13.0 amplitude 0.5 channel -1)
    #i(midi time 100.0 keynum 64 duration 13.0 amplitude 0.5 channel -1)
    #i(midi time 100.0 keynum 66 duration 13.0 amplitude 0.5 channel -1)
    #i(midi time 100.0 keynum 68 duration 13.0 amplitude 0.5 channel -1)
    #i(midi time 100.0 keynum 70 duration 13.0 amplitude 0.5 channel -1))
```

**SYNOPSIS:**

```
(defmethod output-midi-note ((c chord) time amplitude duration)
```

**20.2.174 chord/pitch-***[ chord ] [ Methods ]***DESCRIPTION:**

Determine the difference between the lowest pitch of two chords. This method can be used, for example, to compare the written and sounding versions of a chord to determine transposition.

If the lower chord is passed as the first argument, the method will return a negative number.

NB: This method takes pitch bend into consideration when calculating.

#### ARGUMENTS:

- A first chord object.
- A second chord object.

#### RETURN VALUE:

A positive or negative decimal number.

#### EXAMPLE:

```
;; The method measures the distance between the first (lowest) pitches of the
;;; chord only.
```

```
(let ((chrd-1 (make-chord '(c4 e4 g4)))
      (chrd-2 (make-chord '(d4 e4 fs4 a4))))
  (pitch- chrd-2 chrd-1))
```

```
=> 2.0
```

```
;;; Passing the lower chord as the first argument produces a negative result
```

```
(let ((chrd-1 (make-chord '(c4 e4 g4)))
      (chrd-2 (make-chord '(d4 e4 fs4 a4))))
  (pitch- chrd-1 chrd-2))
```

```
=> -2.0
```

#### SYNOPSIS:

```
(defmethod pitch- ((c1 chord) (c2 chord))
```

#### 20.2.175 chord/respell-chord

```
[ chord ] [ Methods ]
```

#### DESCRIPTION:

Respell the pitches of a given chord object to improve interval structure; i.e., removing augmented intervals etc.

This method respells pitches from the bottom of the chord upwards. It does not process the pitches downwards again once pitches has been changed. Instead, it reattempts the whole respelling with the enharmonic of the lowest pitch to determine which spelling produces the fewest accidentals.

NB: Respelling pitches in a chord is a rather complex process and is by no means fool-proof. The process employed here is based on avoiding double accidentals; thus, since both FS4 and BS4 have single sharps, the BS4 won't be changed to C5.

#### ARGUMENTS:

- A chord object.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to print feedback from the process to the listener. T = print. Default = NIL.

#### RETURN VALUE:

A chord object.

#### EXAMPLE:

```
(let ((chrd (make-chord '(a3 ds4 f4 fs5 c6))))
  (pitch-list-to-symbols (data (respell-chord chrd t))))
```

=> (A3 EF4 F4 GF5 C6)

#### SYNOPSIS:

```
(defmethod respell-chord ((c chord) &optional verbose)
```

#### 20.2.176 chord/rm-pitches

[ chord ] [ Methods ]

#### DESCRIPTION:

Remove the specified pitches from an existing chord object.

**ARGUMENTS:**

- A chord object.
- The pitches to remove from that object. These can be pitch objects or any data that can be passed to `make-pitch`, or indeed lists of these, as they will be flattened. NB: No warning/error will be signalled if the pitches to be removed are not actually in the chord.

**RETURN VALUE:**

- A chord object.

**EXAMPLE:**

```
(let ((ch (make-chord '(af3 bf3 c4 e4 g4 a4 b4 cs5 ds5 fs5))))
  (print (get-pitch-symbols ch))
  (rm-pitches ch 'bf3)
  (print (get-pitch-symbols ch))
  (rm-pitches ch 'af3 'a4 'b4)
  (print (get-pitch-symbols ch))
  (rm-pitches ch '(cs5 ds5 fs5))
  (print (get-pitch-symbols ch)))
```

=>

```
(AF3 BF3 C4 E4 G4 A4 B4 CS5 DS5 FS5)
(AF3 C4 E4 G4 A4 B4 CS5 DS5 FS5)
(C4 E4 G4 CS5 DS5 FS5)
(C4 E4 G4)
```

**SYNOPSIS:**

```
(defmethod rm-pitches ((c chord) &rest pitches)
```

**20.2.177 chord/set-midi-channel**

[ chord ] [ Methods ]

**DESCRIPTION:**

Set the MIDI channel of the pitch objects in a given chord object to the specified values.

**ARGUMENTS:**



- A chord object.
- An integer that is to be the MIDI channel for chromatic pitches in the given chord object.
- An integer that is to be the MIDI channel for microtonal pitches in the given chord object. NB: See `player.lsp/make-player` for details on microtones in MIDI output.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Returns NIL
(let ((chrd (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (set-midi-channel chrd 3 4))

=> NIL

;; Print the value of the MIDI slot for each of the pitch objects contained in
;; the chord object before and after setting
(let ((chrd (make-chord '(c4 e4 gqs4 bqf4 d5 f5)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (print (loop for p in (data chrd) collect (midi-channel p)))
  (set-midi-channel chrd 3 4)
  (print (loop for p in (data chrd) collect (midi-channel p))))

=>
(11 11 12 12 11 11)
(3 3 4 4 3 3)
```

**SYNOPSIS:**

```
(defmethod set-midi-channel ((c chord) midi-channel microtones-midi-channel)
```

**20.2.178 chord/sort-pitches**

```
[ chord ] [ Methods ]
```

**DESCRIPTION:**

Sort the pitch objects contained within a given chord object and return

them as a list of pitch objects.

As an optional argument, 'ascending or 'descending can be given to indicate whether to sort from low to high or high to low.

#### ARGUMENTS:

- A chord object.

#### OPTIONAL ARGUMENTS:

- The symbol 'ASCENDING or 'DESCENDING to indicate whether to sort the given pitch objects from low to high or high to low.  
Default = 'ASCENDING.

#### RETURN VALUE:

Returns a list of pitch objects.

#### EXAMPLE:

```
;; Apply the method with no optional argument (defaults to 'ASCENDING) and
;; collect and print the data of the pitch objects in the resulting list
(let ((chrd (make-chord '(d5 c4 gqs4 bqf5 f5 e4)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (print (loop for p in (sort-pitches chrd) collect (data p))))
```

```
=> (C4 E4 GQS4 D5 F5 BQF5)
```

```
;; Sort from high to low
(let ((chrd (make-chord '(d5 c4 gqs4 bqf5 f5 e4)
                        :midi-channel 11
                        :microtones-midi-channel 12)))
  (print (loop for p in (sort-pitches chrd 'descending) collect (data p))))
```

```
=> (BQF5 F5 D5 GQS4 E4 C4)
```

#### SYNOPSIS:

```
(defmethod sort-pitches ((c chord) &optional (order 'ascending))
```

#### 20.2.179 chord/transpose

```
[ chord ] [ Methods ]
```

#### DESCRIPTION:

Transpose the pitches of a given chord object by a specified number of semitones. The specified number can be positive or negative, and may contain a decimal segment for microtonal transposition. If passed a decimal number, the resulting note-names will be scaled to the nearest degree of the current tuning.

#### ARGUMENTS:

- A chord object.
- A positive or negative integer or decimal number indicating the number of semitones by which the pitches of the given chord object are to be transposed.

#### RETURN VALUE:

Returns a chord object.

#### EXAMPLE:

```
;; Returns a chord object
(let ((chrd (make-chord '(c4 e4 g4))))
  (transpose chrd 3))

=>
CHORD: auto-sort: T, marks: NIL, micro-tone: NIL
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
[...])

;; Accepts positive and negative integers and decimal numbers
(let ((chrd (make-chord '(c4 e4 g4))))
  (pitch-list-to-symbols (data (transpose chrd 3))))

=> (EF4 G4 BF4)

(let ((chrd (make-chord '(c4 e4 g4))))
  (pitch-list-to-symbols (data (transpose chrd -3))))

=> (A3 CS4 E4)

(let ((chrd (make-chord '(c4 e4 g4))))
  (pitch-list-to-symbols (data (transpose chrd -3.17))))
```

=> (AQF3 CQS4 EQF4)

## SYNOPSIS:

```
(defmethod transpose ((c chord) semitones &key ignore1 ignore2 ignore3)
```

### 20.2.180 sclist/circular-sclist

[ *sclist* ] [ *Classes* ]

#### NAME:

circular-sclist

File: circular-sclist.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the circular-sclist class which offers  
the use of a function to cycle through the values in the  
sclist, starting at the beginning again once we've  
reached the end.

Author: Michael Edwards: m@michael-edwards.org

Creation date: February 19th 2001

\$\$ Last modified: 18:14:29 Mon Oct 28 2013 GMT

SVN ID: \$Id: circular-sclist.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.181 circular-sclist/assoc-list

[ *circular-sclist* ] [ *Classes* ]

#### NAME:

assoc-list

File: assoc-list.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the assoc-list class that is somewhat  
like the lisp association list but with more  
error-checking.

Author: Michael Edwards: m@michael-edwards.org

Creation date: February 18th 2001

\$\$ Last modified: 15:03:30 Tue Dec 3 2013 GMT

SVN ID: \$Id: assoc-list.lsp 4341 2013-12-10 14:18:34Z medward2 \$

## 20.2.182 assoc-list/add

[ *assoc-list* ] [ *Methods* ]

### DESCRIPTION:

Add a new element to the given assoc-list object.

### ARGUMENTS:

- A key/data pair as a list, or a named-object.
- The assoc-list object to which it is to be added.

### OPTIONAL ARGUMENTS:

- (This optional argument will be ignored; it exists only because of its use in the recursive-assoc-list class).

### RETURN VALUE:

Returns T if the specified named-object is successfully added to the given assoc-list.

Returns an error if an attempt is made to add NIL to the given assoc-list or if the given named-object is already present in the given assoc-list.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (add '(makers mark) al))
```

=> T

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (add '(makers mark) al)
      (get-data 'makers al))
```

=>

```
NAMED-OBJECT: id: MAKERS, tag: NIL,
data: MARK
```

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (add '(makers mark) al)
      (get-position 'makers al))
```

=> 3

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (add '(knob creek) al))
```

=> T

**SYNOPSIS:**

```
(defmethod add (named-object (al assoc-list) &optional ignore)
```

**20.2.183 assoc-list/add-to-list-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Add an element of any type to the end of the data (list) associated with a

given key of a given assoc-list.

The data associated with the given key must already be a list.

#### ARGUMENTS:

- An item of any type.
- A given key that must be present in the given assoc-list.
- The given assoc-list.

#### RETURN VALUE:

Returns the whole named-object to which the new element was added.

This method will abort with an error if a key is sought which does not exist within the given assoc-list. For such cases, use `add-to-list-data-force` instead.

#### EXAMPLE:

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog (fido spot))
                                   (cow bessie)))))
  (add-to-list-data 'rover 'dog al))

=>
NAMED-OBJECT: id: DOG, tag: NIL,
data: (FIDO SPOT ROVER)
```

#### SYNOPSIS:

```
(defmethod add-to-list-data (new-element key (al assoc-list))
```

#### 20.2.184 assoc-list/add-to-list-data-force

[ *assoc-list* ] [ *Methods* ]

#### DESCRIPTION:

Similar to `add-to-list-data`, but if the given key doesn't already exist in the given assoc-list, it is first added, then the given new element is added to that as a 1-element list.

If the given key already exists within the given assoc-list, its data must already be in the form of a list.

**ARGUMENTS:**

- A (new) element of any type.
- A given key that may or may not be present in the given assoc-list.
- The the given assoc-list.

**RETURN VALUE:**

Returns the whole named-object to which the element was added when used with a key that already exists within the given assoc-list.

Returns T when used with a key that does not already exist in the given assoc-list.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog (fido spot))
                                   (cow bessie)))))
  (add-to-list-data-force 'rover 'dog al))
```

=>

```
NAMED-OBJECT: id: DOG, tag: NIL,
data: (FIDO SPOT ROVER)
```

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog (fido spot))
                                   (cow bessie)))))
  (add-to-list-data-force 'wilbur 'pig al)
  (get-keys al))
```

=> (CAT DOG COW PIG)

**SYNOPSIS:**

```
(defmethod add-to-list-data-force (new-element key (al assoc-list))
```

**20.2.185 assoc-list/get-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Return the named-object (id, tag and data) that is identified by a specified key within a given assoc-list.



NB: This method returns the named object itself, not just the data associated with the key (use `get-data-data` for that).

#### ARGUMENTS:

- A symbol that is the key (id) of the named-object sought.
- The assoc-list object in which it is be sought.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether a warning is printed if the specified key cannot be found within the given assoc-list. T = print. Default = T. Mostly we define whether we want to warn in the instance itself, but sometimes it would be good to warn or not on a call basis, hence the optional argument.

#### RETURN VALUE:

A named-object is returned if the specified key is found within the given assoc-list object.

NIL is returned and a warning is printed if the specified key is not found in the given assoc-list object.

#### EXAMPLE:

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
  (get-data 'four al))
```

=>

```
NAMED-OBJECT: id: FOUR, tag: NIL,
data: ROSES
```

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
  (get-data 'jack al))
```

=> NIL

WARNING:

```
assoc-list::get-data: Could not find data with key JACK in assoc-list with
id TEST
```

```

(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))

  (get-data 'jack al t))

=> NIL
WARNING:
  assoc-list::get-data: Could not find data with key JACK in assoc-list with
  id TEST

(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))

  (get-data 'jack al nil))

=> NIL

```

**SYNOPSIS:**

```
(defmethod get-data (key (al assoc-list) &optional (warn t))
```

**20.2.186 assoc-list/get-data-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

(Short-cut for (data (get-data ...))  
 Get the data associated with the given key of the given assoc-list.

**ARGUMENTS:**

- The assoc-list key symbol associated with the data list which is sought.
- The assoc-list in which it is to be sought.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to print a warning if no such named-object can be found within the given assoc-list (default = T).

**RETURN VALUE:**

If the given key is found within the given assoc-list, the data associated with that key is returned.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (get-data-data 'jim al))
```

=> BEAM

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
      (get-data-data 'jack al))
```

=> NIL

**WARNING:**

```
assoc-list::get-data: Could not find data with key JACK in assoc-list with
id TEST
```

**SYNOPSIS:**

```
(defmethod get-data-data (key (al assoc-list) &optional (warn t))
```

**20.2.187 assoc-list/get-first**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Returns the first named-object in the DATA slot of the given assoc-list object.

**ARGUMENTS:**

- An assoc-list object.

**RETURN VALUE:**

A named-object that is the first object in the DATA slot of the given assoc-list object.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
```

```

                                (wild turkey))))))
    (get-first al))

=>
NAMED-OBJECT: id: JIM, tag: NIL,
data BEAM

```

**SYNOPSIS:**

```
(defmethod get-first ((al assoc-list))
```

**20.2.188 assoc-list/get-keys**

```
[ assoc-list ] [ Methods ]
```

**DESCRIPTION:**

Get a simple list of the keys in a given association list.

**ARGUMENTS:**

- An assoc-list.

**OPTIONAL ARGUMENTS:**

- Optional argument: T or NIL (default T) to indicate whether a warning should be printed when the first argument is a recursive assoc-list.

**RETURN VALUE:**

A list of the keys only of all top-level association list pairs in the given assoc-list.

get-keys is a method of the assoc-list class and therefore returns only top-level keys if accessing a recursive assoc-list.

**EXAMPLE:**

```

(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog fido)
                                   (cow bessie)))))

    (get-keys al))

=> (CAT DOG COW)

```

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog ((scottish terrier)
                                           (german shepherd)
                                           (irish wolfhound)))
                                   (cow bessie)))))

  (get-keys al))

=> (CAT DOG COW)
```

**SYNOPSIS:**

```
(defmethod get-keys ((al assoc-list) &optional (warn t))
```

**20.2.189 assoc-list/get-last**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Returns the last named-object in the data list of a given assoc-list.

**ARGUMENTS:**

- An assoc-list.

**RETURN VALUE:**

The last object in the data list of a given assoc-list.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))

  (get-last al))

=>
NAMED-OBJECT: id: WILD, tag: NIL,
data TURKEY
```

**SYNOPSIS:**

```
(defmethod get-last ((al assoc-list))
```

**20.2.190 assoc-list/get-position***[ assoc-list ] [ Methods ]***DESCRIPTION:**

Returns the index position (zero-based) of a named-object within a given assoc-list.

**ARGUMENTS:**

- The assoc-list key symbol (named-object id) of the object for which the position is sought.
- The assoc-list in which it is to be sought.

**OPTIONAL ARGUMENTS:**

- Optional argument: An indexing integer. In this case, get-position will search for the given object starting part-way into the list, skipping all objects located at indices lower than the given integer (default = 0).

**RETURN VALUE:**

The integer index of the named-object within the given assoc-list.

NIL is returned if the object is not present in the assoc-list starting with the index number given as the start argument (i.e., in the entire list if the optional start argument is omitted).

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
```

```
(get-position 'four al))
```

```
=> 1
```

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))
```

```
(get-position 'jack al))
```

```
=> NIL
```

```
(let ((al (make-assoc-list 'test '((jim beam)
                                   (four roses)
                                   (wild turkey)))))

  (get-position 'jim al 1))

=> NIL
```

**SYNOPSIS:**

```
(defmethod get-position (key (al assoc-list) &optional (start 0))
```

**20.2.191 assoc-list/l-for-lookup**

```
[ assoc-list ] [ Classes ]
```

**NAME:**

l-for-lookup

File: l-for-lookup

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> l-for-lookup

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the l-for-lookup class. The name stands for L-System for Lookups (L for Lindenmayer). This provides an L-System function for generating sequences of numbers from rules and seeds, and then using these numbers for lookups into the assoc-list. In the assoc list are stored groups of numbers, meant to represent in the first place, for example, rhythmic sequences. The grouping could be as follows: ((2 3 7) (11 12 16) (24 27 29) and would mean that a transition should take place (over the length of the number of calls represented by the number of L-Sequence results) from the first group to the second, then from the second to the third. When the first group is in use, then we will simple cycle around the given values, similar with the other groups.

The transition is based on a fibonacci algorithm  
(see below).

The sequences are stored in the data slot. The l-sequence  
will be a list like (3 1 1 2 1 2 2 3 1 2 2 3 2 3 3 1).  
These are the references into the assoc-list (the 1, 2, 3  
ids in the list below).

e.g. ((1 ((2 3 7) (11 16 12)))  
      (2 ((4 5 9) (13 14 17)))  
      (3 ((1 6 8) (15 18 19))))

Author: Michael Edwards: m@michael-edwards.org

Creation date: 15th February 2002

\$\$ Last modified: 12:23:28 Thu Jun 13 2013 BST

SVN ID: \$Id: l-for-lookup.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.192 l-for-lookup/count-elements

[ l-for-lookup ] [ Functions ]

#### DESCRIPTION:

Count the number of times each element occurs in a given list.

#### ARGUMENTS:

- A list of numbers or symbols (or anything which can be compared using EQL).

#### RETURN VALUE:

Returns a list of two-element lists, each consisting of one list  
element from the specified list and the number of times that element occurs  
in the list. If the elements are numbers, these will be sorted from low to  
high, otherwise symbols will be returned from most populous to least.

#### EXAMPLE:

```
(count-elements '(1 4 5 7 3 4 1 5 4 8 5 7 3 2 3 6 3 4 5 4 1 4 8 5 7 3 2))
```

```
=> ((1 3) (2 2) (3 5) (4 6) (5 5) (6 1) (7 3) (8 2))
```



**SYNOPSIS:**

```
(defun count-elements (list)
```

**20.2.193 l-for-lookup/do-lookup**

```
[ l-for-lookup ] [ Methods ]
```

**DESCRIPTION:**

Generate an L-sequence from the rules of the specified l-for-lookup object and use it to perform the Fibonacci-based transitioning look-up of values in the specified sequences.

**ARGUMENTS:**

- An l-for-lookup object.
- The start seed, or axiom, that is the initial state of the L-system. This must be the key-id of one of the sequences.
- An integer that is the length of the sequence to be returned. NB: This number does not indicate the number of L-system passes, but only the number of elements in the list returned, which may be the first segment of a sequence returned by a pass that actually generates a much longer sequence.

**OPTIONAL ARGUMENTS:**

- A number which is the factor by which returned numerical values are to be scaled. If NIL, the method will use the value in the given l-for-lookup object's SCALER slot instead. Default = NIL. NB: The value of the given l-for-lookup object's OFFSET slot is additionally used to increase numerical values before they are returned.

**RETURN VALUE:**

This method returns three lists:

- The resulting sequence.
- The distribution of the values returned by the look-up.
- The L-sequence of the key-IDs.

**EXAMPLE:**

```
;; Create an l-for-lookup object in which the sequences are defined such that
;; the transition takes place over the 3 given lists and from x to y to z, and
;; apply the do-lookup method to see the results. Each time one of these lists
```

;; is accessed, it will cyclically return the next value.

```
(let ((lfl (make-l-for-lookup
  'lfl-test
  '((1 ((ax1 ax2 ax3) (ay1 ay2 ay3 ay4) (az1 az2 az3 az4 az5)))
    (2 ((bx1 bx2 bx3) (by1 by2 by3 by4) (bz1 bz2 bz3 bz4 bz5)))
    (3 ((cx1 cx2 cx3) (cy2 cy2 cy3 cy4) (cz1 cz2 cz3 cz4 cz5))))))
  '((1 (1 2 2 2 1 1))
    (2 (2 1 2 3 2))
    (3 (2 3 2 2 2 3 3)))))
  (do-lookup lfl 1 211))
```

=>

```
(AX1 BX1 BX2 BX3 AX2 AX3 BX1 AX1 BX2 CX1 BX3 BX1 AX2 BX2 CX2 BX3 BX1 AX3 BX2
  CX3 BX3 AX1 BY1 BX1 BX2 AY1 AX2 AX3 BX3 BX1 BX2 AX1 AX2 BX3 AY2 BX1 CX1
  BY2 AX3 BX2 BX3 BX1 AX1 AY3 BX2 AX2 BY3 CY2 BX3 BX1 CX2 BY4 BX2 BX3 CX3
  CY2 BY1 AY4 BX1 CX1 BY2 BX2 AY1 BY3 CY3 BY4 AX3 BX3 BY1 BX1 AY2 AX1 BY2
  AY3 BY3 CY4 BX2 BY4 CX2 BY1 BX3 BY2 CY2 CX3 BY3 AY4 BY4 CY2 BY1 BX1 AX2
  BY2 CY3 BY3 AY1 BY4 BY1 BY2 AY2 AY3 BY3 AY4 BY4 CY4 BY1 BY2 CY2 BY3 BY4
  BY1 CY2 CY3 BY2 AY1 BY3 CY4 BY4 AY2 BY1 BY2 BY3 AY3 AY4 BY4 AY1 BY1 CZ1
  BZ1 BY2 AY2 BY3 CY2 BY4 BY1 AY3 BY2 CY2 BY3 AY4 BY4 BZ2 BY1 AZ1 AY1 AY2
  BY2 BY3 BY4 AY3 AY4 AZ2 BZ3 BY1 BY2 AY1 AY2 BZ4 AZ3 BY3 CZ2 BY4 BZ5 AY3
  BY1 CY3 BZ1 BY2 AZ4 BZ2 CZ3 BZ3 AZ5 BY3 BZ4 BY4 AY4 AZ1 AY1 BZ5 BZ1 BY1
  AZ2 AZ3 BZ2 AY2 BZ3 CY4 BY2 AZ4 BZ4 BZ5 BZ1 AZ5 AZ1 BZ2 AZ2 BY3 CZ4 BZ3
  BZ4 CY2 BZ5 BZ1 BZ2 CZ5 CZ1 BZ3 AZ3 BZ4 CZ2 BZ5),
  ((CX1 3) (AX3 5) (AX1 6) (BX2 11) (CX2 3) (BX3 11) (CX3 3) (BX1 12) (AX2 6)
  (AY3 7) (CY3 4) (CZ3 1) (BY4 14) (AY4 7) (AY1 8) (BY1 15) (AY2 8) (CY4 4)
  (BY2 15) (AZ4 2) (AZ5 2) (AZ1 3) (AZ2 3) (BY3 15) (CY4 1) (CY2 9) (BZ1 5)
  (BZ25) (CZ5 1) (CZ1 2) (BZ3 5) (AZ3 3) (BZ4 5) (CZ2 2) (BZ5 5)),
  (1 2 2 2 1 1 2 1 2 3 2 2 1 2 3 2 2 1 2 3 2 1 2 2 2 1 1 1 2 2 2 1 1 2 1 2 3 2 1
    2 2 2 1 1 2 1 2 3 2 2 3 2 2 2 3 3 2 1 2 3 2 2 1 2 3 2 1 2 2 2 1 1 2 2 2 1 1 2 1 2 3 2
    2 3 2 2 2 3 3 2 1 2 3 2 2 1 2 3 2 1 2 2 2 1 1 2 1 2 3 2 2 3 2 2 2 3 3 2 1 2
    3 2 1 2 2 2 1 1 2 1 2 3 2 2 1 2 3 2 2 1 2 3 2 1 2 2 2 1 1 1 2 2 2 1 1 1 2 2
    2 1 1 2 1 2 3 2 2 1 2 3 2 2 1 2 3 2 1 2 2 2 1 1 1 2 2 2 1 1 2 1 2 3 2 1 2 2
    2 1 1 2 1 2 3 2 2 3 2 2 2 3 3 2 1 2 3 2))
```

## SYNOPSIS:

```
(defmethod do-lookup ((lflu l-for-lookup) seed stop &optional scaler)
```

### 20.2.194 l-for-lookup/do-lookup-linear

[ l-for-lookup ] [ Methods ]

## DESCRIPTION:

Similar to do-lookup but here we generate a linear sequence (with

get-linear-sequence) instead of an L-System.

#### ARGUMENTS:

- An l-for-lookup object.
- The start seed, or axiom, that is the initial state of the linear system. This must be the key-id of one of the sequences.
- An integer that is the length of the sequence to be returned.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :scaler. A number which is the factor by which returned numerical values are to be scaled. If NIL, the method will use the value in the given l-for-lookup object's SCALER slot instead. Default = NIL. NB: The value of the given l-for-lookup object's OFFSET slot is additionally used to increase numerical values before they are returned. Default = NIL.
- :reset. T or NIL to indicate whether to reset the pointers of the given circular lists before proceeding. T = reset. Default = T.

#### RETURN VALUE:

This method returns three lists:

- The resulting sequence.
- The distribution of the values returned by the look-up.
- The L-sequence of the key-IDs.

#### EXAMPLE:

;; This will return the result of lookup, the number of repetitions of each  
;; rule key in the result of lookup, and the linear-sequence itself.

```
(let* ((tune (make-l-for-lookup
      'tune
      '((1 ((2 1 8)))
        (2 ((3 4)))
        (3 ((4 5)))
        (4 ((5 1 6)))
        (5 ((6 5 7 4)))
        (6 ((4 5)))
        (7 ((4 5 1)))
        (8 ((1))))
      '((1 (1 2)) (2 (1 3 2)) (3 (1 4 3)) (4 (1 2 1)) (5 (5 3 1))
        (6 (2 5 6)) (7 (5 6 4)) (8 (3 2))))))
  (do-lookup-linear tune 1 100))
=>
```

```

(1 3 4 1 4 4 6 8 2 1 1 4 5 5 6 5 1 1 7 6 8 2 1 1 3 5 4 4 5 5 6 5 4 7 1 4 4 6 8
 2 1 1 4 5 5 6 5 5 8 2 1 1 3 4 1 7 6 8 2 1 1 4 5 4 1 4 5 6 5 1 6 8 2 1 1 3 5 7
 5 4 1 4 5 6 5 4 7 6 8 2 1 1 4 5 4 1 4 5 6 5)
((1 24) (2 7) (3 4) (4 20) (5 21) (6 12) (7 5) (8 7))
(1 2 3 4 5 6 4 1 1 8 1 2 4 6 5 5 7 4 5 4 1 1 8 1 2 3 5 6 4 6 5 5 7 5 4 5 6 4 1
 1 8 1 2 4 6 5 5 7 1 1 8 1 2 3 4 5 4 1 1 8 1 2 4 6 4 5 6 5 5 7 4 1 1 8 1 2 3 5
 4 6 4 5 6 5 5 7 5 4 1 1 8 1 2 4 6 4 5 6 5 5)

```

**SYNOPSIS:**

```

(defmethod do-lookup-linear ((lflu l-for-lookup) seed stop
                             &key scaler (reset t))

```

**20.2.195 l-for-lookup/do-simple-lookup**

[ *l-for-lookup* ] [ *Methods* ]

**DESCRIPTION:**

Performs a simple look-up procedure whereby a given reference key always returns a specific and single piece of data. This is different from `do-lookup`, which performs a transitioning between lists and returns items from those lists in a circular manner. `do-simple-lookup` always returns the first element of the sequence list associated with a given key-ID.

N.B. the SCALER and OFFSET slots are ignored by this method.

**ARGUMENTS:**

- An `l-for-lookup` object.
- The start seed, or axiom, that is the initial state of the L-system. This must be the key-id of one of the sequences.
- An integer that is the number of elements to be returned.

**RETURN VALUE: EXAMPLE:**

```

;; Create an l-for-lookup object using three production rules and three
;; sequences of three lists. Applying do-simple-lookup returns the first
;; element of each sequence based on the L-sequence of keys created by the
;; rules of the give l-for-lookup object.
(let ((lfl (make-l-for-lookup
          'lfl-test
          '((1 ((ax1 ax2 ax3) (ay1 ay2 ay3 ay4) (az1 az2 az3 az4 az5)))
              (2 ((bx1 bx2 bx3) (by1 by2 by3 by4) (bz1 bz2 bz3 bz4 bz5)))
              (3 ((cx1 cx2 cx3) (cy2 cy2 cy3 cy4) (cz1 cz2 cz3 cz4 cz5))))))

```

```

      '((1 (1 2 2 2 1 1))
        (2 (2 1 2 3 2))
         (3 (2 3 2 2 2 3 3))))))
(do-simple-lookup lfl 1 21))

=> ((AX1 AX2 AX3) (BX1 BX2 BX3) (BX1 BX2 BX3) (BX1 BX2 BX3) (AX1 AX2 AX3)
    (AX1 AX2 AX3) (BX1 BX2 BX3) (AX1 AX2 AX3) (BX1 BX2 BX3) (CX1 CX2 CX3)
    (BX1 BX2 BX3) (BX1 BX2 BX3) (AX1 AX2 AX3) (BX1 BX2 BX3) (CX1 CX2 CX3)
    (BX1 BX2 BX3) (BX1 BX2 BX3) (AX1 AX2 AX3) (BX1 BX2 BX3) (CX1 CX2 CX3)
    (BX1 BX2 BX3))

```

**SYNOPSIS:**

```
(defmethod do-simple-lookup ((lflu l-for-lookup) seed stop)
```

**20.2.196 l-for-lookup/fibonacci**

[ *l-for-lookup* ] [ *Functions* ]

**DESCRIPTION:**

Return the longest possible list of sequential Fibonacci numbers whose combined sum is less than or equal to the specified value. The list is returned in descending sequential order, ending with 0.

The function also returns as a second individual value the first Fibonacci number that is greater than the sum of the list returned.

NB: The value of the second number returned will always be equal to the sum of the list plus one. In most cases that number will be less than the number specified as the argument to the fibonacci function, and sometimes it will be equal to the number specified; but in cases where the sum of the list returned is equal to the number specified, the second number returned will be equal to the specified number plus one.

**ARGUMENTS:**

A number that is to be the test number.

**RETURN VALUE:**

A list of descending sequential Fibonacci numbers, of which list the last element is 0.

Also returns as a second individual value the first Fibonacci number that

is greater than the sum of the list returned, which will always be the sum of that list plus one.

#### EXAMPLE:

```
;; Returns a list of consecutive Fibonacci numbers from 0 whose sum is equal to
;; or less than the value specified. The second number returned is the first
;; Fibonacci number whose value is greater than the sum of the list, and will
;; always be the sum of the list plus one.
(fibonacci 5000)
```

```
=> (1597 987 610 377 233 144 89 55 34 21 13 8 5 3 2 1 1 0), 4181
```

```
;; The sum of the list
(+ 1597 987 610 377 233 144 89 55 34 21 13 8 5 3 2 1 1 0)
```

```
=> 4180
```

#### SYNOPSIS:

```
(defun fibonacci (max-sum)
```

#### 20.2.197 l-for-lookup/fibonacci-start-at-2

[ *l-for-lookup* ] [ *Functions* ]

#### DESCRIPTION:

Return the longest possible list of sequential Fibonacci numbers, excluding 0 and 1, whose combined sum is less than or equal to the specified value. The list is returned in descending sequential order.

The function also returns as a second value the sum of the list.

NB: In addition to excluding 0 and 1, this function also differs from the plain fibonacci function in that the second value returned is the sum of the list rather than the first Fibonacci number greater than that sum.

#### ARGUMENTS:

A number that is to be the test number.

#### RETURN VALUE:

A list of descending sequential Fibonacci numbers, of which list the last element is 2.

Also returns as a second result the sum of the list.

#### EXAMPLE:

```
;; Returns a list whose sum is less than or equal to the number specified as
;; the function's only argument
(fibonacci-start-at-2 17)
```

```
=> (5 3 2), 10
```

```
(fibonacci-start-at-2 20)
```

```
=> (8 5 3 2), 18
```

```
;; Two examples showing the different results of fibonacci
;; vs. fibonacci-start-at-2
```

```
;; 1
(fibonacci 18)
```

```
=> (5 3 2 1 1 0), 13
```

```
(fibonacci-start-at-2 18)
```

```
=> (8 5 3 2), 18
```

```
;; 2
(fibonacci 20)
```

```
=> (8 5 3 2 1 1 0), 21
```

```
(fibonacci-start-at-2 20)
```

```
=> (8 5 3 2), 18
```

#### SYNOPSIS:

```
(defun fibonacci-start-at-2 (max-sum)
```

#### 20.2.198 l-for-lookup/fibonacci-transition

[ *l-for-lookup* ] [ *Functions* ]

**DESCRIPTION:**

Uses Fibonacci relationships to produces a sequence that is a gradual transition from one repeating state to a second over n repetitions. The function gradually increases the frequency of the second repeating state until it completely dominates.

NB: The similar but separate function `fibonacci-transition-aux1` gradually decreases state 1 and increases state 2.

**ARGUMENTS:**

- An integer that is the desired number of elements in the resulting list (i.e., the number of repetitions over which the transition is to occur).

**OPTIONAL ARGUMENTS:**

- Repeating item 1 (starting state). This can be any Lisp type, including lists. Default = 0.
- Repeating item 2 (target state): This can also be any Lisp type. Default = 1.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; Defaults to 0 and 1 (no optional arguments)
(fibonacci-transition 31)
```

```
=> (0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 0 1 1 1 0 1 0 1 1 0 1 1 1 1 1)
```

```
;; Using optional arguments set to numbers
(fibonacci-transition 23 11 37)
```

```
=> (11 11 11 11 37 11 11 37 11 37 11 37 11 37 37 11 37 11 37 11 37 37 37)
```

```
;; Using lists
(fibonacci-transition 27 '(1 2 3) '(5 6 7))
```

```
=> ((1 2 3) (1 2 3) (1 2 3) (1 2 3) (5 6 7) (1 2 3) (1 2 3) (5 6 7) (1 2 3)
      (1 2 3) (5 6 7) (1 2 3) (5 6 7) (1 2 3) (5 6 7) (1 2 3) (5 6 7) (5 6 7)
      (1 2 3) (5 6 7) (5 6 7) (1 2 3) (5 6 7) (5 6 7) (5 6 7) (5 6 7) (5 6 7))
```

**SYNOPSIS:**



```
(defun fibonacci-transition (num-items &optional
                             (item1 0)
                             (item2 1))
```

### 20.2.199 l-for-lookup/fibonacci-transitions

[ *l-for-lookup* ] [ *Functions* ]

#### DATE:

18 Feb 2010

#### DESCRIPTION:

This function builds on the concept of the function `fibonacci-transition` by allowing multiple consecutive transitions over a specified number of repetitions. The function either produces sequences consisting of transitions from each consecutive increasing number to its upper neighbor, starting from 0 and continuing through a specified number of integers, or it can be used to produce a sequence by transitioning between each element of a user-specified list of items.

#### ARGUMENTS:

- An integer indicating the number of repetitions over which the transitions are to be performed.
- Either:
  - An integer indicating the number of consecutive values, starting from 0, the function is to transition (i.e. 3 will produce a sequence that transitions from 0 to 1, then from 1 to 2 and finally from 2 to 3), or
  - A list of items of any type (including lists) through which the function is to transition.

#### RETURN VALUE:

A list.

#### EXAMPLE:

```
;; Using just an integer transitions from 0 to 1 below that integer
(fibonacci-transitions 76 4)
```

```
=> (0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 1 0 1 0 1 1 0 1 1 1 1 1 1 2 1 1 2 1 2 1
    2 2 1 2 1 2 2 2 2 2 2 2 3 2 2 3 2 3 2 3 3 2 3 2 3 3 3 2 3 3 3 3 3 3 3 3 3)
```

```
;; Using a list transitions consecutively through that list
(fibonacci-transitions 152 '(1 2 3 4))

=> (1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 2 1 1 1 1 2 1 1 2 1 1 2 1 2
    2 1 2 1 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 3 2 2 2 2 3 2 2 3 2 2 3 2 3 2 3
    3 2 3 2 3 3 2 3 3 2 3 3 3 3 3 3 3 3 3 3 3 3 4 3 3 3 3 4 3 3 4 3 3 4 3 4 3 4
    4 3 4 3 4 4 3 4 4 3 4 4 4 4 4 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4)
```

```
;; A list of lists is also viable
(fibonacci-transitions 45 '((1 2 3) (4 5 4) (3 2 1)))

=> ((1 2 3) (1 2 3) (1 2 3) (1 2 3) (1 2 3) (4 5 4) (1 2 3) (1 2 3) (4 5 4)
    (1 2 3) (4 5 4) (1 2 3) (4 5 4) (1 2 3) (4 5 4) (1 2 3) (4 5 4) (1 2 3)
    (4 5 4) (4 5 4) (4 5 4) (4 5 4) (4 5 4) (3 2 1) (4 5 4) (3 2 1) (4 5 4)
    (3 2 1) (4 5 4) (3 2 1) (4 5 4) (3 2 1) (4 5 4) (3 2 1) (3 2 1) (3 2 1)
    (4 5 4) (3 2 1) (3 2 1) (3 2 1) (3 2 1) (3 2 1) (3 2 1) (3 2 1) (3 2 1))
```

**SYNOPSIS:**

```
(defun fibonacci-transitions (total-items levels)
```

**20.2.200 l-for-lookup/get-l-sequence**

```
[ l-for-lookup ] [ Methods ]
```

**DESCRIPTION:**

Return an L-sequence of the key-ids for the rules of a given l-for-lookup object, created using the rules of that object. This method can be called with an l-for-lookup object that contains no sequences, as it only returns a list of the key-ids for the object's rules.

Tip: It seems that systems where one rule key yields all other keys as a result makes for evenly distributed results which are different for each seed.

**ARGUMENTS:**

- An l-for-lookup object.
- The start seed, or axiom, that is the initial state of the L-system. This must be the key-id of one of the sequences.
- An integer that is the length of the sequence to be returned. NB: This number does not indicate the number of L-system passes, but only the number of elements in the list returned, which may be the first segment of a sequence returned by a pass that actually generates a much longer sequence.

**RETURN VALUE:**

A list that is the L-sequence of rule key-ids.

The second value returned is a count of each of the rule keys in the sequence created, in their given order.

**EXAMPLE:**

```
;; Create an l-for-lookup object with three rules and generate a new sequence
;; of 29 rule keys from those rules. The l-for-lookup object here has been
;; created with the SEQUENCES argument set to NIL, as the get-l-sequence
;; method requires no sequences. The second list returned indicates the
;; number of times each key appears in the resulting sequence (thus 1 appears 5
;; times, 2 appears 12 times etc.)
```

```
(let ((lfl (make-l-for-lookup 'lfl-test
                             NIL
                             '((1 (2))
                                (2 (1 3))
                                (3 (3 2))))))
```

```
  (get-l-sequence lfl 1 29))
```

```
=> (2 3 2 3 2 1 3 2 3 2 3 2 1 3 2 3 2 1 3 3 2 1 3 2 3 2 3 2 1), (5 12 12)
```

```
;; A similar example using symbols rather than numbers as keys and data
```

```
(let ((lfl (make-l-for-lookup 'lfl-test
                             NIL
                             '((a (b))
                                (b (a c))
                                (c (c b))))))
```

```
  (get-l-sequence lfl 'a 19))
```

```
=> (A C C B A C C B A C B C B A C C B A C), (5 5 9)
```

**SYNOPSIS:**

```
(defmethod get-l-sequence ((lflu l-for-lookup) seed stop-length)
```

**20.2.201 l-for-lookup/get-linear-sequence**

```
[ l-for-lookup ] [ Methods ]
```

**DESCRIPTION:**

Instead of creating L-sequences with specified rules, use the given



**20.2.202 l-for-lookup/make-l-for-lookup***[ l-for-lookup ] [ Functions ]***DESCRIPTION:**

Create an l-for-lookup object. The l-for-lookup object uses techniques associated with Lindenmayer-systems (or L-systems) by storing a series of rules about how to produce new, self-referential sequences from the data of original, shorter sequences.

NB: This method just stores the data concerning sequences and rules. To manipulate the data and create new sequences, see do-lookup or get-l-sequence etc.

**ARGUMENTS:**

- A symbol that will be the object's ID.
- A sequence (list) or list of sequences, that serve(s) as the initial material, from which the new sequence is to be produced.
- A production rule or list of production rules, each consisting of a predecessor and a successor, defining how to expand and replace the individual predecessor items.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :auto-check-redundancy. Default = NIL.
- :scaler. Factor by which to scale the values returned by do-lookup. Default = 1. Does not modify the original data.
- :offset. Number to be added to values returned by do-lookup (after they are scaled). Default = NIL. Does not modify the original data.

**RETURN VALUE:**

Returns an l-for-lookup object.

**EXAMPLE:**

```
;; Create an l-for-lookup object based on the Lindenmayer rules (A->AB) and
;; (B->A), using the defaults for the keyword arguments
(make-l-for-lookup 'l-sys-a
  '((1 ((a)))
    (2 ((b))))
  '((1 (1 2)) (2 (1))))
```

```
=>
L-FOR-LOOKUP:
[...]
    l-sequence: NIL
    l-distribution: NIL
    ll-distribution: NIL
    group-indices: NIL
    scaler: 1
    offset: 0
    auto-check-redundancy: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: L-SYS-A, tag: NIL,
data: (
[...]

;; A larger list of sequences, with keyword arguments specified
(make-l-for-lookup 'lfl-test
    '((1 ((2 3 4) (5 6 7)))
      (2 ((3 4 5) (6 7 8)))
      (3 ((4 5 6) (7 8 9))))
    '((1 (3)) (2 (3 1)) (3 (1 2)))
    :scaler 1
    :offset 0
    :auto-check-redundancy nil)
```

**SYNOPSIS:**

```
(defun make-l-for-lookup (id sequences rules &key (auto-check-redundancy nil)
                        (offset 0)
                        (scaler 1))
```

**20.2.203 l-for-lookup/remix-in**

[ *l-for-lookup* ] [ *Functions* ]

**DESCRIPTION:**

Given a list (for example generated by fibonacci-transitions) where we proceed sequentially through adjacent elements, begin occasionally mixing earlier elements of the list back into the original list once we've reached the third unique element in the original list.

The earlier elements are mixed back in sequentially (the list is mixed back into itself), starting at the beginning of the original list, and inserted at automatically selected positions within the original list.

This process results in a longer list than the original, as earlier elements are spliced in, without removing the original elements and their order. If however the `:replace` keyword is set to T, then at the selected positions those original elements will be replaced by the earlier elements. This could of course disturb the appearance of particular results and patterns.

The `:remix-in-fib-seed` argument determines how often an earlier element is re-inserted into the original list. The lower the number, the more often an earlier element is mixed back in. A value of 1 or 2 will result in each earlier element being inserted after every element of the original (once the third element of the original has been reached).

NB: The affects of this method are less evident on short lists.

#### ARGUMENTS:

- A list.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- `:remix-in-fib-seed`. A number that indicates how frequently an earlier element will be mixed back into the original list. The higher the number, the less often earlier elements are remixed in. Default = 13.
- `:mirror`. T or NIL to indicate whether the method should pass backwards through the original list once it has reached the end. T = pass backwards. Default = NIL.
- `:test`. The function used to determine the third element in the list. This function must be able to compare whatever data type is in the list. Default = `#'eq`.
- `:replace`. If T, retain the original length of the list by replacing items rather than splicing them in (see above). Default = NIL.

#### RETURN VALUE:

Returns a new list.

#### EXAMPLE:





```

2 4 1 3 3 1 4 2 3 3 1 4 1 3 4 2 3 1 4 3 2 4 1 3 4 2 3 1 4 3 2 4 1 3 4 2 4 1
3 4 2 4 1 3 4 2 4 1 4 4 2 3 2 4 4 1 4 2 4 4 2 4 1 4 4 2 4 2 4 4 2 4 4 1
4 2 4 4 2 4 2 4 4 2 5 2 4 4 2 4 2 4 4 2 4 5 2 4 2 4 4 2 4 2 5 4 2 4 2 5
4 2 4 2 5 4 2 5 2 4 5 2 4 3 5 4 2 5 2 4 5 2 4 2 5 4 2 5 2 5 4 2 5 3 5 4 2 5
2 5 5 2 5 2 4 5 3 5 2 5 5 2 5 3 5 5 2 5 2 4 5 3 5 2 5 5 3 5 2 5 5 3 5 2 5 5
3 5 2 5 5 3 5 2 5 5 3 5 2 5 5 3 5 2 5 5 3 5 3 5 5 2 5 3 5 5 3 5 2 5 5 3 5 3
5 5 3 5 3 5 5 2 5 3 5 5 3 5 3 5 5 3 5 3 5 5 3 5 3 5 5 3 5 3 5 5 3 5 5 3 5
5 3 5 5 3 5 3 5 5 3 5 3 5 5 3 5 3 5 5 3 5 4 5 5 3 5 3 5 5 3 5 3 5 4 3 5 3 5
5 3 5 4 5 5 3 5 3 5 4 3 5 3 5 5 4 5 3 4 5 3 5 4 4 5 3 5 3 4 5 4 4 3 5 4 4 5
3 4 5 4 4 3 5 4 4 5 3 4 5 4 4 3 4 5 4 4 3 4 5 4 4 3 4 4 4 4 4 5 4 3 4 4 4 4
4 4 3 4 4 4 5 4 4 4 4 4 4 4 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
4 4 4 3 4 4 4 4 4 4 4 4 4 3 4 4 4 4 3 4 4 4 3 4 4 4 3 5 4 3 4 4 4 3 4 4
3 4 4 3 4 4 4 3 3 4 4 5 3 3 4 4 4 3 3 4 3 4 3 4 5 3 4 3 3 4 3 5 3 3 4 3 4 4
3 5 3 4 3 3 5 3 4 3 3 5 3 4 3 3 5 3 4 3 3 5 3 4 3 3 5 3 4 3 3 5 3 4 2 3 5 3
5 3 3 4 2 5 3 3 5 2 4 3 3 5 2 5 3 2 5 3 5 2 3 4 2 5 3 2 5 3 5 2 3 5 2 5 3 2
5 2 5 3 2 5 2 4 3 2 5 2 5 2 2 5 3 5 2 2 5 2 5 2 2 5 2 5 2 3 5 2 5 2 2 5 2 5
2 2 5 2 5 2 2 5 2 5 2 2 5 2 5 2 2 5 2 5 2 2 5 2 5 2 1 5 2 5 2 2 5 2 5 1 2 5
2 5 1 2 5 2 5 1 2 5 1 5 2 1 5 2 5 1 2 5 1 5 2 1 5 2 5 1 2 5 1 5 1 2 5 1 5 1
2 5 1 5 1 1 5 1 5 2 1 5 1 5 1 1 5 1 5 1 1 5 2 5 1 1 5 1 5 1 1 5 1 5 1 1 5 1
5 1 1 5 1 5 2 1 5 1 5 1 1 5 1 5 1 1 5 1 5 1 1 5 1 5 1 1 5 1 5 1 1 5 1 1 5 1
5 1 5 1 1 5 1 4 1)

```

**SYNOPSIS:**

```

(defun remix-in (list &key (remix-in-fib-seed 13) (mirror nil) (test #'eql)
  (replace nil))

```

**20.2.204 l-for-lookup/reset**

```
[ l-for-lookup ] [ Methods ]
```

**DESCRIPTION:**

Sets the counters (index pointers) of all circular-sclist objects stored within a given l-for-lookup object back to zero.

**ARGUMENTS:**

- An l-for-lookup object.

**OPTIONAL ARGUMENTS:**

- (an optional IGNORE argument for internal use only).

**RETURN VALUE:**

Always T.

## SYNOPSIS:

```
(defmethod reset ((lflu l-for-lookup) &optional ignore1 ignore2)
```

### 20.2.205 assoc-list/make-assoc-list

[ *assoc-list* ] [ *Functions* ]

## DESCRIPTION:

A function that provides a shortcut to creating an assoc-list, filling it with data, and assigning a name to it.

## ARGUMENTS:

- The name of the assoc-list to be created.
- The data with which to fill it.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :warn-not-found. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up. T = warn. Default = T.

## RETURN VALUE:

Returns the assoc-list as a named-object.

## EXAMPLE:

```
(make-assoc-list 'looney-tunes '((bugs bunny)
                                   (daffy duck)
                                   (porky pig)))

=>
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL
                      this: NIL
                      next: NIL
NAMED-OBJECT: id: LOONEY-TUNES, tag: NIL,
data: (
```

```
NAMED-OBJECT: id: BUGS, tag: NIL,
data: BUNNY
```

```
NAMED-OBJECT: id: DAFFY, tag: NIL,
data: DUCK
```

```
NAMED-OBJECT: id: PORKY, tag: NIL,
data: PIG)
```

### SYNOPSIS:

```
(defun make-assoc-list (id al &key (warn-not-found t))
```

### 20.2.206 assoc-list/map-data

```
[ assoc-list ] [ Methods ]
```

### DESCRIPTION:

Map a function over the data in the assoc-list. See also recursive-assoc-list's rmap method which does pretty much the same but acting recursively on each named-object (unless it is itself recursive), rather than the named-object's data.

### ARGUMENTS:

- The assoc-list to which the function is to be applied.
- The function to be applied. This must take the data in the assoc-list as a first argument.

### OPTIONAL ARGUMENTS:

- Optional argument(s): Further arguments for the function.

### RETURN VALUE:

Returns a list of the values returned by the function call on the data.

### EXAMPLE:

```
(let ((al (make-assoc-list 'al-test
                          '((1 (1 2 3 4))
                             (2 (5 6 7 8))
                             (3 (9 10 11 12))))))
```

```
(map-data al #'(lambda (y)
  (loop for i in (data y) collect
    (* i 2))))))

=> ((2 4 6 8) (10 12 14 16) (18 20 22 24))
```

**SYNOPSIS:**

```
(defmethod map-data ((al assoc-list) function &optional further-arguments)
```

**20.2.207 assoc-list/recursive-assoc-list**

[ *assoc-list* ] [ *Classes* ]

**NAME:**

recursive-assoc-list

File: recursive-assoc-list.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Extension of the assoc-list class to allow and  
automatically instantiate association lists inside of  
association lists to any level of nesting. E.g.

```
(setf x
  '((1 one)
    (2 two)
    (3 ((cat "cat")
      (dog ((mickey mouse)
        (donald duck)
        (daffy duck)
        (uncle ((james dean)
          (dean martin)
          (fred astaire)
          (ginger ((wolfgang mozart)
            (johann bach)
            (george gershwin)))))))
      (mouse "mouse"))))
    (4 four)))
```

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 18th 2001

\$\$ Last modified: 18:37:51 Mon Dec 23 2013 WIT

SVN ID: \$Id: recursive-assoc-list.lsp 4343 2013-12-25 05:19:16Z medward2 \$

### 20.2.208 recursive-assoc-list/add

[ *recursive-assoc-list* ] [ *Methods* ]

#### DESCRIPTION:

Add a new element (key/data pair) to the given recursive-assoc-list object.

If no value is specified for the optional argument, the new element is added at the end of the top level. The optional argument allows for the FULL-REF to be specified, i.e. a recursive path of keys down to the nested level where the new element is to be placed.

#### ARGUMENTS:

- A key/data pair.
- A recursive-assoc-list object.

#### OPTIONAL ARGUMENTS:

- A list that is the FULL-REF, i.e. a recursive path of keys, down to the nested level where the new element is to be placed.

#### RETURN VALUE:

Returns T if the specified named-object is successfully added to the given recursive-assoc-list.

Returns an error if an attempt is made to add NIL to the given recursive-assoc-list or if the given named-object is already present at the same level within the given recursive-assoc-list.

#### EXAMPLE:

```
;; Adding an element while specifying no optional argument results in the new
```

```
;; element being placed at the end of the top level by default (evident here by
;; the fact that the ref for (MAKERS) is a single-item list)
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                           (violets ((blue velvet)
                                     (red ((dragon den)
                                           (viper nest)
                                           (fox hole)))
                                     (white ribbon))))))))))

  (add '(makers mark) ral)
  (get-all-refs ral))
```

```
=> ((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
     (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE)
     (MAKERS))
```

```
;; A list that is a path of keys (FULL-REF) to the desired recursive level must
;; be given as the optional argument in order to place the specified element
;; deeper in the given recursive-assoc-list object
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                           (violets ((blue velvet)
                                     (red ((dragon den)
                                           (viper nest)
                                           (fox hole)))
                                     (white ribbon))))))))))

  (add '(yellow sky) ral '(four violets))
  (get-all-refs ral))
```

```
=> ((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
     (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE)
     (FOUR VIOLETS YELLOW))
```

```
;; Attempting to add an element that is already present at the given level of
;; the given recursive-assoc-list object results in an error
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                           (violets ((blue velvet)
                                     (red ((dragon den)
                                           (viper nest)
                                           (fox hole)))
                                     (white ribbon))))))))))

  (add '(yellow sky) ral '(four violets))
  (get-all-refs ral))
```

```

                                (fox hole)))
                                (white ribbon)))))))))

(add '(makers mark) ral)
(add '(makers mark) ral))

=>
assoc-list::add: Can't add MAKERS to assoc-list with id MIXED-BAG
because key already exists!
[Condition of type SIMPLE-ERROR]

;; Attempting to add NIL also results in an error
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon)))))))))
      (add '() ral))

=>
assoc-list::add: named-object is NIL!
[Condition of type SIMPLE-ERROR]

```

**SYNOPSIS:**

```
(defmethod add (named-object (ral recursive-assoc-list) &optional ref)
```

**20.2.209 recursive-assoc-list/add-empty-parcel**

*[ recursive-assoc-list ] [ Methods ]*

**DESCRIPTION:**

Add an recursive-assoc-list object with NIL data (an empty level of recursion) to the end of the top-level of a given recursive-assoc-list object.

NB: Adding an empty parcel to a given recursive-assoc-list object will cause the method `get-all-refs` to fail on that recursive-assoc-list object.

**ARGUMENTS:**

- A recursive-assoc-list object.
- A symbol that will be the ID of the new, empty recursive-assoc-list object that is to be added.

**OPTIONAL ARGUMENTS:**

- <new-class> The name of an existing subclass of recursive-assoc-list that the parcel should be promoted to.

**RETURN VALUE:**

A recursive-assoc-list object with DATA of NIL (the "empty parcel")

**EXAMPLE:**

;; Add two new empty parcels (the first a recursive-assoc-list, by default, the  
;; second a rthm-seq-palette) and return the new list of REFS:

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                      (red ((dragon den)
                                            (viper nest)
                                            (fox hole)))
                                      (white ribbon))))))))))
      (add-empty-parcel ral 'bricolage)
      (add-empty-parcel ral 'rsp 'rthm-seq-palette)
      (get-all-refs ral))
```

Mark set  
=>

```
((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
 (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE)
 (BRICOLAGE) (RSP))
```

**SYNOPSIS:**

```
(defmethod add-empty-parcel ((ral recursive-assoc-list) id &optional new-class)
```

**20.2.210 recursive-assoc-list/assoc-list-id-list**

[ recursive-assoc-list ] [ Functions ]

**DESCRIPTION:**



Determine whether a given list contains only atoms which could be used as assoc-list IDs. To pass the test, a given atom must be either a symbol, a number or a string.

#### ARGUMENTS:

A list.

#### RETURN VALUE:

T or NIL indicating whether the atoms of the given list are all capable of being used as assoc-list IDs. T = all can be used as assoc-list IDs.

#### EXAMPLE:

```
;; All of the elements in this list are either a symbol, a number or a
;; string. The list therefore returns a T when tested.
(let ((alil '(jim beam 3 "Allegro" 5 flute)))
  (assoc-list-id-list alil))
```

=> T

```
;; This list fails, as the last element is a list (and therefore not of type
;; string, number or symbol)
(let ((alil '(jim beam 3 "Allegro" 5 (flute))))
  (assoc-list-id-list alil))
```

=> NIL

#### SYNOPSIS:

```
(defun assoc-list-id-list (id-list)
```

#### 20.2.211 recursive-assoc-list/ensemble

[ recursive-assoc-list ] [ Classes ]

#### NAME:

ensemble

File: ensemble.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->

```

                                ensemble

Version:                        1.0.4

Project:                        slippery chicken (algorithmic composition)

Purpose:                        Implementation of the ensemble class.

Author:                         Michael Edwards: m@michael-edwards.org

Creation date:                  4th September 2001

$$ Last modified: 16:28:27 Wed Oct 23 2013 BST

SVN ID: $Id: ensemble.lsp 4223 2013-10-29 10:57:09Z medward2 $

```

### 20.2.212 ensemble/add-player

[ *ensemble* ] [ *Methods* ]

#### DESCRIPTION:

Add a player to an existing ensemble. It will be added at the end of the list.

#### ARGUMENTS:

- The ensemble object.
- The new player, either as a player object or symbol. If the latter this becomes the id of the player we'll create.

#### OPTIONAL ARGUMENTS:

- The id of the instrument in the already existing instrument-palette. This is required if the player argument is a symbol. Default NIL.
- An instrument-palette object. Default =  
+slippery-chicken-standard-instrument-palette+.

#### RETURN VALUE:

The player object added.

#### SYNOPSIS:

```
(defmethod add-player ((e ensemble) player
```

```
&optional  
instrument-id  
(instrument-palette  
+slippery-chicken-standard-instrument-palette+))
```

### 20.2.213 ensemble/get-player

[ *ensemble* ] [ *Methods* ]

#### DESCRIPTION:

Return a player object from an ensemble, if it exists.

#### ARGUMENTS:

- An ensemble object.
- The ID of a player.

#### RETURN VALUE:

The player object or NIL if there's no such player.

#### SYNOPSIS:

```
(defmethod get-player ((e ensemble) player)
```

### 20.2.214 ensemble/get-players

[ *ensemble* ] [ *Methods* ]

#### DESCRIPTION:

Return the IDs of the players from a given ensemble object.

#### ARGUMENTS:

- An ensemble object.

#### RETURN VALUE:

- A list of symbols that are the player IDs of the given ensemble object.

#### EXAMPLE:

```
(let ((ens (make-ensemble
  'ens
  '((flt ((flute piccolo) :midi-channel 1))
    (clr ((b-flat-clarinet)))
    (tpt ((b-flat-trumpet c-trumpet) :midi-channel 2))
    (vln ((violin))))
  :instrument-palette
  +slippery-chicken-standard-instrument-palette+)))
  (get-players ens))

=> (FLT CLR TPT VLN)
```

**SYNOPSIS:**

```
(defmethod get-players ((e ensemble))
```

**20.2.215 ensemble/make-ensemble**

*[ ensemble ] [ Functions ]*

**DESCRIPTION:**

Make an ensemble object, specifying the players and associated instruments.

NB: If you have an ensemble with a player doubling two instruments, be sure to indicate some keyword argument or other as  
 (fl1 ((piccolo violin) :midi-channel 1)) works but  
 (fl1 ((piccolo violin))) thinks that piccolo is a nested ensemble!!!

NB: The argument :instrument-palette is a required argument although it is a keyword argument.

**ARGUMENTS:**

- An ID consisting of a symbol, string or number.
- A list of 2-element sublists that define the ensemble. See the above comment on adding a keyword argument for doubling players.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :instrument-palette. An instrument palette object. Default = +slippery-chicken-standard-instrument-palette+
- :bar-line-writers. Obsolete as no longer used.

**RETURN VALUE:**

An ensemble object.

**EXAMPLE:**

```
(let ((ens (make-ensemble
  'ens
  '((flt ((flute piccolo) :midi-channel 1))
    (clr ((b-flat-clarinet))))
  :instrument-palette
  +slippery-chicken-standard-instrument-palette+)))
  (print ens))
```

=>

```
ENSEMBLE: bar-line-writers: NIL
          players: (FLT CLR)
                (id instrument-palette): SLIPPERY-CHICKEN-STANDARD-INSTRUMENT-PALETTE
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 2
                      linked: T
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: ENS, tag: NIL,
data: (
PLAYER: (id instrument-palette): SLIPPERY-CHICKEN-STANDARD-INSTRUMENT-PALETTE
doubles: T, cmn-staff-args: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: (FLT), next: (CLR)
NAMED-OBJECT: id: FLT, tag: NIL,
data:
[...]
data: (
INSTRUMENT: lowest-written:
[...]
NAMED-OBJECT: id: FLUTE, tag: NIL,
[...]
INSTRUMENT: lowest-written:
[...]
NAMED-OBJECT: id: PICCOLO, tag: NIL,
[...]
PLAYER: (id instrument-palette): SLIPPERY-CHICKEN-STANDARD-INSTRUMENT-PALETTE
doubles: NIL, cmn-staff-args: NIL
```

```

LINKED-NAMED-OBJECT: previous: (FLT), this: (CLR), next: NIL
NAMED-OBJECT: id: CLR, tag: NIL,
data:
INSTRUMENT: lowest-written:
[...]
NAMED-OBJECT: id: B-FLAT-CLARINET, tag: NIL,
)

```

**SYNOPSIS:**

```

(defun make-ensemble (id ensemble &key bar-line-writers
                     (instrument-palette
                      +slippery-chicken-standard-instrument-palette+))

```

**20.2.216 ensemble/num-notes**

```
[ ensemble ] [ Methods ]
```

**DESCRIPTION:**

Get the number of attacked notes in a given slippery-chicken object. This method accesses the ensemble object within the given slippery-chicken object to perform this task.

**ARGUMENTS:**

- An ensemble object.

**RETURN VALUE:**

An integer that is the total number of attacked notes in the given slippery-chicken object.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '(1 (((2 4) e e e e))
                               :pitch-seq-palette ((1 2 3 4))))
      :rthm-seq-map '(1 ((vn (1 1 1 1 1))

```

```

                                (vc (1 1 1 1 1)))))))))
  (num-notes (ensemble mini)))

=> 40

```

**SYNOPSIS:**

```
(defmethod num-notes ((e ensemble))
```

**20.2.217 ensemble/num-players**

[ ensemble ] [ Methods ]

**DESCRIPTION:**

Get the number of players in a given ensemble object.

**ARGUMENTS:**

- An ensemble object.

**RETURN VALUE:**

- An integer.

**EXAMPLE:**

```

(let ((ens (make-ensemble
              'ens
              '((flt ((flute piccolo) :midi-channel 1))
                    (clr ((b-flat-clarinet)))
                    (tpt ((b-flat-trumpet c-trumpet) :midi-channel 2))
                    (vln ((violin))))
              :instrument-palette
              +slippery-chicken-standard-instrument-palette+)))
  (num-players ens))

=> 4

```

**SYNOPSIS:**

```
(defmethod num-players ((e ensemble))
```

**20.2.218 ensemble/players-exist***[ ensemble ] [ Methods ]***DESCRIPTION:**

Produce an error message and drop into the debugger if the specified player IDs are not found within the given ensemble object.

**ARGUMENTS:**

- An ensemble object.
- A list of symbols that are the IDs of the players sought.

**RETURN VALUE:**

NIL if the specified player ID is present within the given ensemble object, otherwise drops into the debugger with an error.

**EXAMPLE:**

```
;;; Returns NIL if a player with the specified ID is found in the given
;;; ensemble object.
```

```
(let ((ens (make-ensemble
  'ens
  '((flt ((flute piccolo) :midi-channel 1))
    (clr ((b-flat-clarinet)))
    (tpt ((b-flat-trumpet c-trumpet) :midi-channel 2))
    (vln ((violin))))
  :instrument-palette
  +slippery-chicken-standard-instrument-palette+)))
  (players-exist ens '(vln)))
```

```
=> NIL
```

```
;; Drops into the debugger with an error if no player with the specified ID is
;; found in the given ensemble object.
```

```
(let ((ens (make-ensemble
  'ens
  '((flt ((flute piccolo) :midi-channel 1))
    (clr ((b-flat-clarinet)))
    (tpt ((b-flat-trumpet c-trumpet) :midi-channel 2))
    (vln ((violin))))
  :instrument-palette
  +slippery-chicken-standard-instrument-palette+)))
  (players-exist ens '(vla)))
```



```
=>
ensemble::players-exist: VLA is not a member of the ensemble
[Condition of type SIMPLE-ERROR]
```

**SYNOPSIS:**

```
(defmethod players-exist ((e ensemble) players)
```

**20.2.219** ensemble/tessitura

[ ensemble ] [ Methods ]

**DESCRIPTION:**

Get the average pitch of a given slippery-chicken object. This method accesses the ensemble object within the given slippery-chicken object to perform this task.

NB: This method processes data in relationship to degrees of the current tuning system (scale), which is quarter-tone by default. It is therefore possible, when generating a piece using only chromatic pitches but within a non-chromatic tuning to get microtonal results.

**ARGUMENTS:**

- An ensemble object.

**RETURN VALUE:**

An integer that is the average pitch of the given slippery-chicken object in degrees.

**EXAMPLE:**

```
;; Change the tuning to chromatic first to get an accurate result:
(in-scale :chromatic)
```

```
=> #<tuning "chromatic-scale">
```

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                     (vc (cello :midi-channel 2))))
```

```

:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) e e e e))
                        :pitch-seq-palette ((1 2 3 4)))))
:rthm-seq-map '((1 ((vn (1 1 1 1 1))
                      (vc (1 1 1 1 1))))))
(tessitura (ensemble mini))

=> C4

```

**SYNOPSIS:**

```
(defmethod tessitura ((e ensemble))
```

**20.2.220 recursive-assoc-list/get-all-refs**

[ *recursive-assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Return a list of all the keys (REFS) in a given recursive-assoc-list object. Nested keys are given in FULL-REF form, i.e. a list that is the path of keys to the specific key.

Keys that are not part of nesting-path are also returned as lists (single-item lists) by default. An optional argument allows these to be returned as individual symbols rather than lists.

NB This will only work on the top-level object due to the creation of references when linking.

**ARGUMENTS:**

- A recursive-assoc-list object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to return single REFS (non-nested keys) as lists or as individual symbols. T = as list. Default = T.

**RETURN VALUE:**

A list.

**EXAMPLE:**

```
;; By default all keys are returned as lists, even single (non-nested) keys
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (get-all-refs ral))

=> ((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
    (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE))

;; Setting the optional argument to NIL returns non-nested keys as symbols
;; rather than lists
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (get-all-refs ral nil))

=> (JIM WILD (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
    (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE))
```

**SYNOPSIS:**

```
(defmethod get-all-refs ((ral recursive-assoc-list)
                          &optional
                          (single-ref-as-list t))
```

**20.2.221 recursive-assoc-list/get-data**

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

Return the named-object (or linked-named-object) that is identified by a specified key within a given recursive-assoc-list object.

NB: This method returns the named object itself, not just the data associated with the key (use `assoc-list::get-data-data` for that).

#### ARGUMENTS:

- A symbol that is the key (id) of the named-object sought, or a list of symbols that are the path to the desired named-object within the given recursive-assoc-list.
- The recursive-assoc-list object in which it is sought.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether a warning is printed if the specified key cannot be found within the given assoc-list. T = print. Default = T.

#### RETURN VALUE:

A named-object is returned if the specified key is found within the given recursive-assoc-list object.

NIL is returned and a warning is printed if the specified key is not found in the given recursive-assoc-list object. This applies, too, when a nested key is specified without including the other keys that are the path to that key (see example).

#### EXAMPLE:

```
;; Get a named-object from the top-level of the recursive-assoc-list object
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
  (get-data 'wild ral))

=>
NAMED-OBJECT: id: WILD, tag: NIL,
data: TURKEY
```

;; A list including all keys that are the path to the specified key is required

```
;; to get nested named-objects
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (get-data '(four violets white) ral))

=>
NAMED-OBJECT: id: WHITE, tag: NIL,
data: RIBBON

;; Searching for a key that is not present in the given recursive-assoc-list
;; object returns NIL and a warning
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (get-data 'johnnie ral))

=> NIL
WARNING:
  assoc-list::get-data: Could not find data with key JOHNNIE
  in assoc-list with id MIXED-BAG

;; Searching for a nested key without specifying the path to that key within a
;; list also returns a NIL and a warning
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (get-data 'fox ral))
```

```
=> NIL
WARNING:
  assoc-list::get-data: Could not find data with key FOX
  in assoc-list with id MIXED-BAG
```

**SYNOPSIS:**

```
(defmethod get-data :around (ids (ral recursive-assoc-list)
                                &optional (warn t))
```

**20.2.222 recursive-assoc-list/get-first**

```
[ recursive-assoc-list ] [ Methods ]
```

**DESCRIPTION:**

Returns the first named-object in the DATA slot of the given recursive-assoc-list object.

**ARGUMENTS:**

- A recursive-assoc-list object.

**RETURN VALUE:**

A named-object that is the first object in the DATA slot of the given recursive-assoc-list object.

**EXAMPLE:**

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
  (get-first ral))
```

```
=>
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM
```



```

                                (viper nest)
                                (fox hole)))
                                (white ribbon)))))))))
(get-first-ref (get-data-data '(four violets) ral)))

=> (FOUR VIOLETS BLUE)

```

**SYNOPSIS:**

```
(defmethod get-first-ref ((ral recursive-assoc-list))
```

**20.2.224 recursive-assoc-list/get-last**

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

Get the last named-object in a given recursive-assoc-list object.

NB: This method functions linearly, not hierarchically. The last named object is therefore not necessarily the deepest of a nest, but the last listed.

**ARGUMENTS:**

- A recursive-assoc-list object.

**RETURN VALUE:**

A named-object (or linked-named-object).

**EXAMPLE:**

```

;; This returns '(white ribbon), not '(fox hole)
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                          (violets ((blue velvet)
                              (red ((dragon den)
                                  (viper nest)
                                  (fox hole)))
                              (white ribbon)))))))))
      (get-last ral))

```



```
=>
NAMED-OBJECT: id: WHITE, tag: NIL,
data: RIBBON
```

**SYNOPSIS:**

```
(defmethod get-last ((ral recursive-assoc-list))
```

**20.2.225 recursive-assoc-list/get-last-ref**

```
[ recursive-assoc-list ] [ Methods ]
```

**DESCRIPTION:**

Get the last REF (path of nested keys) of the given recursive-assoc-list object.

NB: This method functions linearly, not hierarchically. The last-ref may not be the deepest nested.

**ARGUMENTS:**

- A recursive-assoc-list object.

**RETURN VALUE:**

Returns a list that is the last REF of the given recursive-assoc-list object.

**EXAMPLE:**

```
;; Typical usage with nesting
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
  (get-last-ref ral))

=> (FOUR VIOLETS WHITE)
```

```
;; Returns the last-ref as a list even if the given recursive-assoc-list object
;; contains no nesting
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four roses)))))
  (get-last-ref ral))

=> (FOUR)
```

**SYNOPSIS:**

```
(defmethod get-last-ref ((ral recursive-assoc-list))
```

**20.2.226 recursive-assoc-list/get-previous**

[ *recursive-assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Get the previous named-object in the given recursive-assoc-list object by specifying the ID of a named-object contained within that given recursive-assoc-list object.

An optional argument allows for the retrieval of a previous named-object that is more than one step back in the given recursive-assoc-list object (i.e., not the named-object that immediately precedes the specified key).

If the number given for the optional <how-many> argument is greater than the number of items in the given recursive-assoc-list object, the value returned will be a negative number.

The method proceeds linearly, not hierarchically, when getting previous named-objects from further down into nested assoc-lists. In other words, the named-object immediately previous to (white ribbon) in this nested list is (fox hole), which is at a deeper level, not (red ...) or (blue velvet), which are at the same level:

```
((blue velvet)
 (red ((dragon den)
       (viper nest)
       (fox hole)))
 (white ribbon))
```

In order to retrieve objects that are nested more deeply, the list that is the <keys> argument must consist of the consecutive path of keys leading to

that object. If only the key of a named object that is deeper in the list is given, and not the path of keys to that object, a warning will be printed that the given key cannot be found in the list.

NB: When this method is applied to keys that contain further assoc-list objects, the method will drop into the debugger with an error.

#### ARGUMENTS:

- A recursive-assoc-list object.
- A list containing one or more symbols that are either the ID of the specified named object or the path of keys to that object within the given recursive-assoc-list object.

#### OPTIONAL ARGUMENTS:

- An integer indicating how many steps back in the given recursive-assoc-list from the specified named-object to look when retrieving the desired object (e.g. 1 = immediately previous object, 2 = the one before that etc.)

#### RETURN VALUE:

A linked-named-object.

#### EXAMPLE:

```
;; Get the object immediately previous to that with the key WILD returns the
;; object with key JIM and data BEAM
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
      (get-previous ral '(wild)))

=>
LINKED-NAMED-OBJECT: previous: NIL, this: (JIM), next: (WILD)
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM
```



```

                                (fox hole)))
                                (white ribbon)))))))))
(get-previous ral '(four violets white)))

=>
LINKED-NAMED-OBJECT: previous: (FOUR VIOLETS RED VIPER),
this: (FOUR VIOLETS RED FOX),
next: (FOUR VIOLETS WHITE)
NAMED-OBJECT: id: FOX, tag: NIL,
data: HOLE

;; Use the <how-many> argument to retrieve previous objects further back than
;; the immediate predecessor
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                      (red ((dragon den)
                                            (viper nest)
                                            (fox hole)))
                                      (white ribbon)))))))))
      (get-previous ral '(four violets white) 4))

=>
LINKED-NAMED-OBJECT: previous: (FOUR ROSES),
this: (FOUR VIOLETS BLUE),
next: (FOUR VIOLETS RED DRAGON)
NAMED-OBJECT: id: BLUE, tag: NIL,
data: VELVET

;; Using a <how-many> value greater than the number of items in the given
;; recursive-assoc-list object returns a negative number
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                      (red ((dragon den)
                                            (viper nest)
                                            (fox hole)))
                                      (white ribbon)))))))))
      (get-previous ral '(four violets white) 14))

=> -7

```

**SYNOPSIS:**

```
(defmethod get-previous ((ral recursive-assoc-list) keys
                        &optional (how-many 1))
```

**20.2.227 recursive-assoc-list/link-named-objects**

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

Create linked-named-objects from the named-objects in the data slots of the given recursive-assoc-list object. The linked-named-objects created hold keys that serve as pointers to the previous and next objects in the given recursive-assoc-list object, whether recursive or not.

The optional <previous> and <higher-next> arguments are only for internal recursive calls and so shouldn't be given by the user.

**ARGUMENTS:**

- A recursive-assoc-list object.

**OPTIONAL ARGUMENTS:**

- <previous>
- <higher-next>

**EXAMPLE:**

```
;;; The recursive-assoc-list may not be linked on creation, evident here
;;; through the value of the LINKED slot
```

```
(make-ral 'mixed-bag
          '((jim beam)
            (wild turkey)
            (four ((roses red)
                  (violets ((blue velvet)
                           (red ((dragon den)
                                (viper nest)
                                (fox hole)))
                           (white ribbon)))))))
```

```
=>
```

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
```

```

        linked: NIL
        full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: NIL,
data: (
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM

NAMED-OBJECT: id: WILD, tag: NIL,
data: TURKEY
[...]
```

```
;; The recursive-assoc-list object and the named-objects it contains are linked
;; after applying the link-named-objects method
```

```

(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                      (red ((dragon den)
                                            (viper nest)
                                            (fox hole)))
                                      (white ribbon))))))))))

  (link-named-objects ral))
```

```
=>
```

```

RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                        num-data: 8
                        linked: T
                        full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: NIL,
data: (
LINKED-NAMED-OBJECT: previous: NIL, this: (JIM), next: (WILD)
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM

LINKED-NAMED-OBJECT: previous: (JIM), this: (WILD), next: (FOUR ROSES)
NAMED-OBJECT: id: WILD, tag: NIL,
data: TURKEY
```

**RETURN VALUE:**

the recursive-assoc-list object

**SYNOPSIS:**

```
(defmethod link-named-objects ((ral recursive-assoc-list)
                                &optional previous higher-next)
```

**20.2.228 recursive-assoc-list/lisp-assoc-listp**

[ recursive-assoc-list ] [ Functions ]

**DESCRIPTION:**

Determine whether a given list can has the structure of a lisp assoc-list. This is assessed based on each of the elements being a 2-item list, of which the first is a symbol, number or string (qualifies as a key).

The optional argument <recurse-simple-data> allows the data portion of key/data pairs to be viewed as flat lists rather than as recursive lists.

**ARGUMENTS:**

- A list.

**OPTIONAL ARGUMENTS:**

T or NIL to indicate whether to consider lists of 2-item lists in the data position of a given key/data pair to be a list or a recursive list.

T = list. Default = T.

**RETURN VALUE:**

T or NIL. T = the tested list can be considered a Lisp assoc-list.

**EXAMPLE:**

```
;; A list of 2-item lists, each of whose item are all either a symbol, number,
;; or string, can be considered a Lisp assoc-list.
(let ((lal '((roses red) (3 "allegro") (5 flute))))
  (lisp-assoc-listp lal))
```



=> T

```
;; By default, lists of 2-item lists in the DATA portion of a key/data pair
;; will be considered as a simple list, rather than a recursive list, resulting
;; in the tested list passing as T.
(let ((lal '((1 2) (3 ((4 5) (6 7))) (8 9))))
  (lisp-assoc-listp lal))
```

=> T

```
;; Setting the optional argument to NIL will cause the same list to fail with
(let ((lal '((1 2) (3 ((4 5) (6 7))) (8 9))))
  (lisp-assoc-listp lal nil))
```

=> NIL

## SYNOPSIS:

```
(defun lisp-assoc-listp (candidate &optional (recurse-simple-data t))
```

### 20.2.229 recursive-assoc-list/make-ral

[ recursive-assoc-list ] [ Functions ]

## DESCRIPTION:

Create a recursive-assoc-list object, which allows and automatically instantiates association lists inside of association lists to any level of nesting.

## ARGUMENTS:

- A symbol that is the object's ID.
- A list of nested lists, or a list.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :recurse-simple-data. T or NIL to indicate whether to recursively instantiate a recursive-assoc-list in place of data that appears to be a simple assoc-list (i.e. a 2-element list). If NIL, the data of 2-element lists whose second element is a number or a symbol will be ignored, therefore remaining as a list. For example, this data would normally result in a recursive call: (y ((2 23) (7 28) (18 2))). T = replace assoc-list data with recursive-assoc-lists. Default = T.

- :full-ref. Nil or a list representing the path to a nested recursive-assoc-list object within the given recursive-assoc-list object, starting from the top level of the given object. When NIL, the given recursive-assoc-list object itself is the top level. Default = NIL.
- :tag. A symbol that is another name, description etc. for the given recursive-assoc-list object. The tag may be used for identification but not for searching purposes. Default = NIL.
- :warn-not-found. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up. Default = T.

**RETURN VALUE:**

Returns a recursive-assoc-list object.

**EXAMPLE:**

;; Create a recursive-assoc-list object with default keyword argument values

```
(make-ral 'mixed-bag
  '((jim beam)
    (wild turkey)
    (four ((roses red)
            (violets ((blue velvet)
                      (red ((dragon den)
                          (viper nest)
                          (fox hole)))
                      (white ribbon)))))))
```

=>

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: NIL,
data: (
[...]
```

;; Use the class's get-all-refs method to show that by default, simple data is  
 ;; recursed. The sublists in the second list in this example are processed as  
 ;; nested lists

```
(let ((ral (make-ral 'ral-test
  '((1 one)
    (2 ((3 4) (5 6)))
```

```

                                (3 three))))))
  (get-all-refs ral))

=> ((1) (2 3) (2 5) (3))

;; Using the same data, but setting the :recurse-simple-data argument to NIL
;; will cause the method to process simple data as a unit rather than nested
;; lists
(let ((ral (make-ral 'ral-test
                    '((1 one)
                      (2 ((3 4) (5 6)))
                      (3 three))
                    :recurse-simple-data nil)))
  (get-all-refs ral))

=> ((1) (2) (3))

```

**SYNOPSIS:**

```

(defun make-ral (id ral &key (recurse-simple-data t) (warn-not-found t)
                (tag nil) (full-ref nil))

```

**20.2.230 recursive-assoc-list/palette**

[ recursive-assoc-list ] [ Classes ]

**NAME:**

palette

File: palette.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
palette

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the palette class which adds nothing to  
its direct superclass assoc-list (as of yet) but spawns a  
new base type for more specialised palettes.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 19th February 2001

\$\$ Last modified: 19:45:19 Mon Oct 28 2013 GMT

SVN ID: \$Id: palette.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.231 palette/instrument-palette

[ palette ] [ Classes ]

#### NAME:

instrument-palette

File: instrument-palette.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
palette -> instrument-palette

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the instrument-palette class which  
instantiates instruments to be used in an ensemble  
instance.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 6th September 2001

\$\$ Last modified: 21:57:31 Wed Jul 18 2012 BST

SVN ID: \$Id: instrument-palette.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.232 instrument-palette/make-instrument-palette

[ instrument-palette ] [ Functions ]

#### DESCRIPTION:

Create an instrument-palette object from a list of instrument descriptions  
based on the keyword arguments of make-instrument.

**ARGUMENTS:**

- A symbol that will serve as the ID for the instrument-palette object.
- A list of instrument descriptions based on the keyword arguments of `make-instrument`.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:warn-not-found`. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up. Default = T.

**RETURN VALUE:**

An instrument palette.

**EXAMPLE:**

```
;; Returns an instrument-palette object
(make-instrument-palette 'inst-pal
  '((piccolo (:transposition-semitones 12
              :lowest-written d4 :highest-written c6))
    (bf-clarinet (:transposition-semitones -2
              :lowest-written e3
              :highest-written c6))
    (horn (:transposition f :transposition-semitones -7
           :lowest-written f2 :highest-written c5))
    (violin (:lowest-written g3 :highest-written c7
            :chords t))
    (viola (:lowest-written c3 :highest-written f6
           :chords t))))

=>
INSTRUMENT-PALETTE:
PALETTE:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                     num-data: 5
                     linked: NIL
                     full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 5, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: INST-PAL, tag: NIL,
data: (
[...]
```

**SYNOPSIS:**

```
(defun make-instrument-palette (id ip &key (warn-not-found t))
```

**20.2.233 instrument-palette/set-prefers-high**

[ *instrument-palette* ] [ *Methods* ]

**DATE:**

05 Feb 2011

**DESCRIPTION:**

Set the PREFERS-NOTES slot of a specified instrument object within a given instrument-palette object to 'HIGH. The instrument object is specified using the ID symbol assigned to it within the instrument-palette object definition.

NB: The optional argument is actually required, but is listed as optional because of the attributes of the instrument class method.

**ARGUMENTS:**

- An instrument-palette object.

**OPTIONAL ARGUMENTS:**

- A symbol that is the ID of the instrument object within the instrument-palette object definition.

**RETURN VALUE:**

Returns the symbol 'HIGH.

**EXAMPLE:**

```
;; Define an instrument-palette object, then set the PREFERS-NOTES slot of the
;; instrument object 'piccolo within that instrument-palette object to 'HIGH
(let ((ip (make-instrument-palette 'inst-pal
                                   '((piccolo (:transposition-semitones 12
                                              :lowest-written d4
                                              :highest-written c6))
                                   (bf-clarinet (:transposition-semitones -2
```

```

                                :lowest-written e3
                                :highest-written c6))
(horn (:transposition f
      :transposition-semitones -7
      :lowest-written f2
      :highest-written c5))
(violin (:lowest-written g3
        :highest-written c7
        :chords t))
(viola (:lowest-written c3
        :highest-written f6
        :chords t))))))

(set-prefers-high ip 'piccolo))

=> HIGH

```

**SYNOPSIS:**

```
(defmethod set-prefers-high ((ip instrument-palette) &optional instrument)
```

**20.2.234 instrument-palette/set-prefers-low**

[ *instrument-palette* ] [ *Methods* ]

**DATE:**

05 Feb 2011

**DESCRIPTION:**

Set the PREFERS-NOTES slot of a specified instrument object within a given instrument-palette object to 'LOW. The instrument object is specified using the ID symbol assigned to it within the instrument-palette object definition.

NB: The optional argument is actually required, but is listed as optional because of the attributes of the instrument class method.

**ARGUMENTS:**

- An instrument-palette object.

**OPTIONAL ARGUMENTS:**

- A symbol that is the ID of the instrument object within the instrument-palette object definition.

**RETURN VALUE:**

Returns the symbol 'LOW.

**EXAMPLE:**

```
;; Define an instrument-palette object, then set the PREFERS-NOTES slot of the
;; instrument object 'piccolo within that instrument-palette object to 'LOW
(let ((ip (make-instrument-palette 'inst-pal
                                   '((piccolo (:transposition-semitones 12
                                              :lowest-written d4
                                              :highest-written c6))
                                      (bf-clarinet (:transposition-semitones -2
                                                  :lowest-written e3
                                                  :highest-written c6))
                                      (horn (:transposition f
                                             :transposition-semitones -7
                                             :lowest-written f2
                                             :highest-written c5))
                                      (violin (:lowest-written g3
                                              :highest-written c7
                                              :chords t))
                                      (viola (:lowest-written c3
                                              :highest-written f6
                                              :chords t)))))))

  (set-prefers-low ip 'piccolo))

=> LOW
```

**SYNOPSIS:**

```
(defmethod set-prefers-low ((ip instrument-palette) &optional instrument)
```

**20.2.235 palette/pitch-seq-palette**

[ palette ] [ Classes ]

**NAME:**

pitch-seq-palette

File: pitch-seq-palette.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->



```

palette -> pitch-seq-palette

Version:      1.0.4

Project:      slippery chicken (algorithmic composition)

Purpose:      Implementation of the pitch-seq-palette class.

Author:       Michael Edwards: m@michael-edwards.org

Creation date: 19th February 2001

$$ Last modified: 09:57:56 Tue Oct  1 2013 BST

SVN ID: $Id: pitch-seq-palette.lsp 4223 2013-10-29 10:57:09Z medward2 $

```

### 20.2.236 pitch-seq-palette/add-inversions

[ *pitch-seq-palette* ] [ *Methods* ]

#### DESCRIPTION:

Add inversions of the existing pitch-seq objects in a given pitch-seq-palette object to the end of that pitch-seq-palette object. (See pitch-seq::invert for more details on slippery-chicken inversions.)

#### ARGUMENTS:

- A pitch-seq-palette object.

#### RETURN VALUE:

Always returns T.

#### EXAMPLE:

```

;; Create a pitch-seq-palette object and print the DATA of the pitch-seq
;; objects it contains; then apply the add-inversions method and print the same
;; DATA to see the changes
(let ((mpsp (make-psp 'mpsp 5 '((2 5 3 1 4)
                                (1 4 2 5 3)
                                (5 1 3 2 4)
                                (2 3 4 5 1)
                                (3 2 4 1 5))))))
  (print (loop for ps in (data mpsp)

```

```

        collect (data ps)))
      (add-inversions mpsp)
      (print (loop for ps in (data mpsp)
        collect (data ps))))

=>
((2 5 3 1 4) (1 4 2 5 3) (5 1 3 2 4) (2 3 4 5 1) (3 2 4 1 5))

((2 5 3 1 4) (1 4 2 5 3) (5 1 3 2 4) (2 3 4 5 1) (3 2 4 1 5) (4 1 3 5 2)
(5 2 4 1 3) (1 5 3 4 2) (4 3 2 1 5) (3 4 2 5 1))

```

**SYNOPSIS:**

```
(defmethod add-inversions ((psp pitch-seq-palette))
```

**20.2.237 pitch-seq-palette/combine**

[ *pitch-seq-palette* ] [ *Methods* ]

**DESCRIPTION:**

Create a new pitch-seq-palette object by combining the pitch-seq lists from one pitch-seq-palette object with those of another.

The method combines the contents of the two given rthm-seq-palette objects consecutively; i.e., the first pitch-seq object of the first pitch-seq-palette is combined with the first pitch-seq object of the other, then the second with the second, the third with the third etc.

If one pitch-seq-palette object contains more pitch-seq objects than the other, the method cycles through the shorter one until all of the members of the longer one have been handled. The new pitch-seq-palette object will therefore contain the same number of pitch-seq objects as is in the longest of the two starting pitch-seq-palette objects.

It is not necessary for the lengths of the pitch-seq objects in the two starting pitch-seq-palette objects to be the same.

NB Both pitch-seq-palettes are reset by this method.

**ARGUMENTS:**

- A first pitch-seq-palette object.
- A second pitch-seq-palette object.

**RETURN VALUE:**

A pitch-seq-palette object.

### EXAMPLE:

```
;;; Combine two pitch-seq-palette objects of the same length, each of whose
;;; pitch-seqs are the same length
(let ((mpsp1 (make-ppsp 'mpsp1 5 '((2 5 3 1 4) (1 4 2 5 3) (5 1 3 2 4))))
      (mpsp2 (make-ppsp 'mpsp2 5 '((2 3 4 5 1) (3 2 4 1 5) (3 2 1 5 4)))))
  (combine mpsp1 mpsp2))
```

=>

```
PITCH-SEQ-PALETTE: num-notes: 10, instruments: NIL
PALETTE:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 3
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "MPSP1-MPSP2", tag: NIL,
data: (
PITCH-SEQ: notes: NIL
[...]
data: (2 5 3 1 4 2 3 4 5 1)
PITCH-SEQ: notes: NIL
[...]
data: (1 4 2 5 3 3 2 4 1 5)
[...]
PITCH-SEQ: notes: NIL
[...]
data: (5 1 3 2 4 3 2 1 5 4)
)
```

```
;; When combining pitch-seq-palette objects of different lengths, the method
;; cycles through the shorter of the two
(let ((mpsp1 (make-ppsp 'mpsp1 5 '((2 5 3 1 4) (1 4 2 5 3) (5 1 3 2 4))))
      (mpsp2 (make-ppsp 'mpsp2 5 '((2 3 4 5 1) (3 2 4 1 5)))))
  (loop for ps in (data (combine mpsp1 mpsp2))
        collect (data ps)))
```

=> ((2 5 3 1 4 2 3 4 5 1) (1 4 2 5 3 3 2 4 1 5) (5 1 3 2 4 2 3 4 5 1))

```
;; The two starting pitch-seq-palette objects are not required to have
;; pitch-seq objects of the same length
```

```
(let ((mpsp1 (make-psp 'mpsp1 5 '((2 5 3 1 4) (1 4 2 5 3) (5 1 3 2 4))))
      (mpsp2 (make-psp 'mpsp2 3 '((2 3 4) (3 2 4)))))
  (loop for ps in (data (combine mpsp1 mpsp2))
        collect (data ps)))

=> ((2 5 3 1 4 2 3 4) (1 4 2 5 3 3 2 4) (5 1 3 2 4 2 3 4))
```

**SYNOPSIS:**

```
(defmethod combine ((psp1 pitch-seq-palette) (psp2 pitch-seq-palette))
```

**20.2.238 pitch-seq-palette/make-psp**

[ *pitch-seq-palette* ] [ *Functions* ]

**DESCRIPTION:**

Create a pitch-seq-palette object from an ID, a specified number of notes, and a list of lists of numbers representing the pitch curve of the intended pitch-seq objects.

**ARGUMENTS:**

- A symbol that is to be the ID of the pitch-seq-palette to be created.
- An integer that is the number of notes there are to be in each pitch-seq object created.
- A list of lists, each of which contained list is a list of numbers representing the pitch curve of the intended pitch-seq object.

**RETURN VALUE:**

A pitch-seq-palette object.

**EXAMPLE:**

```
;; Returns a pitch-seq-palette object
(make-psp 'mpsp 5 '((2 5 3 1 4)
                    (1 4 2 5 3)
                    (5 1 3 2 4)
                    (2 3 4 5 1)
                    (3 2 4 1 5)))
```

=>

```
PITCH-SEQ-PALETTE: num-notes: 5, instruments: NIL
PALETTE:
```

```

RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                        num-data: 5
                        linked: NIL
                        full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 5, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MPSP, tag: NIL,
data: (
  PITCH-SEQ: notes: NIL
  [...]
  data: (2 5 3 1 4)
  PITCH-SEQ: notes: NIL
  [...]
  data: (1 4 2 5 3)
  PITCH-SEQ: notes: NIL
  [...]
  data: (5 1 3 2 4)
  PITCH-SEQ: notes: NIL
  [...]
  data: (2 3 4 5 1)
  PITCH-SEQ: notes: NIL
  [...]
  data: (3 2 4 1 5)
)

```

```

;; Interrupts with an error if any of the <pitch-seqs> lists is not of the
;; length specified by <num-notes>
(make-psp 'mpsp 5 '((1 2 1 1 3)
                    (1 3 2 1 5)
                    (1 3 5 6 7 8)))

```

```

=>
pitch-seq-palette::verify-and-store:
In pitch-seq MPSP-ps-3 from palette MPSP:
Each pitch sequence must have 5 notes (you have 6):
[...]
(1 3 5 6 7 8))
[Condition of type SIMPLE-ERROR]

```

```

;; We can also assign instruments to specific pitch-seqs by passing their names
;; (not player names, but instrument names) e.g.
(make-psp 'mpsp 5 '((1 2 1 1 3)
                    ((1 3 2 1 5) violin flute)
                    (1 3 5 6 7)))

```

**SYNOPSIS:**

```
(defun make-psp (id num-notes pitch-seqs)
```

**20.2.239 palette/rthm-seq-palette**

```
[ palette ] [ Classes ]
```

**NAME:**

```
set-palette
```

```
File:          rthm-seq-palette.lsp
```

```
Class Hierarchy:  named-object -> linked-named-object -> sclist ->
                  circular-sclist -> assoc-list -> recursive-assoc-list ->
                  palette -> rthm-seq-palette
```

```
Version:        1.0.4
```

```
Project:        slippery chicken (algorithmic composition)
```

```
Purpose:          Implementation of the rthm-seq-palette class.
```

```
Author:         Michael Edwards: m@michael-edwards.org
```

```
Creation date:   19th February 2001
```

```
$$ Last modified: 18:31:28 Mon Dec 23 2013 WIT
```

```
SVN ID: $Id: rthm-seq-palette.lsp 4343 2013-12-25 05:19:16Z medward2 $
```

**20.2.240 rthm-seq-palette/chop**

```
[ rthm-seq-palette ] [ Methods ]
```

**DESCRIPTION:**

Applies the chop method to each rthm-seq object in the given rthm-seq-palette object (see rthm-seq-bar::chop for details). Returns a new rthm-seq-palette object with the same structure as the argument, but with a further level of nesting: Each rthm-seq object in the argument is replaced by a list of rthm-seq objects that are each one "slice" of the original rthm-seq objects.

The chop method is the basis for slippery-chicken's feature of intra-phrasal looping.

NB: Since the chop method functions by comparing each beat of a given rthm-seq-bar object to the specified <chop-points> pattern for segmenting that beat, all rthm-seq-bar objects in the given rthm-seq-palette object must be evenly divisible by the beat for which the pattern is defined. For example, if the <chop-points> argument defines a quarter-note, all bars in the given rthm-seq-palette object must be evenly divisible by a quarter-note, and a rthm-seq-palette consisting of a rthm-seq object with a 2/4, a 3/4 and a 3/8 bar would fail at the 3/8 bar with an error.

NB: The <unit> argument must be a duplet rhythmic value (i.e. 32, 's, 'e etc.) and cannot be a tuplet value (i.e. 'te 'fe etc.).

NB: In order for the resulting chopped rhythms to be parsable by LilyPond and CMN, there can be no tuplets (triplets etc.) among the rhythms to be chopped. Such rhythms will result in LilyPond and CMN errors. This has only minimal bearing on any MIDI files produced, however, and these can potentially be imported into notation software.

#### ARGUMENTS:

- A rthm-seq-palette object.

#### OPTIONAL ARGUMENTS:

- <chop-points>. A list of integer pairs, each of which delineates a segment of the beat of the given rthm-seq-bar objects within the given rthm-seq-palette object, measured in the rhythmic unit specified by the <unit> argument. See the documentation for rthm-seq-bar::chop for more details.
- <unit>. The rhythmic duration that serves as the unit of measurement for the chop points. Default = 's.
- <number-bars-first>. T or NIL. This argument helps in naming (and therefore debugging) the newly-created bars. If T, the bars in the original rthm-seq will be renumbered, starting from 1, and this will be reflected in the tag of the new bars. E.g. if T, a new bar's tag may be new-bar-from-rs1-b3-time-range-1.750-to-2.000, if NIL this would be new-bar-from-rs1-time-range-1.750-to-2.000. Default = T.

#### RETURN VALUE:

A rthm-seq-palette with the same top-level structure of the first argument,

but each ID now referencing a sub-rthm-seq-palette with sequentially numbered rthm-seqs for each of the chopped results.

#### EXAMPLE:

;;; Create a rthm-seq-palette object, chop it with user-defined chop-points and  
 ;;; a <unit> value of 'e, and print-simple the results

```
(let* ((rsp-orig (make-rsp
                    'sl-rsp
                    '((1
                      (((2 4) (e) e (e) e))
                      :pitch-seq-palette (1 8)))
                    (2
                      (((2 4) (s) e s e. (s)))
                      :pitch-seq-palette (3 5 7)))
                    (3
                      (((3 4) q +s e. +q))
                      :pitch-seq-palette (1 7))))))
      (rsp-chopped (chop rsp-orig
                        '((1 1) (1 2) (2 2))
                        'e)))
  (print-simple rsp-chopped))
```

=>

```
rthm-seq-palette SL-RSP
rthm-seq-palette 1
rthm-seq 1
(1 8): rest 8,
rthm-seq 2
(1 4): rest E, NIL E,
rthm-seq 3
(1 8): NIL E,
rthm-seq 4
(1 8): rest 8,
rthm-seq 5
(1 4): rest E, NIL E,
rthm-seq 6
(1 8): NIL E,
rthm-seq 1
(1 8): rest S, NIL S,
rthm-seq 2
(1 4): rest S, NIL E, NIL S,
rthm-seq 3
(1 8): rest S, NIL S,
rthm-seq 4
(1 8): NIL E,
```



```

rthm-seq 5
(1 4): NIL E., rest S,
rthm-seq 6
(1 8): rest 8,
rthm-seq 1
(1 8): NIL E,
rthm-seq 2
(1 4): NIL Q,
rthm-seq 3
(1 8): rest 8,
rthm-seq 4
(1 8): rest S, NIL S,
rthm-seq 5
(1 4): rest S, NIL E.,
rthm-seq 6
(1 8): rest 8,
rthm-seq 7
(1 8): rest 8,
rthm-seq 8
(1 4): rest 4,
rthm-seq 9
(1 8): rest 8,

```

**SYNOPSIS:**

```

(defmethod chop ((rsp rthm-seq-palette) &optional chop-points
                  (unit 's)
                  (number-bars-first t))

```

**20.2.241 rthm-seq-palette/cmn-display**

*[ rthm-seq-palette ] [ Methods ]*

**DESCRIPTION:**

Generate printable music notation output (.EPS) of the given rthm-seq-palette object using the Common Music Notation (CMN) interface. The method requires at least the name of the given rthm-seq-palette object to set, but has several additional optional arguments for customizing output.

NB: Most of the keyword arguments are CMN attributes and share the same name as the CMN feature they effect.

**ARGUMENTS:**

- A rthm-seq-palette object.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :all-output-in-one-file. T or NIL to indicate whether to write the output to a multi-page file or to separate files for each page.  
T = one multi-page file. Default = T. This is a direct CMN attribute.
- :file. The file path, including the file name, of the file to be generated.
- :staff-separation. A number to indicate the amount of white space between staves belong to the same system, measured as a factor of the staff height. Default = 3. This is a direct CMN attribute.
- :line-separation. A number to indicate the amount of white space between lines of music (systems), measured as a factor of the staff height. Default = 5. This is a direct CMN attribute.
- :page-nums. T or NIL to indicate whether or not to print page numbers on the pages. T = print page numbers. Default = T.
- :no-accidentals. T or NIL to indicate whether or not to suppress printing accidentals for each and every note (rather than once per bar).  
T = suppress printing all accidentals. Default = NIL.
- :seqs-per-system. An integer indicating the number of rthm-seq objects to be printed in one staff system. Default = 1.
- :size. A number to indicate the font size of the CMN output.
- :auto-open. Automatically open the EPS file?.  
Default = (get-sc-config cmn-display-auto-open)

### RETURN VALUE:

T

### EXAMPLE:

```
;; A typical example with some specified keyword values for file and size
(let ((mrsp
      (make-rsp 'rsp-test
                '(seq1 (((2 4) q +e. s)
                        ((s) e (s) q)
                        (+e. s { 3 (te) te te } ))
                  :pitch-seq-palette ((1 2 3 4 5 6 7)
                                       (1 3 5 7 2 4 6)
                                       (1 4 2 6 3 7 5)
                                       (1 5 2 7 3 2 4))))
      (seq2 (((4 4) (e.) s { 3 te te te } +h)
              ({ 3 +te (te) te } e e (h))))
```

```

                :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((2 4) e e { 3 te te te })
              ((4 4) (e) e e e s s (s) s q))
              :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2 3 7))))))
  (cmn-display mrsp
    :file "/tmp/rmsp-output.eps"
    :size 10))

```

**SYNOPSIS:**

```

(defmethod cmn-display ((rsp rthm-seq-palette)
  &key
  (all-output-in-one-file t)
  (file
    (format nil "~a~a.eps"
      (get-sc-config 'default-dir)
      (string-downcase (id rsp)))))
  (staff-separation 3)
  (line-separation 5)
  (page-nums t)
  (no-accidentals t)
  (seqs-per-system 1)
  (auto-open (get-sc-config 'cmn-display-auto-open))
  (size 15))

```

**20.2.242 rthm-seq-palette/create-psps**

*[ rthm-seq-palette ] [ Methods ]*

**DATE:**

30 Mar 2006

**DESCRIPTION:**

Automatically create pitch-seq-palette objects for each rthm-seq object in the given rthm-seq-palette object.

The selection function given as an optional keyword argument should be able to generate a list of numbers (relative note levels) for a rthm-seq of any length; it takes two arguments only: the number of notes needed and the pitch-seq data lists (see below).

As a pitch-seq-palette usually has several options for each rthm-seq object, it's best when the selection-fun doesn't always return the same

thing given the same number of notes. NB: This will silently kill the data of any pitch-seq-palette objects already supplied for any rthm-seqs in the palette.

Note that the default selection function will suffice in lots of cases. However, you may just want to use different data lists with the default function. In that case just pass these via :selection-fun-data.

## ARGUMENTS:

- A rth-seq-palette object.

## OPTIONAL ARGUMENTS:

keyword arguments

- :selection-fun. This is a function that will return the pitch-seq numbers. It takes two arguments only: 1) the number of notes needed, and 2) the pitch-seq data lists. The function also needs to be able to handle being passed NIL NIL as arguments. In this case it should reset, if needs be; i.e. it's just a call to init and should return nothing. Default = #'create-psps-default.
- :pitch-seqs-per-rthm-seq. This is an integer that is the number of pitch-seqs each rthm-seq should have. NB: The method will simply cycle through the pitch-seqs given in the selection function to create the required number. Default = 3.
- :selection-fun-data. This contains the pitch-seq lists to be passed to the default selection function. There can be as many pitch-seqs in these lists as desired. The number of notes the pitch-seq will provide is the first item of the list. They need not be in ascending order. When this argument is passed a value of T, the selection function will reinitialize its default data and use that.
- :reinit. Used internally. Do not change.

At the moment, the default data are:

```
'((1 ((3) (3) (1) (25)))
  (2 ((3 4) (5 2) (25 25) (1 25)))
  (3 ((3 4 3) (5 9 6) (1 2 4) (5 2 2) (6 2 3)))
  (4 ((3 4 3 4) (5 3 6 4) (9 4 5 11) (2 10 4 8)))
  (5 ((5 5 6 5 8) (7 7 7 4 8) (11 8 4 10 2) (7 7 4 9 9)))
  (6 ((4 5 5 3 6 6) (3 8 3 9 3 8) (9 3 9 5 10 6)))
  (7 ((8 8 8 5 9 6 9 ) (9 3 8 4 7 5 4) (3 4 3 5 3 4 3)))
  (8 ((3 3 4 3 3 1 5 4) (10 3 9 3 8 3 7 4) (3 5 8 2 8 9 4 11)))
  (9 ((3 6 4 7 4 7 3 6 7) (10 2 9 2 8 2 7 2 3)
      (2 9 3 9 4 9 9 6 11)))
  (10 ((9 9 9 3 9 9 3 5 9 5) (8 9 8 9 5 9 9 5 6 6)))
  (12 ((1 2 5 5 5 5 5 5 5 4 5) (2 1 5 1 5 1 6 5 1 5 2 5)))
```

```

(13 ((1 2 5 5 5 5 5 5 5 4 5 2) (2 1 5 1 5 1 6 5 1 5 2 5 1)))
(14 ((1 2 5 5 5 5 5 5 5 4 5 2 1)
      (2 1 5 1 5 1 6 5 1 5 2 5 1 2)))
(15 ((1 2 5 5 5 5 5 5 5 4 5 2 1 2)
      (2 1 5 1 5 1 6 5 1 5 2 5 1 2 6))))))

```

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```

;; Create a rthm-seq-palette object that specifies pitch-seq-palettes for each
;; contained rthm-seq object and print the values of the individual
;; pitch-seq-palettes. Then apply the create-psps method using its default
;; values, and print the values of the individual pitch-seq-palettes again to
;; see the change. NB You wouldn't normally specify pitch-seq-palettes in your
;; rthm-seq-palette as the whole point of this method is to have them created
;; algorithmically, but they are given here for purposes of comparison.

```

```

(let ((mrsp (make-rsp 'rsp-test
                      '((seq1 (((2 4) q +e. s)
                                ((s) e (s) q)
                                (+e. s { 3 (te) te te } ))
                                :pitch-seq-palette (1 2 3 4 5 6 7)))
                      (seq2 (((3 4) (e.) s { 3 te te te } +q)
                                ({ 3 +te (te) te } e e (q)))
                                :pitch-seq-palette (2 3 4 5 6 7 8)))
                      (seq3 (((2 4) e e { 3 te te te }
                                ((5 8) (e) e e e s s))
                                :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2))))))

  (print
    (loop for rs in (data mrsp)
      collect
        (loop for ps in (data (pitch-seq-palette rs))
          collect (data ps))))
  (create-psps mrsp)
  (print
    (loop for rs in (data mrsp)
      collect
        (loop for ps in (data (pitch-seq-palette rs))
          collect (data ps)))))

```

=>

```

(((1 2 3 4 5 6 7)) ((2 3 4 5 6 7 8)) ((3 4 5 6 7 8 9 10 1 2)))

(((8 8 8 5 9 6 9) (9 3 8 4 7 5 4) (3 4 3 5 3 4 3)))

```

```

((8 8 8 5 9 6 9) (9 3 8 4 7 5 4) (3 4 3 5 3 4 3))
((9 9 9 3 9 9 3 5 9 5) (8 9 8 9 5 9 9 5 6 6) (9 9 9 3 9 9 3 5 9 5)))

;; Use the :pitch-seqs-per-rthm-seq keyword argument to specify the number of
;; pitch-seq objects to be created for each rthm-seq. This example creates 5
;; instead of the default 3.
(let ((mrsp (make-rsp 'rsp-test
  '((seq1 (((2 4) q +e. s)
    ((s) e (s) q)
    (+e. s { 3 (te) te te } ))))
    (seq2 (((3 4) (e.) s { 3 te te te } +q)
    ({ 3 +te (te) te } e e (q))))
    (seq3 (((2 4) e e { 3 te te te }
    ((5 8) (e) e e e s s)))))))
  (create-psps mrsp :pitch-seqs-per-rthm-seq 5)
  (loop for rs in (data mrsp)
    collect
      (loop for ps in (data (pitch-seq-palette rs))
        collect (data ps))))

=>
((8 8 8 5 9 6 9) (9 3 8 4 7 5 4) (3 4 3 5 3 4 3) (8 8 8 5 9 6 9)
 (9 3 8 4 7 5 4))
((3 4 3 5 3 4 3) (8 8 8 5 9 6 9) (9 3 8 4 7 5 4) (3 4 3 5 3 4 3)
 (8 8 8 5 9 6 9))
((9 9 9 3 9 9 3 5 9 5) (8 9 8 9 5 9 9 5 6 6) (9 9 9 3 9 9 3 5 9 5)
 (8 9 8 9 5 9 9 5 6 6) (9 9 9 3 9 9 3 5 9 5)))

;;; Now an example with our own selection-fun creating random pitch-seqs for
;;; demo purposes only:
(let ((mrsp (make-rsp 'rsp-test
  '((seq1 (((2 4) q +e. s)
    ((s) e (s) q)
    (+e. s { 3 (te) te te } ))))
    (seq2 (((3 4) (e.) s { 3 te te te } +q)
    ({ 3 +te (te) te } e e (q))))
    (seq3 (((2 4) e e { 3 te te te }
    ((5 8) (e) e e e s s)))))))
  (create-psps
    mrsp
    :selection-fun #'(lambda
      (num-notes data-lists)
      ;; NB we're not doing anything with data-lists here
      (loop repeat num-notes collect (random 10))))
    (loop for rs in (data mrsp)
      collect

```

```

      (loop for ps in (data (pitch-seq-palette rs))
            collect (data ps))))
=>
(((5 4 3 0 3 8 0) (1 2 8 5 3 7 8) (5 5 7 3 9 1 7))
 ((3 1 5 6 6 7 1) (7 7 8 5 5 2 4) (9 1 3 0 8 7 8))
 ((4 8 6 9 6 6 0 8 1 2) (1 5 5 7 7 2 9 3 1 2) (1 5 6 2 5 3 7 3 4 2)))

```

**SYNOPSIS:**

```

(defmethod create-psps ((rsp rthm-seq-palette)
                        &key
                        (selection-fun #'create-psps-default)
                        (selection-fun-data nil)
                        ;; MDE Sat Jul 14 17:20:27 2012 --
                        (reinit t)
                        (pitch-seqs-per-rthm-seq 3))

```

**20.2.243 rthm-seq-palette/create-psps-default**

[ *rthm-seq-palette* ] [ *Functions* ]

**ARGUMENTS:**

- An integer that is the number of notes for which a pitch-seq-palette object is needed.
- the pitch-seq data (see documentation for create-psps method). Ideally this would only be passed the first time the function is called.

**RETURN VALUE:**

A list of numbers suitable for use in creating a pitch-seq object.

**SYNOPSIS:**

```

(defun create-psps-default (num-notes data-lists)

```

**20.2.244 rthm-seq-palette/get-multipliers**

[ *rthm-seq-palette* ] [ *Methods* ]

**DESCRIPTION:**

Get a list of factors by which a specified rhythmic unit must be multiplied in order to create the rhythms of a specified rthm-seq object within the given rthm-seq-palette object.

See also `rthm-seq` method for more information.

#### ARGUMENTS:

- A `rthm-seq` object.
- A rhythm unit, either as a number or a CMN shorthand symbol (i.e. `'e`)
- A symbol that is the ID of the `rthm-seq`-object for which the multipliers is sought is also a required argument (though it is listed as an optional argument for internal reasons).

#### OPTIONAL ARGUMENTS:

- `T` or `NIL` to indicate whether to round the results. `T` = round.  
Default = `NIL`. NB: Lisp always rounds to even numbers, meaning `x.5` may sometimes round up and sometimes round down; thus `(round 1.5) => 2`, and `(round 2.5) => 2`.

#### RETURN VALUE:

A list of numbers.

#### EXAMPLE:

```
;; Returns a list of numbers, by default not rounded
(let ((mrsp
      (make-rsp 'rsp-test
                '((seq1 (((2 4) q +e. s)
                        ((s) e (s) q)
                        (+e. s { 3 (te) te te } ))
                  :pitch-seq-palette ((1 2 3 4 5 6 7)
                                       (1 3 5 7 2 4 6)
                                       (1 4 2 6 3 7 5)
                                       (1 5 2 7 3 2 4))))
      (seq2 (((4 4) (e.) s { 3 te te te } +h)
            ({ 3 +te (te) te } e e (h)))
            :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((2 4) e e { 3 te te te }
            ((4 4) (e) e e e s s (s) s q))
            :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2 3 7))))))
  (get-multipliers mrsp 'e 'seq1))

=> (2.0 1.0 1.5 2.0 1.1666666666666665 0.6666666666666666 0.6666666666666666)

;; Setting the option <round> argument to T returns rounded results
```



```

(let ((mrsp
      (make-rsp 'rsp-test
                '((seq1 (((2 4) q +e. s)
                        ((s) e (s) q)
                        (+e. s { 3 (te) te te } ))
                  :pitch-seq-palette ((1 2 3 4 5 6 7)
                                       (1 3 5 7 2 4 6)
                                       (1 4 2 6 3 7 5)
                                       (1 5 2 7 3 2 4))))
            (seq2 (((4 4) (e.) s { 3 te te te } +h)
                  ({ 3 +te (te) te } e e (h)))
                  :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((2 4) e e { 3 te te te }
              ((4 4) (e) e e e s s (s) s q))
              :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2 3 7))))))
  (get-multipliers mrsp 'e 'seq1 t))

=> (2 1 2 2 1 1 1)

```

;; The ID argument is required, even though it's listed as being optional. The  
 ;; method interrupts with an error if no ID is supplied

```

(let ((mrsp
      (make-rsp 'rsp-test
                '((seq1 (((2 4) q +e. s)
                        ((s) e (s) q)
                        (+e. s { 3 (te) te te } ))
                  :pitch-seq-palette ((1 2 3 4 5 6 7)
                                       (1 3 5 7 2 4 6)
                                       (1 4 2 6 3 7 5)
                                       (1 5 2 7 3 2 4))))
            (seq2 (((4 4) (e.) s { 3 te te te } +h)
                  ({ 3 +te (te) te } e e (h)))
                  :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((2 4) e e { 3 te te te }
              ((4 4) (e) e e e s s (s) s q))
              :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2 3 7))))))
  (get-multipliers mrsp 'e))

```

=>

rthm-seq-palette::get-multipliers: third argument (rthm-seq ID) is required.  
 [Condition of type SIMPLE-ERROR]

;;; Applying the method to the a multiple-bar rthm-seq object may return  
 ;;; different results than applying the method to each of the bars contained  
 ;;; within that rthm-seq object as individual one-bar rthm-seq objects, as the  
 ;;; method measures the distances between attacked notes, regardless of ties

```

;;; and rests.
(let ((rs1 (make-rthm-seq '(seq1 (((2 4) q +e. s))
                                :pitch-seq-palette ((1 2))))))
      (rs2 (make-rthm-seq '(seq2 (((2 4) (s) e (s) q))
                                :pitch-seq-palette ((1 2))))))
      (rs3 (make-rthm-seq '(seq3 (((2 4) +e. s { 3 (te) te te } ))
                                :pitch-seq-palette ((1 2 3))))))
      (rs4 (make-rthm-seq '(seq4 (((2 4) q +e. s)
                                ((s) e (s) q)
                                (+e. s { 3 (te) te te } ))
                                :pitch-seq-palette ((1 2 3 4 5 6 7))))))

  (print (get-multipliers rs1 'e))
  (print (get-multipliers rs2 'e))
  (print (get-multipliers rs3 'e))
  (print (get-multipliers rs4 'e)))

=>
(3.5 0.5)
(1.5 2.0)
(1.1666666666666665 0.6666666666666666 0.6666666666666666)
(3.5 1.0 1.5 3.5 1.1666666666666665 0.6666666666666666 0.6666666666666666)

```

**SYNOPSIS:**

```
(defmethod get-multipliers ((rsp rthm-seq-palette) rthm &optional id round)
```

**20.2.245 rthm-seq-palette/make-rsp**

[ *rthm-seq-palette* ] [ *Functions* ]

**DESCRIPTION:**

Create a rthm-seq-palette object.

**ARGUMENTS:**

- A symbol that is to be the ID of the rthm-seq-palette object created.
- A list containing rthm-seq data to be made into rthm-seqs. Each item in this list is a list of data formatted as it would be when passed to the make-rthm-seq function.

**OPTIONAL ARGUMENTS:**

T or NIL to indicate whether to automatically generate and store inversions of the pitch-seq-palette passed to the rthm-seq objects in the rthm-seq-palette object created. T = generate and store. Default = NIL.

**RETURN VALUE:**

A rthm-seq-palette object.

**EXAMPLE:**

```
(make-rsp 'rsp-test '((seq1 (((2 4) q +e. s)
                             ((s) e (s) q)
                             (+e. s { 3 (te) te te } ))
                             :pitch-seq-palette (1 7 3 4 5 2 6)))
          (seq2 (((3 4) (e.) s { 3 te te te } +q)
                  ({ 3 +te (te) te } e e (q)))
                  :pitch-seq-palette (3 1 2 5 1 7 6)))
          (seq3 (((2 4) e e { 3 te te te }
                  ((5 8) (e) e e e s s))
                  :pitch-seq-palette (4 4 4 5 4 4 4 5 4 3))))))
```

=>

```
RTHM-SEQ-PALETTE: psp-inversions: NIL
PALETTE:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 3
                      linked: T
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: RSP-TEST, tag: NIL,
data: (
RTHM-SEQ: num-bars: 3
[...]
```

;; Create two rthm-seq-palette objects, one with :psp-inversions set to NIL and  
 ;; one with it set to T, and print the DATA of the pitch-seq-palettes of each

```
(let ((mrsp1 (make-rsp 'rsp-test
                      '((seq1 (((2 4) q +e. s)
                              ((s) e (s) q)
                              (+e. s { 3 (te) te te } ))
                              :pitch-seq-palette (1 7 3 4 5 2 6))))
                      :psp-inversions nil))
      (mrsp2 (make-rsp 'rsp-test
                      '((seq1 (((2 4) q +e. s)
                              ((s) e (s) q)
                              (+e. s { 3 (te) te te } ))
                              :pitch-seq-palette (1 7 3 4 5 2 6))))
                      :psp-inversions t)))
```

```

                                :psp-inversions t)))
(print
  (loop for i in (data (pitch-seq-palette (first (data mrsp1))))
        collect (data i)))
(print
  (loop for i in (data (pitch-seq-palette (first (data mrsp2))))
        collect (data i)))

=>
((1 7 3 4 5 2 6))
((1 7 3 4 5 2 6) (7 1 5 4 3 6 2))

```

**SYNOPSIS:**

```
(defun make-rsp (id data &key (psp-inversions nil))
```

**20.2.246 rthm-seq-palette/reset-psps**

*[ rthm-seq-palette ] [ Methods ]*

**DESCRIPTION:**

Call the reset method (inherited from circular-sclist) for all pitch-seq-palette objects of all rthm-seq objects in the given rthm-seq-palette object, resetting their pointers to the head of the sequence. This ensures that each rthm-seq starts over again at the first note of the first given pitch-seq.

NB Since 28/10/13 there's also a reset method for the palette class which will mean we call the reset method of all pitch-seqs here. So this method is now partially obsolete (but still perhaps useful in that it only resets the psps, not the whole palette).

**ARGUMENTS:**

- A rthm-seq-palette object.

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```
;; Create a rthm-seq-palette object whose first rthm-seq has three pitch-seq
;; objects in its pitch-seq-palette. Apply the get-next method to the
```

```
;; pitch-seq-palette object of the first rthm-seq object twice, then print the
;; data of the next pitch-seq object to show where we are. Apply the reset-psps
;; method and print the data of the next pitch-seq object to show that we've
;; returned to the beginning of the pitch-seq-palette.
```

```
(let ((mrsp
      (make-rsp 'rsp-test
                '((seq1 (((2 4) q +e. s)
                        ((s) e (s) q)
                        (+e. s { 3 (te) te te } ))
                  :pitch-seq-palette ((1 2 3 4 5 6 7)
                                         (1 3 5 7 2 4 6)
                                         (1 4 2 6 3 7 5)
                                         (1 5 2 7 3 2 4))))))
      (seq2 (((3 4) (e.) s { 3 te te te } +q)
              ({ 3 +te (te) te } e e (q)))
              :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((2 4) e e { 3 te te te }
                ((5 8) (e) e e e s s))
              :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2))))))

(loop repeat 2
  do (get-next (pitch-seq-palette (first (data mrsp))))
  (print (data (get-next (pitch-seq-palette (first (data mrsp))))))
  (reset-psps mrsp)
  (print (data (get-next (pitch-seq-palette (first (data mrsp)))))))

=>
(1 4 2 6 3 7 5)
(1 2 3 4 5 6 7)
```

## SYNOPSIS:

```
(defmethod reset-psps ((rsp rthm-seq-palette))
```

### 20.2.247 rthm-seq-palette/rsp-subseq

```
[ rthm-seq-palette ] [ Methods ]
```

## DATE:

23rd October 2013

## DESCRIPTION:

(Recursively) change all the rthm-seq objects in the palette to be a subsequence of the existing rthm-seqs.

**ARGUMENTS:**

- the original `rthm-seq-palette` object
- the start bar (1-based)

**OPTIONAL ARGUMENTS:**

- the end bar (1-based and (unlike Lisp's `subseq` function) inclusive). If NIL, we'll use the original end bar of each `rthm-seq`. Default = NIL.

**RETURN VALUE:**

The original `rthm-seq-palette` but with the new `rthm-seqs`

**SYNOPSIS:**

```
(defmethod rsp-subseq ((rsp rthm-seq-palette) start &optional end)
```

**20.2.248 rthm-seq-palette/scale**

```
[ rthm-seq-palette ] [ Methods ]
```

**DESCRIPTION:**

Scale the durations of the rhythm objects in a given `rthm-seq-palette` object by the specified factor.

NB: As is evident in the examples below, this method does not replace the original data in the `rthm-seq-palette` object's DATA slot.

**ARGUMENTS:**

- A `rthm-seq-palette` object.
- A real number that is the scaling factor.

**OPTIONAL ARGUMENTS:**

(- the three IGNORE arguments are for internal purposes only).

**RETURN VALUE:**

Returns a `rthm-seq-palette` object.

**EXAMPLE:**



```

      (seq2 (((((4 4) (e.) s { 3 te te te } +h)
              ({ 3 +te (te) te } e e (h)))
              :pitch-seq-palette (2 3 4 5 6 7 8)))
      (seq3 (((((2 4) e e { 3 te te te }
              ((4 4) (e) e e e s s (s) s q))
              :pitch-seq-palette (3 4 5 6 7 8 9 10 1 2 3 7)))))))
  (scale mrsp .5)
  (print-simple mrsp))

=>
rthm-seq-palette RSP-TEST
rthm-seq SEQ1
(2 8): note E, note S., note 32,
(2 8): rest 32, note S, rest 32, note E,
(2 8): note S., note 32, rest TS, note TS, note TS,
rthm-seq SEQ2
(4 8): rest S., note 32, note TS, note TS, note TS, note Q,
(4 8): note TS, rest TS, note TS, note S, note S, rest Q,
rthm-seq SEQ3
(2 8): note S, note S, note TS, note TS, note TS,
(4 8): rest S, note S, note S, note S, note 32, note 32, rest 32, note 32, note E,

```

**SYNOPSIS:**

```

(defmethod scale ((rsp rthm-seq-palette) scaler
                  &optional ignore1 ignore2 ignore3)

```

**20.2.249 rthm-seq-palette/set-slot**

```
[ rthm-seq-palette ] [ Methods ]
```

**DESCRIPTION:**

Set the specified slot of an object with a recursive-assoc-list structure to the specified value. This is particularly useful for changing the parameters of instrument objects within an instrument palette, for example.

**ARGUMENTS:**

- The name of the slot whose value is to be set.
- The value to which that slot is to be set.
- The key within the given recursive-assoc-list object for which the slot is to be set.
- The recursive-assoc-list object in which the slot is to be changed.

**RETURN VALUE:**



The value to which the slot has been set.

#### EXAMPLE:

```
(set-slot 'largest-fast-leap 10 'oboe
  +slippery-chicken-standard-instrument-palette+)
```

```
=> 10
```

#### SYNOPSIS:

```
(defmethod set-slot (slot value id (ral recursive-assoc-list))
```

#### 20.2.250 rthm-seq-palette/split-into-single-bars

[ *rthm-seq-palette* ] [ *Methods* ]

#### DESCRIPTION:

Split every rthm-seq in a palette into as many single-bar rthm-seqs as there are bars. This creates an extra level of recursion so that whereas a rthm-seq that was referenced by e.g. '(long 1 a) beforehand, afterwards each bar will be reference by '(long 1 a 1), '(long 1 a 2) etc. This is true even for sequences that only contained one bar before processing. The pitch-seq-palettes of the original rthm-seqs will be used to set the pitch-seqs of the new rthm-seqs.

#### ARGUMENTS:

- the rthm-seq-palette object

#### OPTIONAL ARGUMENTS:

- whether to clone the palette before processing (T or NIL). Default = T.

#### RETURN VALUE:

A rthm-seq-palette object with extra layers of recursion.

#### SYNOPSIS:

```
(defmethod split-into-single-bars ((rsp rthm-seq-palette) &optional (clone t))
```

**20.2.251 palette/set-palette***[ palette ] [ Classes ]***NAME:**`set-palette`**File:** `set-palette.lsp`**Class Hierarchy:** `named-object -> linked-named-object -> sclist -> circular-sclist -> assoc-list -> recursive-assoc-list -> palette -> set-palette`**Version:** `1.0.4`**Project:** `slippery chicken (algorithmic composition)`**Purpose:** Implementation of the set-palette class which extends the palette class by simply instantiating the sets given in the palette.

Note that the sets in this palette may refer to previously defined sets in order to obviate retyping note lists. Hence the reference to `bcl-chord2` in the `bcl-chord3` set of the example below will instantiate a set based on a transposed clone of that set previously stored as `bcl-chord2`.

```
(make-set-palette
 'test
 '((bcl-chord1
   ((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5
     dqf5 gs5 b5)
    :subsets
    ((tc1 (ds2 e3 a4))
     (tc2 (bf1 d4 cqs5))
     (qc1 (aqf2 e3 a4 dqf5 b5))
     (qc2 (bf1 c3 gqs3 cs4 cqs5)))
    :related-sets
    ((missing (bqs0 eqs1 f5 aqs5 eqf6 fqs6
               bqf6 dqs7 fs7))))))
 (bcl-chord2
  ((bf1 d2 fqf2 fqs2 b2 c3 f3 g3 bqf3 bqs3 fs4 gs4 a4
    cs5 gqf5)
   :subsets
```

```

((tc1 (d2 g3 cs5))
 (tc2 (eqs2 f3 bqf3))
 (qc1 (eqs2 c3 f3 fs4 gqf5))
 (qc2 (d2 fqs2 bqs3 gs4 a4)))
:related-sets
((missing (aqs0 dqs1 ds5 gqs5 dqf6 eqf6 aqf6 cqs7
           e7))))))
(bcl-chord3
 (bcl-chord2 :transposition 13))))

```

Author: Michael Edwards: m@michael-edwards.org

Creation date: August 14th 2001

\$\$ Last modified: 17:53:28 Mon Oct 28 2013 GMT

SVN ID: \$Id: set-palette.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.252 set-palette/cmn-display

[ *set-palette* ] [ *Methods* ]

#### DESCRIPTION:

Generate printable music notation output (.EPS) of the given set-palette object, including separate notation of the SUBSETS and RELATED-SETS slots, using the Common Music Notation (CMN) interface. The method requires at least the name of the given set-palette object, but has several additional optional arguments for customizing output.

NB: Some of the keyword arguments are CMN attributes and share the same name as the CMN feature they effect.

#### ARGUMENTS:

- A set-palette object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :file. The file path, including the file name, of the file to be generated.
- :4stave. T or NIL to indicate whether the note-heads of the output should be printed on 4 staves (or 2). T = 4. Default = NIL.

- :text-x-offset. Number (positive or negative) to indicate the horizontal offset of any text in the output. A value of 0.0 results in all text being lined up left-flush with the note-heads below it. Units here and below are relative to CMN staff size. Default = -0.5.
- :text-y-offset. Number (positive or negative) to indicate the vertical offset of any text in the output.
- :font-size. A number indicating the size of any text font used in the output. This affects text only and not the music (see :size below for changing the size of the music).
- :break-line-each-set. T or NIL to indicate whether each set-palette object should be printed on a separate staff or consecutively on the same staff. T = one staff per set-palette object. Default = T.
- :line-separation. A number to indicate the amount of white space between lines of music (systems), measured as a factor of the staff height. Default = 3. This is a direct CMN attribute.
- :staff-separation. A number to indicate the amount of white space between staves belong to the same system, measured as a factor of the staff height. Default = 3. This is a direct CMN attribute.
- :transposition. Nil or a number (positive or negative) to indicate the number of semitones by which the pitches of the given set-palette object should be transposed before generating the CMN output. Default = NIL (0).
- :size. A number to indicate the size of the music-font in the CMN output. This affects music only, not text.
- :use-octave-signs. T or NIL to indicate whether to automatically insert ottava spanners. Automatic placement depends on the overall pitch content. This is a slippery-chicken process and may produce different results than :automatic-octave-signs, which is a direct CMN process. T = insert octave signs. Default = NIL.
- :automatic-octave-signs. T or NIL to indicate whether to automatically insert ottava spanners. Automatic placement depends on the overall pitch content. This is a direct CMN process and may produce different results than :use-octave-signs, which is a slippery-chicken process. T = insert octave signs. Default = NIL.
- :include-missing-chromatic. T or NIL to indicate whether to also print any chromatic pitches from the complete-set that are not present in the given set-palette object. T = print. Default = T.
- :include-missing-non-chromatic. T or NIL to indicate whether to also print any microtonal pitches from the complete-set that are not present in the given set-palette object. T = print. Default = T.

**RETURN VALUE:**

T

**EXAMPLE:**

**SYNOPSIS:**

```
(defmethod cmn-display ((sp set-palette)
                        &key
                        ;; 10.3.10: display on 4 staves (treble+15 bass-15)?
                        (4stave nil)
                        (file
                         (format nil "~a~a.eps"
                                (get-sc-config 'default-dir)
                                (string-downcase (id sp)))))
      (text-x-offset -0.5)
      (text-y-offset nil)
      (font-size 10.0)
      (break-line-each-set t)
      (line-separation 3)
      (staff-separation nil)
      (transposition nil) ;; in semitones
      (size 20)
      (use-octave-signs nil)
      (automatic-octave-signs nil)
      (include-missing-chromatic t))
```

```
(auto-open (get-sc-config 'cmn-display-auto-open+))
(include-missing-non-chromatic t))
```

### 20.2.253 set-palette/find-sets-with-pitches

[ *set-palette* ] [ *Methods* ]

#### DESCRIPTION:

Return a list of sets (as complete-set objects) from a given set-palette object based on whether they contain specified pitches.

NB: Only sets which contain all of the specified pitches will be returned.

#### ARGUMENTS:

- A set-palette object.
- A list of pitches, either as pitch objects or note-name symbols.

#### OPTION ARGUMENTS

- T or NIL to indicate whether to print the notes of each successful set as they are being examined.

#### RETURN VALUE:

A list of complete-set objects.

#### EXAMPLE:

```
;; Find sets that contain a single pitch
(let ((msp (make-set-palette
              'test
              '((1 ((1
                    ((g3 c4 e4 g4)))
                    (2
                     ((c4 d4 e4 g4))))
                (2 ((1 ((1 1) :transposition 5))
                    (2 ((1 2) :transposition 5))))
                (3 ((1 ((1 1) :transposition -2))
                    (2 ((1 2) :transposition -2)))))))
      (find-sets-with-pitches msp '(c4)))

=>
(
COMPLETE-SET: complete: NIL
```

```

[...]
data: (BF3 C4 D4 F4)
[...]
COMPLETE-SET: complete: NIL
[...]
data: (C4 F4 A4 C5)
[...]
COMPLETE-SET: complete: NIL
[...]
data: (C4 D4 E4 G4)
[...]
COMPLETE-SET: complete: NIL
[...]
data: (G3 C4 E4 G4)
)

```

;; Search for a set of two pitches, printing the successfully matched sets

```

(let ((msp (make-set-palette
  'test
  '((1 ((1
    ((g3 c4 e4 g4)))
    (2
    ((c4 d4 e4 g4))))))
    (2 ((1 ((1 1) :transposition 5))
      (2 ((1 2) :transposition 5))))
    (3 ((1 ((1 1) :transposition -2))
      (2 ((1 2) :transposition -2)))))))
  (print (find-sets-with-pitches msp '(c4 f4) t)))

```

=>

```

(2 1): (C4 F4 A4 C5)
(3 2): (BF3 C4 D4 F4)
(
COMPLETE-SET: complete: NIL
[...]
data: (BF3 C4 D4 F4)
COMPLETE-SET: complete: NIL
[...]
data: (C4 F4 A4 C5)
)

```

## SYNOPSIS:

```
(defmethod find-sets-with-pitches ((sp set-palette) pitches &optional print)
```

**20.2.254 set-palette/force-micro-tone***[ set-palette ] [ Methods ]***DESCRIPTION:**

Change the value of the MICRO-TONE slot of all pitch objects in a given set-palette object to the specified <value>.

**ARGUMENTS:**

- A set-palette object.

**OPTIONAL ARGUMENTS:**

- An item of any type that is to be the new value of the MICRO-TONE slot of all pitch objects in the given sc-set object (generally T or NIL). Default = NIL.

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```
;; Create a set-palette object whose individual sets contain some micro-tones
;; and print the contents of all the MICRO-TONE slots to see the values. Then
;; apply the force-micro-tone method and print the slots again to see the
;; changes.
```

```
(let ((msp (make-set-palette
              'test
              '((1 ((1
                    ((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5 dqf5 gs5
                      b5)))
                  (2
                   ((bf1 d2 fqf2 fqs2 b2 c3 f3 g3 bqf3 bqs3 fs4 gs4 a4 cs5 gqf5)
                    :subsets
                    ((tc1 (d2 g3 cs5))
                     (tc2 (eqs2 f3 bqf3))
                     (tc3 (b2 bqs3 gqf5)))))))
              (2 ((1 ((1 1) :transposition 5))
                  (2 ((1 2) :transposition 5))))
              (3 ((1 ((1 1) :transposition -2))
                  (2 ((1 2) :transposition -2)))))))
```



```

(print (loop for i in (data msp)
  collect (loop for j in (data (data i))
    collect (loop for p in (data j)
      collect (micro-tone p))))))

(force-micro-tone msp t)
(print (loop for i in (data msp)
  collect (loop for j in (data (data i))
    collect (loop for p in (data j)
      collect (micro-tone p))))))

=>
(((NIL NIL T NIL NIL T T NIL NIL NIL NIL T T NIL NIL)
  (NIL NIL T T NIL NIL NIL NIL T T NIL NIL NIL NIL T))
 (NIL NIL T NIL NIL T T NIL NIL NIL NIL T T NIL NIL)
  (NIL NIL T T NIL NIL NIL NIL T T NIL NIL NIL NIL T))
 (NIL NIL T NIL NIL T T NIL NIL NIL NIL T T NIL NIL)
  (NIL NIL T T NIL NIL NIL NIL T T NIL NIL NIL NIL T))

(((T T T T T T T T T T T T T T) (T T T T T T T T T T T T T T))
 ((T T T T T T T T T T T T T T) (T T T T T T T T T T T T T T))
 ((T T T T T T T T T T T T T T) (T T T T T T T T T T T T T T)))

```

**SYNOPSIS:**

```
(defmethod force-micro-tone ((sp set-palette) &optional value)
```

**20.2.255 set-palette/gen-max-coll-file**

```
[ set-palette ] [ Methods ]
```

**DATE:**

26-Dec-2009

**DESCRIPTION:**

Write a text file from a given set-palette object suitable for reading into Max/MSP's coll object. The resulting text file has one line for each set in the palette, with the coll index being the ID of the set. The rest of the line is a list of frequency/amplitude pairs (or MIDI note numbers if required).

**ARGUMENTS:**

- A set-palette object.
- The name (and path) of the .txt file to write.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether MIDI note numbers or frequencies should be generated. T = MIDI. Default = NIL (frequencies).

**RETURN VALUE: EXAMPLE:**

```
;; Generates frequencies by default
(let ((msp (make-set-palette
  'test
  '((1 ((1
    ((g3 c4 e4 g4)))
    (2
      ((c4 d4 e4 g4))))))
    (2 ((1 ((1 1) :transposition 5))
      (2 ((1 2) :transposition 5))))
    (3 ((1 ((1 1) :transposition -2))
      (2 ((1 2) :transposition -2)))))))
  (gen-max-coll-file msp "/tmp/msp-mcf.txt"))

;; Set the optional argument to T to generate MIDI note numbers instead
(let ((msp (make-set-palette
  'test
  '((1 ((1
    ((g3 c4 e4 g4)))
    (2
      ((c4 d4 e4 g4))))))
    (2 ((1 ((1 1) :transposition 5))
      (2 ((1 2) :transposition 5))))
    (3 ((1 ((1 1) :transposition -2))
      (2 ((1 2) :transposition -2)))))))
  (gen-max-coll-file msp "/tmp/msp-mcf.txt" t))
```

**SYNOPSIS:**

```
(defmethod gen-max-coll-file ((sp set-palette) file &optional midi)
```

**20.2.256 set-palette/gen-midi-chord-seq**

```
[ set-palette ] [ Methods ]
```

**DESCRIPTION:**

Generate a MIDI file in which each set of the given set-palette object is played at 1 second intervals.

**ARGUMENTS:**

- A set-palette object.
- The name and path for the MIDI file to be generated.

**RETURN VALUE:**

Always returns T

**EXAMPLE:**

```
(let ((msp (make-set-palette
  'test
  '((1 ((1
    ((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5 dqf5 gs5
      b5)))
    (2
      ((bf1 d2 fqf2 fqs2 b2 c3 f3 g3 bqf3 bqs3 fs4 gs4 a4 cs5 gqf5)
      :subsets
      ((tc1 (d2 g3 cs5))
       (tc2 (eqs2 f3 bqf3))
       (tc3 (b2 bqs3 gqf5)))))))
    (2 ((1 ((1 1) :transposition 5))
      (2 ((1 2) :transposition 5))))
    (3 ((1 ((1 1) :transposition -2))
      (2 ((1 2) :transposition -2)))))))
  (gen-midi-chord-seq msp "/tmp/msp-gmchs.mid"))
```

**SYNOPSIS:**

```
(defmethod gen-midi-chord-seq ((sp set-palette) midi-file)
```

**20.2.257 set-palette/make-set-palette**

[ *set-palette* ] [ *Functions* ]

**DESCRIPTION:**

Create a set-palette object.

Note that the sets in this palette may refer to previously defined sets in order to avoid retyping note lists (see example below).

**ARGUMENTS:**

- A symbol that is to be the ID of the resulting set-palette object.
- A recursive list of key/data pairs, of which the deepest level of data will be a list of note-name symbols.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :recurse-simple-data. T or NIL to indicate whether to interpret two-element data lists as recursive palettes. Default = T.
- :warn-note-found. T or NIL to indicate whether to print warnings when specified data is not found with subsequent calls to the get-data method.

**RETURN VALUE:**

A set-palette object.

**EXAMPLE:**

```
;;; Create a set-palette object
(make-set-palette
 'test
 '((1 ((1
      ((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5 dqf5 gs5 b5)
      :subsets
      ((tc1 ((ds2 e3 a4) "a-tag"))
       (tc2 (bf1 d4 cqs5))
       (tc3 (c3 cs4 gs5))))))
      (2
      ((bf1 d2 fqf2 fqs2 b2 c3 f3 g3 bqf3 bqs3 fs4 gs4 a4 cs5 gqf5)
      :subsets
      ((tc1 (d2 g3 cs5))
       (tc2 (eqs2 f3 bqf3))
       (tc3 (b2 bqs3 gqf5))))))
      (3
      ((cqs2 fs2 g2 c3 d3 fqs3 gqf3 cs4 ds4 e4 gs4 dqf5 f5 a5 bqs5)
      :subsets
      ((tc1 (cqs2 c3 f5))
       (tc2 (fs2 e4 bqs5))
       (tc3 (d3 ef4 a5)))))))
      (2 ((1 ((1 1) :transposition 5))
        (2 ((1 2) :transposition 5))
        (3 ((1 3) :transposition 5))))
      (3 ((1 ((1 1) :transposition -2))
        (2 ((1 2) :transposition -2))
        (3 ((1 3) :transposition -2))))))
```

=&gt;

SET-PALETTE:

PALETTE:

RECURSIVE-ASSOC-LIST: recurse-simple-data: T

num-data: 9

linked: NIL

full-ref: NIL

ASSOC-LIST: warn-not-found T

CIRCULAR-SCLIST: current 0

SCLIST: sclist-length: 3, bounds-alert: T, copy: T

LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL

NAMED-OBJECT: id: TEST, tag: NIL,

data: (

[...]

;;; NB A simple list of sets (with unique id slots) can also be passed.

;;; Create a set-palette object by referencing a set-palette-object already

;;; defined (sp1) and transposing a clone of that object.

(make-set-palette

'test

'((sp1

((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5  
dqf5 gs5 b5)

:subsets

((tc1 (ds2 e3 a4))

(tc2 (bf1 d4 cqs5))

(qc1 (aqf2 e3 a4 dqf5 b5))

(qc2 (bf1 c3 gqs3 cs4 cqs5)))

:related-sets

((missing (bqs0 eqs1 f5 aqs5 eqf6 fqs6  
bqf6 dqs7 fs7))))))

(sp2

(sp1 :transposition 13))))

=&gt;

SET-PALETTE:

PALETTE:

RECURSIVE-ASSOC-LIST: recurse-simple-data: T

num-data: 2

linked: NIL

full-ref: NIL

ASSOC-LIST: warn-not-found T

CIRCULAR-SCLIST: current 0

SCLIST: sclist-length: 2, bounds-alert: T, copy: T

```

LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: TEST, tag: NIL,
data: (
  COMPLETE-SET: complete: NIL
            num-missing-non-chromatic: 7
            num-missing-chromatic: 2
            missing-non-chromatic: (BQS BQF AQS FQS EQS EQF DQS)
            missing-chromatic: (FS F)
  [...]
    subsets:
  TC1: (DS2 E3 A4)
  TC2: (BF1 D4 CQS5)
  QC1: (AQF2 E3 A4 DQF5 B5)
  QC2: (BF1 C3 GQS3 CS4 CQS5)
    related-sets:
  MISSING: (BQS0 EQS1 F5 AQS5 EQF6 FQS6 BQF6 DQS7 FS7)
  SCLIST: sclist-length: 15, bounds-alert: T, copy: T
  LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
  NAMED-OBJECT: id: SP1, tag: NIL,
  data: (BF1 EF2 AQF2 C3 E3 GQF3 GQS3 CS4 D4 G4 A4 CQS5 DQF5 GS5 B5)
  [...]
  COMPLETE-SET: complete: NIL
            num-missing-non-chromatic: 7
            num-missing-chromatic: 2
            missing-non-chromatic: (BQS BQF AQS FQS EQS EQF DQS)
            missing-chromatic: (FS F)
  TL-SET: transposition: 13
            limit-upper: NIL
            limit-lower: NIL
  [...]
    subsets:
  TC1: (E3 F4 BF5)
  TC2: (B2 EF5 DQF6)
  QC1: (AQS3 F4 BF5 DQS6 C7)
  QC2: (B2 CS4 AQF4 D5 DQF6)
    related-sets:
  MISSING: (BQS0 EQS1 F5 AQS5 EQF6 FQS6 BQF6 DQS7 FS7)
  SCLIST: sclist-length: 15, bounds-alert: T, copy: T
  LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
  NAMED-OBJECT: id: SP2, tag: NIL,
  data: (B2 E3 AQS3 CS4 F4 GQS4 AQF4 D5 EF5 AF5 BF5 DQF6 DQS6 A6 C7)
  *****
)

```

**SYNOPSIS:**

```
(defun make-set-palette (id palette
                        &key (recurse-simple-data t) (warn-not-found t))
```

### 20.2.258 set-palette/recursive-set-palette-from-ring-mod

[ *set-palette* ] [ *Functions* ]

#### DESCRIPTION:

Create a set-palette object consisting of sub palette-objects whose pitch content is generated based on ring modulation routines applied to the specified pitches.

#### ARGUMENTS:

- A list of note-name symbols, each of which will serve as the reference pitch from which a new set-palette object is made using the set-palette-from-ring-mod method.
- A symbol that will be the ID for the top-level set-palette object. The IDs of the new set-palette objects contained in the top-level object are generated from the note-name symbols of the reference-pitches, with the IDs of the pitch sets contained with them then generated by sequential numbers.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :partials. A list of integers that are the partials which the method is to ring modulate, with 1 being either the reference-note or the bass note that would have the reference-note as the highest partial in the given list. Default = '(1 3 5 7).
- :warn-no-bass. T or NIL to indicate whether to issue a warning when ring-mod-bass fails to find suitable bass notes for the generated sets. T = warn. Default = T.
- :do-bass. T or NIL to indicate whether to add notes created by the ring-mod-bass function to the resulting set-palette object. T = create and add bass notes. Default = T.
- :remove-octaves. T or NIL to indicate whether to remove the upper instances of any octave-equivalent pitches from the resulting set-palette object. T = remove. Default = NIL.
- :min-bass-notes. An integer that is the minimum number of bass notes to be generated and added to the resulting set-palette object. Default = 1.
- :ring-mod-bass-octave. An integer that is the MIDI octave reference number (such as the 4 in 'C4), indicating the octave from which the bass note(s) are to be taken.





```

remove-octaves
(min-bass-notes 1)
(partials '(1 3 5 7)))

```

### 20.2.259 set-palette/ring-mod

[ *set-palette* ] [ *Functions* ]

#### DESCRIPTION:

Ring modulate two frequencies and return the resulting pitch and harmonic partials thereof.

#### ARGUMENTS:

- A first pitch, either as a numeric hertz frequency or a note-name symbol.
- A second pitch, either as a numeric hertz frequency or a note-name symbol. The second value needn't be higher than first.

#### OPTIONAL ARGUMENTS:

keyword arguments

- :return-notes. T or NIL to indicate whether to return the results as note-name symbols or frequency numbers. T = note-name symbols. Default = NIL.
- :pitch1-partial. An integer that indicates how many harmonic partials of the first pitch are to be included in the modulation. Default = 3.
- :pitch2-partial. An integer that indicates how many harmonic partials of the second pitch are to be included in the modulation. Default = 2.
- :min-freq. A number that is the the minimum frequency (hertz) that may be returned. Default = 20.
- :max-freq. A number that is the the maximum frequency (hertz) that may be returned. Default = 20000.
- :round. T or NIL to indicate whether frequency values returned are first rounded to the nearest hertz. T = round. Default = T
- :remove-duplicates. T or NIL to indicate whether any duplicate frequencies are to be removed from the resulting list before returning it. T = remove. Default = T.
- :print. T or NIL to indicate whether resulting data is to be printed as it is being generated. T = print. Default = NIL.
- :remove-octaves. T or NIL to indicate whether octave repetitions of pitches will be removed from the resulting list before returning it, keeping only the lowest instance of each pitch. This argument can also be set as a number or a list of numbers that indicates which octave

repetitions will be allowed, the rest being removed. For example,  
`:remove-octaves '(1 2)` will remove all octave repetitions of a given pitch except for those that are 1 octave and 2 octaves above the given pitch; thus `'(c1 c2 c3 c4 c5)` would return `'(c1 c2 c3)`, removing `c4` and `c5`. Default = `NIL`.  
 - `:scale`. A variable that indicates which scale to use when converting frequencies to note-names. Default = `cm::*scale*` i.e. the value to which the Common Music scale is set, which in *slippery chicken* is `*quarter-tone*` by default.

**RETURN VALUE:**

A list of note-name symbols or frequencies.

**EXAMPLE:**

`;; Apply ring modulation to 'C4 and 'D4, using 5 partials of the first pitch  
 ;; and 3 partials of the second, removing octave repetitions, and returning the  
 ;; results as rounded hertz-frequencies`

```
(ring-mod 'c4 'd4
  :pitch1-partial 5
  :pitch2-partial 3
  :min-freq 60
  :max-freq 2000
  :remove-octaves t)
```

```
=> (64.0 96.0 166.0 198.0 230.0 358.0 427.0 459.0 491.0 555.0 619.0 817.0
    1079.0 1143.0 1340.0 1372.0 1404.0 1666.0 1895.0 1927.0)
```

`;; Applying ring modulation to two frequencies, returning the results as  
 ;; note-name symbols within the chromatic scale.`

```
(ring-mod '261.63 '293.66
  :return-notes t
  :remove-duplicates nil
  :scale cm::*chromatic-scale*)
```

```
=> (C1 C2 G3 BF3 E4 B4 CS5 AF5 AF5 CS6 CS6 F6)
```

**SYNOPSIS:**

```
(defun ring-mod (pitch1 pitch2 ;; hertz or notes
  &key (return-notes nil) (pitch1-partial 3) (pitch2-partial 2)
  (min-freq 20) (max-freq 20000) (round t) (remove-duplicates t)
  (print nil) remove-octaves (scale cm::*scale*))
```

**20.2.260 set-palette/ring-mod-bass***[ set-palette ] [ Functions ]***DESCRIPTION:**

Using ring-modulation techniques, invent (sensible) bass note(s) from a list of frequencies.

**ARGUMENTS:**

- A list of numbers that are hertz frequencies from which the bass note(s) are to be generated.

**OPTIONAL ARGUMENTS:**

keyword arguments

- :bass-octave. An integer that is an octave indicator (e.g. the 4 in 'C4). The method will only return any frequencies/note-names generated that fall in this octave. Default = 0.
- :low. A note-name symbol that is the lowest possible pitch of those returned. This argument further restricts the :bass-octave argument. Thus a :bass-octave value of 1 could be further limited to no pitches below :low 'DS1. Default = 'A0.
- :high. A note-name symbol that is the highest possible pitch of those returned. This argument further restricts the :bass-octave argument. Thus a :bass-octave value of 1 could be further limited to no pitches above :high 'FS1. Default = 'G3.
- :round. T or NIL to indicate whether the frequencies returned are rounded to integer values. T = round. Default = T.
- :warn. T or NIL to print a warning when no bass can be created from the specified frequencies/note-names. T = print warning. Default = T.
- :return-notes. T or NIL to indicate whether the resulting pitches should be returned as note-names instead of frequencies. T = return as note-names. Default = NIL.
- :scale. A variable pointing to the scale to which any translation of frequencies into note-names symbols should take place. By default this value is set to cm::\*scale\*, which is automatically set by slippery chicken to 'quarter-tone at initialisation. To return e.g. pitches rounded to chromatic note-names set this argument to cm::\*chromatic-scale\*.

**RETURN VALUE:**

Returns a list of frequencies by default.

Setting the :return-notes keyword argument to T will cause the method to return note-name symbols instead.

**EXAMPLE:**

```
;; Simple usage with default keyword argument values
(ring-mod-bass '(261.63 293.66 329.63 349.23))
```

```
=> (28 29 32)
```

```
;; Return as note-names instead, in quarter-tone scale by default
(ring-mod-bass '(261.63 293.66 329.63 349.23)
  :return-notes t)
```

```
=> (A0 BF0 BQS0)
```

```
;; Set the :scale argument to cm::*chromatic-scale* to return equal-tempered
;; note-name symbols instead
(ring-mod-bass '(261.63 293.66 329.63 349.23)
  :return-notes t
  :scale cm::*chromatic-scale*)
```

```
=> (A0 BF0 C1)
```

```
;; Return pitches from bass octave 1 rather than default 0
(ring-mod-bass '(261.63 293.66 329.63 349.23 392.00)
  :return-notes t
  :scale cm::*chromatic-scale*
  :bass-octave 1)
```

```
=> (CS1 D1 F1 G1 A1 B1)
```

```
;; Further limit the notes returned by setting :low and :high values
(ring-mod-bass '(261.63 293.66 329.63 349.23 392.00)
  :return-notes t
  :scale cm::*chromatic-scale*
  :bass-octave 1
  :low 'e1
  :high 'a1)
```

```
=> (F1 G1)
```

```
;; Set the :round argument to NIL to return decimal-point frequencies
(ring-mod-bass '(261.63 293.66 329.63 349.23 392.00)
  :bass-octave 1
  :low 'e1
  :high 'a1
  :round NIL)
```

```
=> (42.76999999999998 43.45666666666667 43.80000000000001 49.16999999999999)
```

```
;; The method prints a warning by default if no bass note can be made
(ring-mod-bass '(261.63))
```

```
=>
```

```
NIL
```

```
WARNING: set-palette::ring-mod-bass: can't get bass from (261.63)!
```

```
;; This warning can be suppressed by setting the :warn argument to NIL
(ring-mod-bass '(261.63) :warn nil)
```

```
=> NIL
```

## SYNOPSIS:

```
(defun ring-mod-bass (freqs &key (bass-octave 0) (low 'a0) (high 'g3) (round t)
                     (warn t) (return-notes nil) (scale cm::*scale*))
```

### 20.2.261 set-palette/set-palette-from-ring-mod

[ *set-palette* ] [ *Functions* ]

## DESCRIPTION:

Create a new set-palette object from the pitches returned by applying ring modulation procedures (difference and sum tones of partials).

## ARGUMENTS:

- A note-name symbol that is the central pitch from which we perform the ring-modulation. See :partials below.
- A symbol that is to be the ID for the new set-palette object.

## OPTIONAL ARGUMENTS:

keyword arguments

- :partials. A list of integers that are the partials which the method uses to ring modulate. We create partials ascending from the reference-note but also ascending from a fundamental calculated so that reference-note would be the highest partial in the partials list. E.g. if reference-note were 'a4 (440Hz) and :partials was '(1 2) we'd have partial frequencies of 440 and 880, as these are the ascending partials 1 and 2 from 440, but also have 220, as that is the fundamental for which 440 would be the highest partial out of (1 2). Default = '(1 3 5 7).

- :warn-no-bass. T or NIL to indicate whether to issue a warning when ring-mod-bass fails to find suitable bass notes for the generated sets. T = warn. Default = T.
- :do-bass. T or NIL to indicate whether to add notes created by the ring-mod-bass function to the resulting set-palette object. T = create and add bass notes. Default = T.
- :remove-octaves. T or NIL to indicate whether to remove the upper instances of any octave-equivalent pitches from the resulting set-palette object. T = remove. Default = NIL.
- :min-bass-notes. An integer that is the minimum number of bass notes to be generated and added to the resulting set-palette object. Default = 1.
- :ring-mod-bass-octave. An integer that is the MIDI octave reference number (such as the 4 in 'C4), indicating the octave from which the bass note(s) are to be taken.

**RETURN VALUE:**

A set-palette object.

**EXAMPLE:**

```
;; Simple usage with default keyword argument values
(set-palette-from-ring-mod 'a4 'spfrm-test)
```

```
=>
```

```
SET-PALETTE:
```

```
PALETTE:
```

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 21
                      linked: NIL
                      full-ref: NIL
```

```
ASSOC-LIST: warn-not-found T
```

```
CIRCULAR-SCLIST: current 0
```

```
SCLIST: sclist-length: 21, bounds-alert: T, copy: T
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: SPFRM-TEST, tag: NIL,
```

```
data: (
```

```
[...]
```

```
;;; Use with the :partials argument
```

```
(let ((spfrm2 (set-palette-from-ring-mod 'a4 'spfrm-test
                                         :partials '(2 4 6 8))))
  (loop for cs in (data spfrm2) collect (pitch-symbols cs)))
```

```
=> ((BQS0 CS5 E5 GQF5 B5 CS6 DQS6 FQS6 GQF6 AF6 BF6 B6 C7)
     (BQF0 B0 A2 A3 E4 A4 CS5 E5 GQF5))
```

```

(BQS0 FQS6 GQF6 AF6 BF6 B6 C7 GQS7 AF7 AQF7 AQS7 BF7 BQF7)
(B0 A2 A3 E4 A4 CS5 E5 GQF5 A5 B5) (BQS0 DQF7 DQS7 EQF7 EQS7 FQS7 FS7)
(BQF0 A2 A3 E4 CS5 E5 GQF5 B5 CS6 DQS6)
(AQS0 BQF0 B0 GQS7 AF7 AQF7 AQS7 BF7 BQF7)
(B0 A4 E5 CS6 E6 GQF6 B6 CS7 DQS7 FQS7 GQF7) (B0 A5 A6 E7 A7)
(B0 A3 CS5 CS6 DQS6 FQS6 GQF6 B6 C7 DQF7 DQS7 FS7 AF7) (BQS0 A5 A6 E7 A7)
(B0 A4 A5 E6 A6 CS7 E7 GQF7 A7) (BQS0 A5 A6 E7)
(BQS0 CS6 E6 GQF6 B6 CS7 DQS7 FQS7 GQF7 AF7 BF7 B7 C8)
(BQF0 B0 BQS0 A2 A3 E4 A4 CS5 GQF5 A5 B5 CS6 E6)
(BQS0 B6 CS7 DQS7 FQS7 GQF7 AF7) (B0 A3 A4 E5 A5 CS6 E6 GQF6)
(B0 BQS0 FQS7 GQF7 AF7 BF7 B7 C8) (BQS0 CS6 FQS6 C7 DQS7 FQS7 GQS7 BQF7 C8)
(B0 A5 A6 E7 A7) (BQS0 A5 E6 CS7 E7 GQF7 B7) (BQS0 A6 A7)
(BQS0 AF6 B6 DQF7 FS7 AF7 AQS7)
(BQF0 B0 BQS0 A2 A3 CS5 GQF5 CS6 DQS6 FQS6 GQF6 BF6)
(BQS0 EQF7 FQS7 GQS7 BQF7 C8) (BQS0 A6 CS7 GQF7 A7) (B0 A5 A6)
(BQS0 CS7 E7 GQF7 B7))

;;; Use with the :do-bass and :remove-octaves arguments
(let ((spfrm3 (set-palette-from-ring-mod 'a4 'spfrm-test
                                         :do-bass nil
                                         :remove-octaves t)))
  (loop for cs in (data spfrm3) collect (pitch-symbols cs)))
=> ((BQS1 GQF3 EF4 A4 DQF5) (DQF6 DQS6 EF6 F6 FQS6 GQF6 EQF7 EQS7)
    (BQS2 GQF3 A4 DQF5 F5 GQS5) (BQS6 C7 CQS7 DQF7 D7 DQS7)
    (BQS3 EF4 GQF4 DQF5 F5 GQS5 BF5 CQS6) (FQS7 FS7 GQF7 G7 GQS7)
    (GQF5 BF5 DQF6 AQF6 C7 DQS7 F7 GQS7) (BQS1 A4 F5 GQS5 DQS6)
    (GQS6 AQS6 BQS6 DQS7 EQF7 F7 BQF7) (BQS1 EF4 F5 GQS5 CQS6 FQS6)
    (EF7 EQS7 FQS7 GQS7 AQF7 AQS7) (F5 BQS5 GQS6 B6 D7 FS7 AF7 AQS7) (A4 GQF7)
    (A4 CS7 GQF7) (A4 CS7) (EF6 G6 BF6 F7 AQF7 BQS7)
    (BQS1 GQF3 DQF5 CQS6 DQS6 F6 AQS6) (CQS7 DQS7 F7 AQF7 BF7 BQS7)
    (E6 A6 GQF7 B7) (A4 E6 B7) (A6 CS7 E7 B7))

```

**SYNOPSIS:**

```

(defun set-palette-from-ring-mod (reference-note id &key
                                (warn-no-bass t)
                                (do-bass t)
                                remove-octaves
                                (min-bass-notes 1)
                                (ring-mod-bass-octave 0)
                                (partials '(1 3 5 7)))

```

**20.2.262 set-palette/set-palette-p**

[ set-palette ] [ Functions ]

**DESCRIPTION:**

Test whether a given object is a set-palette object.

**ARGUMENTS:**

- A lisp object

**EXAMPLE:**

```
(let ((msp (make-set-palette
              'test
              '(1 ((1
                    ((bf1 ef2 aqf2 c3 e3 gqf3 gqs3 cs4 d4 g4 a4 cqs5 dqf5 gs5
                      b5)))
                  (2
                   ((bf1 d2 fqf2 fqs2 b2 c3 f3 g3 bqf3 bqs3 fs4 gs4 a4 cs5 gqf5)
                    :subsets
                    ((tc1 (d2 g3 cs5))
                     (tc2 (eqs2 f3 bqf3))
                     (tc3 (b2 bqs3 gqf5)))))))
              (2 ((1 ((1 1) :transposition 5))
                  (2 ((1 2) :transposition 5))))
              (3 ((1 ((1 1) :transposition -2))
                  (2 ((1 2) :transposition -2)))))))
    (set-palette-p msp))

=> T
```

**RETURN VALUE:**

t or nil

**SYNOPSIS:**

```
(defun set-palette-p (thing)
```

**20.2.263 palette/sndfile-palette**

[ palette ] [ Classes ]

**NAME:**

sndfile-palette



File: sndfile-palette.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
palette -> sndfile-palette

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the sndfile-palette class, which is a simple palette that checks that all the sound files given in a list for each id exist. See comments in methods for limitations and special features of this class.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 18th March 2001

\$\$ Last modified: 16:19:56 Wed Oct 23 2013 BST

SVN ID: \$Id: sndfile-palette.lsp 4223 2013-10-29 10:57:09Z medward2 \$

## 20.2.264 sndfile-palette/analyse-followers

[ *sndfile-palette* ] [ *Methods* ]

### DESCRIPTION:

Using the followers slots of each sndfile in the palette, go through each sndfile in the palette and generate a large number of following sounds, i.e. emulate the max-play. The results of the follow-on process are then analysed and a warning will be issued if any sndfile seems to dominate (defined as being present at least twice as many times as its 'fair share', where 'fair share' would mean an even spread for all the sound files in the palette).

### ARGUMENTS:

- The sndfile-palette object.

### OPTIONAL ARGUMENTS:

How many times to repeat the generation process. Default = 1000.

### RETURN VALUE:

T or NIL depending on whether the analysis detects an even spread or not.

#### SYNOPSIS:

```
(defmethod analyse-followers ((sfp sndfile-palette) &optional (depth 1000))
```

#### 20.2.265 sndfile-palette/auto-cue-nums

[ *sndfile-palette* ] [ *Methods* ]

#### DESCRIPTION:

Set the cue-num slot of every sndfile-ext object in the palette to be an ascending integer starting at 2. NB If a sndfile has it's :use slot set to NIL it won't be given a cue number.

#### ARGUMENTS:

- a sndfile-palette object.

#### RETURN VALUE:

The cue number of the last sndfile-ext object.

#### SYNOPSIS:

```
(defmethod auto-cue-nums ((sfp sndfile-palette))
```

#### 20.2.266 sndfile-palette/find-sndfile

[ *sndfile-palette* ] [ *Methods* ]

#### DESCRIPTION:

Return the full directory path and file name of a specified sound file, from within the directories given in the PATHS slot.

#### ARGUMENTS:

- A sndfile-palette object.
- The name of a sound file from within that object. This can be a string or a symbol. Unless it is given as a string, it will be handled as a symbol and will be converted to lowercase. Inclusion of the file extension is optional.

**RETURN VALUE:**

Returns the full directory path and file name of the specified sound file as a string.

**EXAMPLE:**

```
(let ((msfp (make-sfp 'sfp-test
  ((sndfile-group-1
    (test-sndfile-1))
   (sndfile-group-2
    (test-sndfile-2 test-sndfile-3
      (test-sndfile-4 :frequency 261.61)))
   (sndfile-group-3
    ((test-sndfile-5 :start 0.006 :end 0.182)
     test-sndfile-6)))
    :paths
    '("/path/to/sndfiles-dir-1"
      "/path/to/sndfiles-dir-2"))))
  (find-sndfile msfp 'test-sndfile-4))

=> "/path/to/sndfiles-dir-2/test-sndfile-4.aiff"
```

**SYNOPSIS:**

```
(defmethod find-sndfile ((sfp sndfile-palette) sndfile)
```

**20.2.267 sndfile-palette/get-snd-with-cue-num**

[ *sndfile-palette* ] [ *Methods* ]

**DESCRIPTION:**

Return the (first, but generally unique) sndfile object which has the given cue-num slot.

**ARGUMENTS:**

- the sndfile-palette object.
- the cue number (integer).

**RETURN VALUE:**

The sndfile/sndfile-ext object with the given cue number or NIL if it can't be found.

**SYNOPSIS:**

```
(defmethod get-snd-with-cue-num ((sfp sndfile-palette) cue-num)
```

**20.2.268 sndfile-palette/make-sfp**

[ *sndfile-palette* ] [ *Functions* ]

**DESCRIPTION:**

Make a `sndfile-palette` object. This object is a simple palette which checks to make sure that all of the sound files in a given list exist for each given ID.

Sound files are given as as single names, without the path and without the extension. These can be given using the optional keyword arguments `<paths>` and `<extensions>`.

NB Although this class is a palette and therefore a subclass of `recursive-assoc-list`, the sound lists in this case cannot be nested beyond a depth of two (as in example below).

**ARGUMENTS:**

- An ID for the palette.
- A list of lists that contains IDs for the names of one or more groups of sound files, each paired with a list of one or more names of existing sound files. The sound file names themselves can be paired with keywords from the `sndfile` class, such as `:start`, `:end`, and `:frequency`, to define and describe segments of a given sound file.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:paths`. A list of one or more paths to where the sound files are located.
- `:extensions`. A list of one or more sound file extensions for the specified sound files. The default initialization for this slot of the `sndfile-palette` already contains ("wav" "aiff" "aif" "snd"), so this argument can often be left unspecified.
- `:warn-not-found`. T or NIL to indicate whether a warning should be printed to the Lisp listener if the specified sound file cannot be found.  
T = print warning. Default = T.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(let ((msfp (make-sfp 'sfp-test
  '((sndfile-group-1
    (test-sndfile-1))
    (sndfile-group-2
    (test-sndfile-2 test-sndfile-3
    (test-sndfile-4 :frequency 261.61)))
    (sndfile-group-3
    ((test-sndfile-5 :start 0.006 :end 0.182)
    test-sndfile-6)))
  :paths '("/path/to/sound-files-dir-1/"
    "/path/to/sound-files-dir-2/")))))
```

**SYNOPSIS:**

```
(defun make-sfp (id sfp &key paths (extensions '("wav" "aiff" "aif" "snd"))
  with-followers (warn-not-found t))
```

**20.2.269 sndfile-palette/make-sfp-from-groups-in-wavelab-marker-file**

[ *sndfile-palette* ] [ *Functions* ]

**DESCRIPTION:**

Automatically generate a `sndfile-palette` object using the specified sound file from grouping defined in the specified wavelab marker file.

The `<marker-file>` argument can be passed as a list of marker files, in which case these will first be concatenated.

**ARGUMENTS:**

- A string that is the name of the marker file, including the directory path and extension.
- A string that is the name of the sound file. This can either be a full directory path, file name, and extension, or just a base file name. If the latter, values for the optional arguments `:paths` and `:extensions` must also be specified.

**OPTIONAL ARGUMENTS:**

- `:paths`. NIL or a list of strings that are the directory paths to the specified sound files. If the sound file is passed with the directory path, this must be set to NIL. NB: The paths given here apply only to the

- sound files, not to the marker files. Default = NIL.
- :extensions. A list of strings that are the extensions to the given sound files. If the sound files are passed with their extensions, this must be set to NIL. Default = NIL.
- :warn-not-found. T or NIL to indicate whether to print a warning to the listener if the specified sound file is not found. T = print a warning. Default = NIL.
- :sampling-rate. An integer that is the sampling rate of the specified sound file. Changing this value will alter the start-times determined for each sound segment. Default = 44100.
- :print. T or NIL to indicate whether feedback about the groups found and created should be printed to the listener. T = print. Default = T.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
(make-sfp-from-groups-in-wavelab-marker-file
  "/path/to/24-7.mrk"
  "24-7"
  :paths '("/path/to/sndfile/directory/")
  :sampling-rate 44100
  :extensions '("wav"))
```

=>

```
24 markers read from /path/to/24-7.mrk
Adding tapping: 2.753 -> 4.827
Adding tapping: 5.097 -> 6.581
Adding tapping: 6.763 -> 8.538
Adding splinter: 13.878 -> 15.993
Adding tapping: 16.338 -> 18.261
Adding splinter: 19.403 -> 25.655
```

```
tapping: 4 sounds
splinter: 2 sounds
```

**SYNOPSIS:**

```
(defun make-sfp-from-groups-in-wavelab-marker-file (marker-file sndfile
  &key
  paths
  extensions
  warn-not-found
```

```
(sampling-rate 44100)
(print t))
```

### 20.2.270 sndfile-palette/make-sfp-from-wavelab-marker-file

[ *sndfile-palette* ] [ *Functions* ]

#### DESCRIPTION:

Automatically create a `sndfile-palette` object from the specified wavelab marker file and the specified sound file (from which the marker file must have been generated).

The function will produce a `sndfile-palette` object with multiple groups, each of which consists of the number of sound file segments specified using the `:snds-per-group` argument (defaults to 8). By default the segments will be collected into the groups in chronological order. If the optional `:random-every` argument is given a value, every *nth* group will consist of random segments instead.

The sound file segments of each group will correspond to the time points stored in the marker file.

The `<marker-file>` argument can consist of a list of marker files, in which case these would first be concatenated.

NB: Be aware that marker files created on operating systems differing from the one on which this function is called might trigger errors due to newline character mismatches.

#### ARGUMENTS:

- A string that is the name of the marker file, including the directory path and extension.
- A string that is the name of the sound file. This can either be a full directory path, file name, and extension, or just a base file name. If the latter, values for the optional arguments `:paths` and `:extensions` must also be specified.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- `:snds-per-group`. An integer that is the number of sound file segments to include in each group. Default = 8.
- `:random-every`. An integer to indicate that every *nth* group is to consist

- of random (rather than chronologically consecutive) sound file segments.  
Default = 999999 (i.e. essentially never)
- :paths. NIL or a list of strings that are the directory paths to the specified sound files. If the sound file is passed with the directory path, this must be set to NIL. NB: The paths given here apply only to the sound files, not to the marker files. Default = NIL.
- :sampling-rate. An integer that is the sampling rate of the specified sound file. Changing this value will alter the start-times determined for each sound segment. Default = 44100.
- :extensions. A list of strings that are the extensions to the given sound files. If the sound files are passed with their extensions, this must be set to NIL. Default = NIL.
- :warn-not-found. T or NIL to indicate whether to print a warning to the listener if the specified sound file is not found. T = print a warning. Default = NIL.
- :name. The name for the overall sndfile-palette and the base name for each group within (these will have a suffix that is an auto-incrementing number e.g. 'auto would become 'auto1 'auto2 etc.). Default = 'auto.

**RETURN VALUE:**

A sndfile-palette object.

**EXAMPLE:**

```
(make-sfp-from-wavelab-marker-file
  "/path/to/24-7.mrk"
  "24-7"
  :snds-per-group 2
  :random-every 3
  :paths '("/path/to/sound-file/directory/")
  :sampling-rate 44100
  :extensions '("wav"))
```

=>

```
SNDFILE-PALETTE: paths: (/Volumes/JIMMY/SlipperyChicken/sc/test-suite/)
                  extensions: (wav)
```

PALETTE:

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
                      linked: NIL
                      full-ref: NIL
```

ASSOC-LIST: warn-not-found NIL

CIRCULAR-SCLIST: current 0

SCLIST: sclist-length: 8, bounds-alert: T, copy: T

LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL



```

NAMED-OBJECT: id: AUTO, tag: NIL,
data: (
NAMED-OBJECT: id: "auto1", tag: NIL,
data: (

SNDFILE: path: /Volumes/JIMMY/SlipperyChicken/sc/test-suite/24-7.wav,
          snd-duration: 29.652811, channels: 2, frequency: 261.62555
          start: 0.09142857, end: 1.0361905, amplitude: 1.0, duration 0.94476193
          will-be-used: 0, has-been-used: 0
          data-consistent: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "24-7", tag: NIL,
data: /Volumes/JIMMY/SlipperyChicken/sc/test-suite/24-7.wav
[...]
```

**SYNOPSIS:**

```

(defun make-sfp-from-wavelab-marker-file (marker-file sndfile
                                          &key
                                          (snds-per-group 8)
                                          (random-every 999999) ;; i.e. never
                                          paths
                                          (sampling-rate 44100)
                                          extensions
                                          ;; MDE Fri Oct 5 14:04:08 2012
                                          (name 'auto)
                                          warn-not-found)
```

**20.2.271 sndfile-palette/max-play**

[ *sndfile-palette* ] [ *Methods* ]

**DESCRIPTION:**

This generates the data necessary to play the next sound in the current sound's followers list. See the `sndfile-ext` method for details.

**ARGUMENTS:**

- The `sndfile-palette` object.
- The fade (in/out) duration in seconds.
- The maximum loop duration in seconds.
- The time to trigger the next file, as a percentage of the current `sndfile-ext`'s duration.

**OPTIONAL ARGUMENTS:**

- whether to print data to the listener as it is generated. Default = NIL.

**RETURN VALUE:**

A list of values returned by the sndfile-ext method.

**SYNOPSIS:**

```
(defmethod max-play ((sfp sndfile-palette) fade-dur max-loop start-next
                    &optional print)
```

**20.2.272 sndfile-palette/osc-send-cue-nums**

[ *sndfile-palette* ] [ *Methods* ]

**DESCRIPTION:**

Send via OSC the cue number of each sound file in a form that a Max sflist~ can process and store.

**ARGUMENTS:**

- the sndfile-palette object.

**RETURN VALUE:**

The number of cue numbers sent. NB This is not the same as the last cue number as cues start from 2.

**SYNOPSIS:**

```
#+(and darwin sbcl)
(defmethod osc-send-cue-nums ((sfp sndfile-palette))
```

**20.2.273 sndfile-palette/reset**

[ *sndfile-palette* ] [ *Methods* ]

**DESCRIPTION:**

Reset the followers' slot circular list to the beginning or to <where>

**ARGUMENTS:**

- the sndfile-palette object.

**OPTIONAL ARGUMENTS:**

- an integer to set the point at which to restart. This can be higher than the number of followers as it will wrap. Default = nil (which equates to 0 lower down in the class hierarchy).
- whether to issue a warning if <where> is greater than the number of followers (i.e. that wrapping will occur). Default = T.

**RETURN VALUE:**

T

**SYNOPSIS:**

```
(defmethod reset ((sfp sndfile-palette) &optional where (warn t))
```

**20.2.274 recursive-assoc-list/parcel-data**

[ recursive-assoc-list ] [ Methods ]

**DATE:**

10 Apr 2010

**DESCRIPTION:**

Put all the data of a given recursive-assoc-list object into a new named-object at the top level of that recursive-assoc-list object; i.e. add a level of recursion. This is a means of making a collection of data before perhaps adding more with potentially conflicting ids.

**ARGUMENTS:**

- A recursive-assoc-list object.
- A symbol that is new the top-level id for the current data

**RETURN VALUE:**

The new recursive-assoc-list object.

**EXAMPLE:**

```
;; Collect all the data contained within the object 'mixed-bag and store it at
;; the top-level of 'mixed-bag within a new named-object with the id 'potpourri
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                           (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

    (parcel-data ral 'potpourri))
```

=>

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 1, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: FROM-PARCEL-DATA,
data: (
NAMED-OBJECT: id: POTPOURRI, tag: NIL,
data:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: NIL,
data: (
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM
[...]
```

## SYNOPSIS:

```
(defmethod parcel-data ((ral recursive-assoc-list) new-id)
```

### 20.2.275 recursive-assoc-list/r-count-elements

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

Return the total number of elements recursively (across all depths) of the given recursive-assoc-list object.

**ARGUMENTS:**

- A recursive-assoc-list object.

**RETURN VALUE:**

An integer.

**EXAMPLE:**

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

    (r-count-elements ral))

=> 8
```

**SYNOPSIS:**

```
(defmethod r-count-elements ((ral recursive-assoc-list))
```

**20.2.276 recursive-assoc-list/ral-econs**

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

Automatically create new recursive-assoc-list objects.

This method assumes that any existing key that may be referenced will be associated with data that is already a list, to the end of which the new data will be added (an error will be signalled if this is not the case.)

**ARGUMENTS:**

- The data which is to be added.
- The key to which the data is to be added (see above note for cases where this key already exists).
- The recursive-assoc-list object to which this data is to be added.

**RETURN VALUE:**

The new data added.

**EXAMPLE:**

```
;;; Make an empty recursive-assoc-list object and add key/data pairs to the top
;;; level.
```

```
(let ((ral (make-ral nil nil)))
  (print (get-all-refs ral))
  (ral-econs 'beam 'jim ral)
  (ral-econs 'turkey 'wild ral)
  (ral-econs 'roses 'four ral)
  (print (get-all-refs ral))
  (print (get-data-data 'wild ral)))
```

```
=>
```

```
NIL
```

```
((JIM) (WILD) (FOUR))
(TURKEY)
```

```
;;; Add data to existing keys within a given recursive-assoc-list object
;;; Note that the data VELVET must be a list for this to succeed
```

```
(let ((ral (make-ral 'mixed-bag
                     '((jim beam)
                       (wild turkey)
                       (four ((roses red)
                              (violets ((blue (velvet))
                                           (red ((dragon den)
                                                (viper nest)
                                                (fox hole)))
                                           (white ribbon))))))))))
  (print (get-all-refs ral))
  (ral-econs 'underground '(four violets blue) ral)
  (print (get-data-data '(four violets blue) ral)))
```

```
=>
```

```
((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
 (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE))
(VELVET UNDERGROUND)
```

**SYNOPSIS:**

```
(defmethod ral-econs (data key (ral recursive-assoc-list))
```

**20.2.277 recursive-assoc-list/recursivep**

```
[ recursive-assoc-list ] [ Methods ]
```

**DESCRIPTION:**

Check whether the data in a recursive-assoc-list object is really recursive.

**ARGUMENTS:**

- A recursive-assoc-list object.

**RETURN VALUE:**

T or NIL to indicate whether or not the tested data is recursive.  
T = recursive.

**EXAMPLE:**

```
;; The data in this recursive-assoc-list object is really recursive, and  
;; the method therefore returns T
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
      (recursivep ral))
```

```
=> T
```

```
;; The data in this recursive-assoc-list object is not actually recursive, and  
;; the method therefore returns NIL
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four roses)))))
```

```
(recursivep ral))

=> NIL
```

**SYNOPSIS:**

```
(defmethod recursivep ((ral recursive-assoc-list))
```

**20.2.278 recursive-assoc-list/relink-named-objects**

[ recursive-assoc-list ] [ Methods ]

**DESCRIPTION:**

This method is essentially the same as the method link-named objects, but resets the LINKED slot to NIL and forces the link-named-objects method to be applied again.

**ARGUMENTS:**

- A recursive-alloc-list object.

**RETURN VALUE:**

A recursive-alloc-list object.

**EXAMPLE:**

```
;; Usage as presented here; see the documentation for method link-named-objects
;; for more detail
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))
      (relink-named-objects ral))

=>
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 8
                      linked: T
```



```

                                full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: MIXED-BAG, tag: NIL,
data: (
LINKED-NAMED-OBJECT: previous: NIL, this: (JIM), next: (WILD)
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM
[...]
```

**SYNOPSIS:**

```
(defmethod relink-named-objects ((ral recursive-assoc-list))
```

**20.2.279 recursive-assoc-list/rmap**

```
[ recursive-assoc-list ] [ Methods ]
```

**DESCRIPTION:**

Recurse over the objects in a recursive-assoc-list and call the given function for each each named-object. See also assoc-list's map-data method which does pretty much the same but acting on each named-object's data rather than the named-object itself.

**ARGUMENTS:**

- the recursive-assoc-list object
- the function to call (function object)

**OPTIONAL ARGUMENTS:**

- &rest further arguments to be passed to the function after the named-object from the recursive-assoc-list.

**RETURN VALUE:**

T

**EXAMPLE:**

```
(let ((ral (make-ral 'mixed-bag
```

```

      '((jim beam)
        (wild turkey)
        (four ((roses red)
                (violets ((blue velvet)
                          (red ((dragon den)
                                (viper nest)
                                (fox hole)))
                          (white ribbon)))))))))

    (rmap ral #'print))
=>
NAMED-OBJECT: id: JIM, tag: NIL,
data: BEAM
*****
NAMED-OBJECT: id: WILD, tag: NIL,
data: TURKEY
*****
NAMED-OBJECT: id: ROSES, tag: NIL,
data: RED
*****
NAMED-OBJECT: id: BLUE, tag: NIL,
data: VELVET
*****
NAMED-OBJECT: id: DRAGON, tag: NIL,
data: DEN
*****
NAMED-OBJECT: id: VIPER, tag: NIL,
data: NEST
*****
NAMED-OBJECT: id: FOX, tag: NIL,
data: HOLE
*****
NAMED-OBJECT: id: WHITE, tag: NIL,
data: RIBBON
*****
T

```

**SYNOPSIS:**

```
(defmethod rmap ((ral recursive-assoc-list) function &rest arguments)
```

**20.2.280 recursive-assoc-list/sc-map**

[ recursive-assoc-list ] [ Classes ]

**NAME:**

sc-map

File: sc-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the sc-map class for mapping rhythmic sequences, chords etc. to specific parts of a piece. The extension to the recursive-assoc-list class is in the data returned when get-data-from-palette is called: being a map, the data returned by the superclass get-data function is actually a reference into a palette. Instead of just returning this reference, with get-data-from-palette we then use this as a lookup into the palette slot. If the reference happens to be a list, then each element of the list is used as a reference into the palette and the resulting objects are returned in a list.

When in a list of references, perhaps the rthm-seq references for a section, a single reference is also a list this can be one of two things: the reference is to a recursive palette, whereupon the data will simply be returned for that reference; or, the reference is a list of references that together build up an object consisting of the referenced smaller objects. This is the case when, for example, 4-bar sequences in one or more instruments are accompanied by groups of 4 single bar sequences in others:

```
(2
  ((bsn ((r1-1 r1-2 r1-3 r1-5) 20 1 ...))
   (trb (2 23 3 ...))))
```

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 21st 2001

\$\$ Last modified: 19:58:51 Mon Oct 28 2013 GMT

SVN ID: \$Id: sc-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.281 sc-map/change-map

[ *sc-map* ] [ *Classes* ]

#### NAME:

change-map

File: change-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map -> change-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the change-map class where, unlike normal sc-maps (data is given for each sequence) gives data sporadically when the parameter changes, for instance tempo.

It is assumed that maps will be typed in the order in which sections occur so that previous-data slots can be kept up-to-date; also, unless all data will be given, that the sections (but not instrument ids) will be in integer sequential order so that nearest sections can be returned when given a non-existent section reference.

For example, the following change-map indicates tempo (though tempo-maps have their own class now). It has sections within sections so that the tempo for section '(1 2 3) can be defined, that is, section 1 has subsections 1, 2, and 3 and subsection 2 has further subsections 1, 2, and 3. This can be nested to any depth. The tempo information itself is given in sublists where (3 27) means that in the third sequence of the section, the tempo is 27. (3 2 27) means the 2nd bar of the third sequence has tempo 27: when only two numbers are in the list, bar 1 is assumed. The trick is, that this tempo then remains, as would be expected, until the next tempo change is indicated, which means that requesting the tempo of section (2 2 3) with any sequence

and bar in the map below would return 25, because that is the last tempo given in section 1 and no tempo is defined for section 2.

```
(setf x
  (make-change-map
    'test nil
    '((0 ((3 27) (9 3 45)))
      (1
        ((1 ((1 21) (5 28) (8 35) (3 2 40) (3 1 54)))
          (2
            ((1 ((1 23) (6 28) (18 35)))
              (2 ((2 2 24) (7 28) (18 22)))
              (3 ((3 34) (7 28) (18 42))))))
          (3 ((1 22) (5 34) (10 5 25))))))
      (4
        ((1 ((1 21) (5 28) (8 36) (3 2 40) (3 1 55)))
          (2 ((1 22) (5 34) (10 5 103))))))
      (5 ((2 28) (6 3 45)))
      (10
        ((1 ((1 21) (5 28) (8 37) (3 2 40) (3 1 56)))
          (2 ((1 22) (5 34) (10 5 27))))))))
```

You have to be careful with change-maps however as the nesting is flexible and therefore ambiguous. For instance, in the following the bcl, tape1 etc. ids are not subsections of section 1, rather these are the hint pitches assigned to the instruments in section 1 (which has no subsections). This is where the last-ref-required class slot comes in: If this slot is t (this is the second argument to make-change-map) then the last reference in a call to cm-get-data is always respected, i.e. not the last data given will be returned when the section doesn't exist, rather the last data for this reference. E.g. In the following map, if last-ref-required were nil, then the call to (cm-get-data x '(2 tape2) 1) would fail (because we can't find nearest data when references aren't numbers), but because it's t, we get the last data given for tape2 and return cs5.

```
(setf x
  (make-change-map
    'hint-pitches t
    '((1 ((bcl ((1 a4) (2 b4) (3 c5) (4 d6)))
          (tape1 ((1 a3) (2 ds2) (3 e4)))
```

```

(tape2 ((1 a3) (2 ds2) (3 cs5)))
(tape3 ((1 a3) (2 ds2) (3 eqf4))))))
(2 ((bcl ((1 a4) (2 b4) (3 c5) (4 d6)))
(tape1 ((1 a3) (2 ds2) (5 fs4))))))
(3 ((bcl ((1 a4) (2 b4) (3 c5) (4 d6)))
(tape1 ((1 a3) (2 ds2) (5 f4))))))))

```

Author: Michael Edwards: m@michael-edwards.org

Creation date: 2nd April 2001

\$\$ Last modified: 21:14:11 Thu Dec 8 2011 ICT

SVN ID: \$Id: change-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.282 change-map/cm-get-data

[ *change-map* ] [ *Methods* ]

#### DESCRIPTION:

Return the data for a specified section and player of a given change-map object.

NB: The <section> argument may require the ID of the player as well if used, for example, with the instrument-change-map subclass of this class .

#### ARGUMENTS:

- A change-map object.
- A simple key reference into the given change-map object or a list of references. NB: This reference may require a player ID if, for example, used with an instrument-change-map subclass of this class.

#### OPTIONAL ARGUMENTS:

- The ID of the sequence from which to return the change-map data.
- An integer that is the bar number for which to return the change-map data.

#### RETURN VALUE:

The change-map data stored at the specified location within the given change-map.

**EXAMPLE:**

;;; An example using the instrument-change-map subclass of change-map

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))))
       :instrument-change-map '(((1 ((sax ((1 alto-sax) (3 tenor-sax))))
                                     (2 ((sax ((2 alto-sax) (5 tenor-sax))))
                                     (3 ((sax ((3 alto-sax) (4 tenor-sax))))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '(((1 ((sax (1 1 1 1 1))))
                        (2 ((sax (1 1 1 1 1))))
                        (3 ((sax (1 1 1 1 1)))))))
      (cm-get-data (instrument-change-map mini) '(2 sax) 4))
```

=> ALTO-SAX

**SYNOPSIS:**

```
(defmethod cm-get-data ((cm change-map) section
                        &optional (sequence 1) (bar 1))
```

**20.2.283 change-map/find-nearest**

[ *change-map* ] [ *Methods* ]

**DESCRIPTION:**

Return the nearest change-data object to the specified section within the given change-map. NB: The section may require a player ID if used, for example, with an instrument-change-map subclass of change-map.

**ARGUMENTS:**

- A section indication, either as a single reference ID or a list of reference IDs into the given change-map.
- A change-map object.

**RETURN VALUE:**

Returns a change-data object.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))))
       :instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax))))
                                   (2 ((sax ((2 alto-sax) (5 tenor-sax))))
                                   (3 ((sax ((3 alto-sax) (4 tenor-sax))))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1 1 1))))
                       (2 ((sax (1 1 1 1 1))))
                       (3 ((sax (1 1 1 1 1))))))
      (find-nearest '(4 sax) (instrument-change-map mini)))
```

=>

CHANGE-DATA:

```
      previous-data: TENOR-SAX,
      last-data: TENOR-SAX
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: (2 SAX), this: (3 SAX), next: NIL
NAMED-OBJECT: id: SAX, tag: NIL,
data: ((3 1 ALTO-SAX) (4 1 TENOR-SAX))
```

#### SYNOPSIS:

```
(defmethod find-nearest (section (cm change-map))
```

#### 20.2.284 change-map/instrument-change-map

[ *change-map* ] [ *Classes* ]

NAME:

instrument-change-map

File: instrument-change-map



Class Hierarchy: `named-object -> linked-named-object -> sclist -> circular-sclist -> assoc-list -> recursive-assoc-list -> sc-map -> change-map -> instrument-change-map`

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Extends `change-map` to check that instruments defined in the map have data for the first bar of the first section.

Author: Michael Edwards: `m@michael-edwards.org`

Creation date: 12th April 2002

\$\$ Last modified: 18:12:52 Tue Apr 3 2012 BST

SVN ID: \$Id: instrument-change-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

## 20.2.285 instrument-change-map/get-first-for-player

*[ instrument-change-map ] [ Methods ]*

### DESCRIPTION:

Return the first instrument object assigned to a given player in cases where a player has been assigned more than one instrument.

### ARGUMENTS:

- An `instrument-change-map`
- The ID of the player for whom to return the first instrument.

### RETURN VALUE:

The ID of the first instrument object assigned to the specified player.

### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
                        (db (double-bass :midi-channel 2))))
       :instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax)))))))
```

```

:set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
:set-map '((1 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
                        :pitch-seq-palette ((1 2 3 4 5)))))
:rthm-seq-map '((1 ((sax (1 1 1 1 1))
                      (db (1 1 1 1 1))))))
(get-first-for-player (instrument-change-map mini) 'sax))

=> ALTO-SAX, T

```

**SYNOPSIS:**

```

(defmethod get-first-for-player ((icm instrument-change-map)
                                player)

```

**20.2.286 instrument-change-map/make-instrument-change-map**

[ *instrument-change-map* ] [ *Functions* ]

**DESCRIPTION:**

Create an instrument-change-map object.

**ARGUMENTS:**

- An ID for the instrument-change-map to be created.
- A list of lists. The top level of these lists consists of the section IDs for the given slippery-chicken object paired with lists of data for the specified players for each section. Each player list then consists of the ID of the player paired with a list of two-item lists pairing measure numbers with the instrument to which that player is to change, e.g.:

```

'((1 ((fl ((1 flute) (3 piccolo) (5 flute)))
      (cl ((1 b-flat-clarinet) (2 bass-clarinet) (6 b-flat-clarinet)))))
  (2 ((fl ((2 piccolo) (4 flute)))
      (cl ((2 bass-clarinet) (3 b-flat-clarinet)))))

```

**OPTIONAL ARGUMENTS:**

- :warn-not-found. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up. T = warn. Default = T.

**RETURN VALUE: EXAMPLE:**

```

(make-instrument-change-map

```

```
'icm-test
'((1 ((fl ((1 flute) (3 piccolo) (5 flute)))
      (cl ((1 b-flat-clarinet) (2 bass-clarinet) (6 b-flat-clarinet)))))
  (2 ((fl ((2 piccolo) (4 flute)))
      (cl ((2 bass-clarinet) (3 b-flat-clarinet)))))
```

=>

```
INSTRUMENT-CHANGE-MAP:
CHANGE-MAP: last-ref-required: T
SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: NIL
                      num-data: 4
                      linked: T
                      full-ref: NIL
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: ICM-TEST, tag: NIL,
data: (
NAMED-OBJECT: id: 1, tag: NIL,
data:
CHANGE-MAP: last-ref-required: T
SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: NIL
                      num-data: 2
                      linked: T
                      full-ref: (1)
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "sub-ral-of-ICM-TEST", tag: NIL,
data: (
CHANGE-DATA:
          previous-data: NIL,
          last-data: FLUTE
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: (1 FL), next: (1 CL)
NAMED-OBJECT: id: FL, tag: NIL,
data: ((1 1 FLUTE) (3 1 PICCOLO) (5 1 FLUTE))
*****
```

CHANGE-DATA:

```

        previous-data: NIL,
        last-data: B-FLAT-CLARINET
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: (1 FL), this: (1 CL), next: (2 FL)
NAMED-OBJECT: id: CL, tag: NIL,
data: ((1 1 B-FLAT-CLARINET) (2 1 BASS-CLARINET) (6 1 B-FLAT-CLARINET))
*****
)
*****

*****

NAMED-OBJECT: id: 2, tag: NIL,
data:
CHANGE-MAP: last-ref-required: T
SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: NIL
                        num-data: 2
                        linked: T
                        full-ref: (2)
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "sub-ral-of-ICM-TEST", tag: NIL,
data: (
CHANGE-DATA:
        previous-data: FLUTE,
        last-data: FLUTE
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: (1 CL), this: (2 FL), next: (2 CL)
NAMED-OBJECT: id: FL, tag: NIL,
data: ((2 1 PICCOLO) (4 1 FLUTE))
*****

CHANGE-DATA:
        previous-data: B-FLAT-CLARINET,
        last-data: B-FLAT-CLARINET
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: (2 FL), this: (2 CL), next: NIL
NAMED-OBJECT: id: CL, tag: NIL,
data: ((2 1 BASS-CLARINET) (3 1 B-FLAT-CLARINET))
*****
)

```

\*\*\*\*\*

\*\*\*\*\*  
 )

## SYNOPSIS:

```
(defun make-instrument-change-map (id icm &key (warn-not-found nil))
```

### 20.2.287 change-map/simple-change-map

[ *change-map* ] [ *Classes* ]

#### NAME:

simple-change-map

File: simple-change-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
 circular-sclist -> assoc-list -> recursive-assoc-list ->  
 sc-map -> change-map -> simple-change-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the simple-change-map class which gives  
 data associated with a non-recursive list of number ids.  
 For example, good for specifying data which changes at  
 specific bar numbers.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 31st 2002

\$\$ Last modified: 20:16:16 Mon May 14 2012 BST

SVN ID: \$Id: simple-change-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.288 simple-change-map/make-simple-change-map

[ *simple-change-map* ] [ *Functions* ]

#### DESCRIPTION:

Create a simple-change-map object, which stores data associated with a non-recursive list of number IDs. This object could be good, for example, for specifying data which changes at specific bar numbers.

#### ARGUMENTS:

- An ID for the simple-change-map object to be created.
- A list of non-recursive lists consisting of ID/data pairs, of which the first item is a numerical ID.

#### RETURN VALUE:

A simple-change-map object.

#### EXAMPLE:

```
(make-simple-change-map 'bar-map '((1 3) (34 3) (38 4)))
```

```
=>
```

```
SIMPLE-CHANGE-MAP:
```

```
CHANGE-MAP: last-ref-required: NIL
```

```
SC-MAP: palette id: NIL
```

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: NIL
```

```
num-data: 3
```

```
linked: NIL
```

```
full-ref: NIL
```

```
ASSOC-LIST: warn-not-found NIL
```

```
CIRCULAR-SCLIST: current 0
```

```
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: BAR-MAP, tag: NIL,
```

```
data: (
```

```
NAMED-OBJECT: id: 1, tag: NIL,
```

```
data: 3
```

```
*****
```

```
NAMED-OBJECT: id: 34, tag: NIL,
```

```
data: 3
```

```
*****
```

```
NAMED-OBJECT: id: 38, tag: NIL,
```

```
data: 4
```

```
*****
```

```
)
*****
```

**SYNOPSIS:**

```
(defun make-simple-change-map (id scm)
```

**20.2.289 simple-change-map/scm-get-data**

```
[ simple-change-map ] [ Methods ]
```

**DESCRIPTION:**

Get the data associated with the specified key within a given simple-change-map object.

**ARGUMENTS:**

- An integer that is an existing key ID within the given simple-change-map object.
- A simple-change-map-object.

**RETURN VALUE:**

The data associated with the specified key ID, as a named object.

**EXAMPLE:**

```
(let ((scm (make-simple-change-map 'bar-map '((1 3) (34 3) (38 4)))))
  (scm-get-data 34 scm))
```

```
=>
```

```
NAMED-OBJECT: id: 34, tag: NIL,
data: 3
```

**SYNOPSIS:**

```
(defmethod scm-get-data (ref (scm simple-change-map))
```

**20.2.290 simple-change-map/tempo-map**

```
[ simple-change-map ] [ Classes ]
```

**NAME:**

tempo-map

File: tempo-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map -> change-map -> simple-change-map -> tempo-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Allow the specification of tempi by just a number  
(defaulting to crotchet number) or a list where the first  
element would be the beat, the second the speed.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 6th May 2006

\$\$ Last modified: 15:49:41 Fri Oct 11 2013 BST

SVN ID: \$Id: tempo-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.291 sc-map/delete-nth-in-map

[ *sc-map* ] [ *Methods* ]

#### DATE:

05 Feb 2011

#### DESCRIPTION:

Replace the element at the specified location within the specified list of  
a given sc-map object with NIL.

#### ARGUMENTS:

- A list that is the map-ref; i.e., the path of IDs into the list to be searched.
- An integer that is the zero-based index of the element to be returned from the specified list.
- An sc-map object.

#### RETURN VALUE:



Always returns NIL

**EXAMPLE:**

```
(let ((mscm (make-sc-map 'scm-test
                        '((1
                          ((vn (1 2 3 4 5))
                           (va (2 3 4 5 1))
                           (vc (3 4 5 1 2))))
                          (2
                          ((vn (6 7 8))
                           (va (7 8 6))
                           (vc (8 6 7))))
                          (3
                          ((vn (9))
                           (va (9))
                           (vc (9))))))))
    (delete-nth-in-map '(1 vn) 1 mscm)
    (get-data-from-palette '(1 vn) mscm))
```

=>

```
NAMED-OBJECT: id: VN, tag: NIL,
data: (1 NIL 3 4 5)
```

**SYNOPSIS:**

```
(defmethod delete-nth-in-map (map-ref nth (scm sc-map))
```

**20.2.292 sc-map/double**

[ *sc-map* ] [ *Methods* ]

**DATE:**

13-Feb-2011

**DESCRIPTION:**

Change the specified sequences of one or more specified players within an existing sc-map object to double the rhythms of the corresponding sequences of another specified player.

This allows an existing map, for example, to have several players playing in rhythmic unison.

**ARGUMENTS:**

- An sc-map object.
- A section reference (i.e. section ID or list of section-subsection IDs).
- An integer that is the 1-based number of the first sequence within the given section to be changed.
- An integer that is the 1-based number of the last sequence within the given section to be changed.
- The ID of the player whose part is to serve as the source for the doubling.
- An ID or list of IDs of the player(s) whose parts are to be changed.

**RETURN VALUE:**

Returns NIL.

**EXAMPLE:**

```
;;; Create an sc-map with parts for players 'fl and 'cl containing only NILs
;;; and print the corresponding data. Double the second and third sequence of
;;; the 'vn part of that section into the 'fl and 'cl parts and print the same
;;; data again to see the change.
```

```
(let ((scm (make-sc-map 'sc-m
                        '(1
                          ((fl (nil nil nil))
                           (cl (nil nil nil))
                           (vn (set1 set3 set2))
                           (va (set2 set3 set1))
                           (vc (set3 set1 set2))))
                          (2
                           ((vn (set1 set2 set1))
                            (va (set2 set1 set3))
                            (vc (set1 set3 set3))))
                          (3
                           ((vn (set1 set1 set3))
                            (va (set1 set3 set2))
                            (vc (set3 set2 set3)))))))
  (print (get-data-data '(1 fl) scm))
  (print (get-data-data '(1 cl) scm))
  (double scm 1 2 3 'vn '(fl cl))
  (print (get-data-data '(1 fl) scm))
  (print (get-data-data '(1 cl) scm)))
```

```
=>
```

```
(NIL NIL NIL)
(NIL NIL NIL)
(NIL SET3 SET2)
(NIL SET3 SET2)
```

**SYNOPSIS:**

```
(defmethod double ((scm sc-map) section-ref start-seq end-seq master-player
                  doubling-players)
```

**20.2.293 sc-map/get-all-data-from-palette**

[ *sc-map* ] [ *Methods* ]

**DESCRIPTION:**

Given an *sc-map* object that has been bound to a palette object of any type, return all of the palette data contained in the given *sc-map* object as it has been allocated to the map, in the order in which it appears in the map.

The given *sc-map* object must be bound to a palette object for this method to work. If no palette object has been bound to the given *sc-map* object, the method returns NIL and prints a warning.

**ARGUMENTS:**

- An *sc-map* object.

**RETURN VALUE:**

- A list of objects, the type depending on the given palette.

**EXAMPLE:**

```
;; Create a set-palette object and an sc-map object, bind them using the
;; <palette> argument of the make-sc-map function, and print the results of
;; applying the get-all-data-from-palette method by printing the data of each
;; of the objects in the list it returns as note-name symbols.
```

```
(let* ((sp (make-set-palette 'set-pal '((set1 ((c2 b2 a3 g4 f5 e6)))
                                           (set2 ((d2 c3 b3 a4 g5 f6)))
                                           (set3 ((e2 d3 c4 b4 a5 g6))))))
      (scm (make-sc-map 'sc-m '((sec1
                                ((vn (set1 set3 set2))
                                 (va (set2 set3 set1))
                                 (vc (set3 set1 set2))))
                          (sec2
                           ((vn (set1 set2 set1))
                            (va (set2 set1 set3))
                            (vc (set1 set3 set3))))
                          (sec3
```

```

                                ((vn (set1 set1 set3))
                                 (va (set1 set3 set2))
                                 (vc (set3 set2 set3))))
                                :palette sp)))
(loop for cs in (get-all-data-from-palette scm)
  collect (pitch-list-to-symbols (data cs))))

=>
((C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6) (D2 C3 B3 A4 G5 F6)
 (D2 C3 B3 A4 G5 F6) (E2 D3 C4 B4 A5 G6) (C2 B2 A3 G4 F5 E6)
 (E2 D3 C4 B4 A5 G6) (C2 B2 A3 G4 F5 E6) (D2 C3 B3 A4 G5 F6)
 (C2 B2 A3 G4 F5 E6) (D2 C3 B3 A4 G5 F6) (C2 B2 A3 G4 F5 E6)
 (D2 C3 B3 A4 G5 F6) (C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6)
 (C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6) (E2 D3 C4 B4 A5 G6)
 (C2 B2 A3 G4 F5 E6) (C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6)
 (C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6) (D2 C3 B3 A4 G5 F6)
 (E2 D3 C4 B4 A5 G6) (D2 C3 B3 A4 G5 F6) (E2 D3 C4 B4 A5 G6))

;; Applying the method to an sc-map object that is not bound to a palette
;; object returns NIL
(let ((scm (make-sc-map 'sc-m '((sec1
                                ((vn (set1 set3 set2))
                                 (va (set2 set3 set1))
                                 (vc (set3 set1 set2))))
                              (sec2
                               ((vn (set1 set2 set1))
                                (va (set2 set1 set3))
                                (vc (set1 set3 set3))))
                              (sec3
                               ((vn (set1 set1 set3))
                                (va (set1 set3 set2))
                                (vc (set3 set2 set3)))))))
  (get-all-data-from-palette scm))

=>
NIL
WARNING:
  sc-map::get-all-data-from-palette:
  palette slot is nil so can't return data from it.

SYNOPSIS:

(defmethod get-all-data-from-palette ((scm sc-map))

```

**20.2.294 sc-map/get-data-from-palette***[ sc-map ] [ Methods ]***DESCRIPTION:**

Given an `sc-map` object that has been bound to a palette object of any type, return the palette data contained allocated to the location within the given `sc-map` object as specified by the `<IDs>` argument.

Deeper levels of the map can be accessed by specifying a path of IDs into the given `sc-map` object.

If no palette object has been bound to the given `sc-map` object, the method returns the contents of the `sc-map` object at the specified location instead.

**ARGUMENTS:**

- A symbol or list of symbols that is/are the ID or path of nested IDs within the given `sc-map` object for which the data is sought.
- The `sc-map` object in which the data is sought.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to print a warning if the specified ID is not found in the given `sc-map` object. T = print warning. Default = T.

**RETURN VALUE:**

The named object or list of named objects associated with the specified ID or path of IDs.

If the specified ID is not found within the given `sc-map` object, the method returns NIL. If the optional `<warn>` argument is set to T, a warning is also printed in this case.

**EXAMPLE:**

```
;; Create a palette object and an sc-map object and bind them using the
;; <palette> keyword argument of the make-sc-map function. Then apply the
;; get-data-from-palette object to a nested ID in the sc-map object. Loop
;; through the data of the named objects in the list returned and return them
;; as note-name symbols.
(let* ((sp (make-set-palette 'set-pal '((set1 ((c2 b2 a3 g4 f5 e6)))
```

```

                                (set2 ((d2 c3 b3 a4 g5 f6)))
                                (set3 ((e2 d3 c4 b4 a5 g6)))))
(scm (make-sc-map 'sc-m '((sec1
  ((vn (set1 set3 set2))
   (va (set2 set3 set1))
   (vc (set3 set1 set2)))))
  (sec2
  ((vn (set1 set2 set1))
   (va (set2 set1 set3))
   (vc (set1 set3 set3)))))
  (sec3
  ((vn (set1 set1 set3))
   (va (set1 set3 set2))
   (vc (set3 set2 set3)))))
  :palette sp)))
(loop for cs in (get-data-from-palette '(sec1 vn) scm)
  collect (pitch-list-to-symbols (data cs))))

=> ((C2 B2 A3 G4 F5 E6) (E2 D3 C4 B4 A5 G6) (D2 C3 B3 A4 G5 F6))

;; If applied to an sc-map object that is not bound to a palette, the contents
;; of the sc-map object at the specified location are returned and a warning is
;; printed by default
(let ((scm (make-sc-map 'sc-m '((sec1
  ((vn (set1 set3 set2))
   (va (set2 set3 set1))
   (vc (set3 set1 set2)))))
  (sec2
  ((vn (set1 set2 set1))
   (va (set2 set1 set3))
   (vc (set1 set3 set3)))))
  (sec3
  ((vn (set1 set1 set3))
   (va (set1 set3 set2))
   (vc (set3 set2 set3)))))
  (get-data-from-palette '(sec1 vn) scm))

=>
NAMED-OBJECT: id: VN, tag: NIL,
data: (SET1 SET3 SET2)
*****
, NO-PALETTE

SYNOPSIS:

(defmethod get-data-from-palette (ids (scm sc-map) &optional (warn t))

```

**20.2.295 sc-map/get-nth-from-map***[ sc-map ] [ Methods ]***DESCRIPTION:**

Get the element located at the *nth* position within a given *sc-map* object. Both the *map-ref* (the path of IDs into the list to be searched) and the *nth* must be specified.

**ARGUMENTS:**

- A list that is the *map-ref*; i.e., the path of IDs into the list to be searched.
- An integer that is the zero-based index of the element to be returned from the specified list.
- An *sc-map* object.

**RETURN VALUE:**

Returns the element located at the given index.

Returns NIL if the index does not exist.

**EXAMPLE:**

;; Specify the path of IDs into the desired list ("map-ref") as a list, then  
 ;; the position to be read from within the list located there.

```
(let ((mscm (make-sc-map 'scm-test
                        '(1
                          ((vn (1 2 3 4 5))
                           (va (2 3 4 5 1))
                           (vc (3 4 5 1 2))))
                          (2
                           ((vn (6 7 8))
                            (va (7 8 6))
                            (vc (8 6 7))))
                          (3
                           ((vn (9))
                            (va (9))
                            (vc (9)))))))
  (get-nth-from-map '(1 vn) 1 mscm))
```

=> 2

;; Returns NIL if the specified index does not exist

```
(let ((mscm (make-sc-map 'scm-test
                          '((1
                             ((vn (1 2 3 4 5))
                              (va (2 3 4 5 1))
                              (vc (3 4 5 1 2))))
                             (2
                              ((vn (6 7 8))
                               (va (7 8 6))
                               (vc (8 6 7))))
                             (3
                              ((vn (9))
                               (va (9))
                               (vc (9))))))))
      (get-nth-from-map '(3 vn) 1 mscm))
```

=> NIL

#### SYNOPSIS:

```
(defmethod get-nth-from-map (map-ref nth (scm sc-map))
```

#### 20.2.296 sc-map/get-nth-from-palette

[ *sc-map* ] [ *Methods* ]

#### DESCRIPTION:

Given an sc-map object that is bound to a palette object of any type, return the data of the palette object located at the nth position of the list found at the specified ID or path of nested IDs.

If the given sc-map object is not bound to a palette object, NIL is returned instead.

#### ARGUMENTS:

- An ID or list of IDs that are the path to the list within the given sc-map object from which the specified nth position is to be returned.
- A zero-based integer that is the position within the list found at the path specified from which the given element is to be returned.
- An sc-map object.

#### RETURN VALUE:

- An element/object of the type contained within the given palette object of the given sc-map object.



**EXAMPLE:**

```

;;; Create a set-palette object and an sc-map object, bind them using the
;;; <palette> object of the make-sc-map function, and apply the
;;; get-nth-from-palette method
(let* ((sp (make-set-palette 'set-pal '((set1 ((c2 b2 a3 g4 f5 e6)))
                                             (set2 ((d2 c3 b3 a4 g5 f6)))
                                             (set3 ((e2 d3 c4 b4 a5 g6))))))
      (scm (make-sc-map 'sc-m '((sec1
                                   ((vn (set1 set3 set2))
                                    (va (set2 set3 set1))
                                    (vc (set3 set1 set2))))
                          (sec2
                           ((vn (set1 set2 set1))
                            (va (set2 set1 set3))
                            (vc (set1 set3 set3))))
                          (sec3
                           ((vn (set1 set1 set3))
                            (va (set1 set3 set2))
                            (vc (set3 set2 set3))))
                          :palette sp)))
      (get-nth-from-palette '(sec1 vn) 0 scm))

=>
COMPLETE-SET: complete: NIL
              num-missing-non-chromatic: 12
              num-missing-chromatic: 6
              missing-non-chromatic: (BQS BQF AQS AQF GQS GQF FQS EQS EQF DQS
                                       DQF CQS)
              missing-chromatic: (BF AF FS EF D CS)
TL-SET: transposition: 0
       limit-upper: NIL
       limit-lower: NIL
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                     num-data: 0
                     linked: NIL
                     full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL
*****

```

\*\*\*\* N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```

subsets:
related-sets:
SCLIST: sclist-length: 6, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SET1, tag: NIL,
data: (C2 B2 A3 G4 F5 E6)
*****

```

;;; Applying the method to an sc-map object that is not bound to a palette  
 ;;; object returns NIL

```

(let ((scm (make-sc-map 'sc-m '((sec1
                                ((vn (set1 set3 set2))
                                 (va (set2 set3 set1))
                                 (vc (set3 set1 set2))))
                              (sec2
                                ((vn (set1 set2 set1))
                                 (va (set2 set1 set3))
                                 (vc (set1 set3 set3))))
                              (sec3
                                ((vn (set1 set1 set3))
                                 (va (set1 set3 set2))
                                 (vc (set3 set2 set3)))))))
  (get-nth-from-palette '(sec1 vn) 0 scm))

```

=> NIL

## SYNOPSIS:

```
(defmethod get-nth-from-palette (sc-map-ref nth (scm sc-map))
```

### 20.2.297 sc-map/make-sc-map

[ *sc-map* ] [ *Functions* ]

## DESCRIPTION:

Create an sc-map object, which will be used for mapping rhythmic sequences, chords etc. to specific parts of a piece.

## ARGUMENTS:

- The ID of the resulting sc-map object.
- A list of data, most likely recursive.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :warn-not-found. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up. T = warn. Default = T.
- :recurse-simple-data. T or NIL to indicate whether to recursively instantiate a recursive-assoc-list in place of data that appears to be a simple assoc-list (i.e. a 2-element list). If NIL, the data of 2-element lists whose second element is a number or a symbol will be ignored, therefore remaining as a list. For example, this data would normally result in a recursive call: (y ((2 23) (7 28) (18 2))).  
T = recurse. Default = T.
- :replacements. A list of lists in the format '(((1 2 vla) 3 20b) ((2 3 vln) 4 16a)) that indicate changes to individual elements of lists within the given sc-map object. (Often sc-map data is generated algorithmically, but individual elements of the lists need to be changed.) Each such list indicates a change, the first element of the list being the reference into the sc-map (the viola voice of section 1 subsection 2 in the first element here, for example), the second element being the nth of the data list to change for this key, and the third being the new data.
- :palette. A palette object or NIL. If a palette object is specified or defined here, it will be automatically bound to the given sc-map object. Default = NIL

### RETURN VALUE:

An sc-map object.

### EXAMPLE:

```
;; Create an sc-map object with contents that could be used as a rthm-seq-map
(make-sc-map 'scm-test
  '(1
    ((vn (1 2 3 4 5))
     (va (2 3 4 5 1))
     (vc (3 4 5 1 2))))
  (2
    ((vn (6 7 8))
     (va (7 8 6))
     (vc (8 6 7))))
  (3
    ((vn (9))
```

```

                (va (9))
                (vc (9))))))

=>
SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 9
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SCM-TEST, tag: NIL,
data: (
NAMED-OBJECT: id: 1, tag: NIL,
data:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 3
                      linked: NIL
                      full-ref: (1)
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "sub-ral-of-SCM-TEST", tag: NIL,
data: (
NAMED-OBJECT: id: VN, tag: NIL,
data: (1 2 3 4 5)
[...]
```

```

;;; Create an sc-map object and automatically bind it to a set-palette object
;;; using the <palette> keyword argument. Then read the PALETTE slot of the
;;; sc-map created to see its contents.
```

```

(let ((scm
      (make-sc-map
       'scm-test
       '(1
         ((vn (1 2 3 4 5))
          (va (2 3 4 5 1))
          (vc (3 4 5 1 2))))
       (2
         ((vn (6 7 8))
          (va (7 8 6))
          (vc (8 6 7))))
       (3
```

```

      ((vn (9))
       (va (9))
       (vc (9))))
:palette (make-set-palette 'set-pal
                          '((set1 ((c2 b2 a3 g4 f5 e6)))
                            (set2 ((d2 c3 b3 a4 g5 f6)))
                            (set3 ((e2 d3 c4 b4 a5 g6))))))

(palette scm))

```

=>

```

SET-PALETTE:
PALETTE:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 3
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SET-PAL, tag: NIL,
data: (
COMPLETE-SET: complete: NIL
[...]
data: (C2 B2 A3 G4 F5 E6)
[...]
COMPLETE-SET: complete: NIL
[...]
data: (D2 C3 B3 A4 G5 F6)
[...]
COMPLETE-SET: complete: NIL
[...]
data: (E2 D3 C4 B4 A5 G6)
)

```

;;; An example using replacements

```

(make-sc-map 'sc-m
             '((1
                ((vn (set1 set3 set2))
                 (va (set2 set3 set1))
                 (vc (set3 set1 set2))))
              (2
                ((vn (set1 set2 set1))
                 (va (set2 set1 set3))
                 (vc (set1 set3 set3)))))

```

```

      (3
        ((vn (set1 set1 set3))
          (va (set1 set3 set2))
          (vc (set3 set2 set3))))
      :replacements '(((1 va) 2 set2)))

=>

SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 9
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SC-M, tag: NIL,
data: (
NAMED-OBJECT: id: 1, tag: NIL,
data:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 3
                      linked: NIL
                      full-ref: (1)
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "sub-ral-of-SC-M", tag: NIL,
data: (
NAMED-OBJECT: id: VN, tag: NIL,
data: (SET1 SET3 SET2)
*****

NAMED-OBJECT: id: VA, tag: NIL,
data: (SET2 SET2 SET1)
*****

NAMED-OBJECT: id: VC, tag: NIL,
data: (SET3 SET1 SET2)
*****
)

```

[...]

## SYNOPSIS:

```
(defun make-sc-map (id scm &key (palette nil) (warn-not-found t)
                   (recurse-simple-data t) (replacements nil))
```

### 20.2.298 sc-map/rthm-seq-map

[ *sc-map* ] [ *Classes* ]

#### NAME:

rthm-seq-map

File: rthm-seq-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map -> rthm-seq-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the rthm-seq-map class which maps references to rthm-seq objects for the players in the piece. Extensions to the sc-map superclass are the collection of all the players in the piece and a check to make sure that each list each instrument has the same number of rthm-seq references for each section.

Instances of this class must declare sections and players so if the piece is in one section, give it the label 1 or whatever, e.g.

```
'((1
  ((vln (2 20 1 9 10 22 16 25 6 14 21 17 4 9 13 2))
   (vla (2 23 3 7 13 22 19 3 8 12 23 14 2 10 15 4))
   (vc (2 21 3 12 11 22 16 1 8 17 23 20 24 9 12 2))))))
```

Author: Michael Edwards: m@michael-edwards.org

Creation date: July 28th 2001

\$\$ Last modified: 18:24:55 Mon Dec 23 2013 WIT

SVN ID: \$Id: rthm-seq-map.lsp 4343 2013-12-25 05:19:16Z medward2 \$

### 20.2.299 rthm-seq-map/add-repeats

[ *rthm-seq-map* ] [ *Methods* ]

#### DATE:

30-Dec-2010

#### DESCRIPTION:

Generate repeating sequences at given cycle points using recurring-event data. This process modifies the number of beats.

#### ARGUMENTS:

- A rthm-seq-map object.
- A list of two-item lists of integers that determine the cycle pattern. This list will have the format of the recurring-event class's DATA slot (see recurring-event.lsp).
- A list of two-item lists of integers that determine the number of repeats made (or references into the :repeats list). This list is also processed cyclically (i.e. the recurring-event class's RETURN-DATA-CYCLE slot).

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :section. The section map reference. Default = 1.
- :repeats-indices. A list of the number of repeat bars returned by the cycle data (i.e. recurring-event class's RETURN-DATA slot). Generally this will remain NIL and the number of repeats will be expressed directly in the third argument, but it could be useful to use references into this list there instead, since the recurring-event class already makes this possible. Default = NIL.
- :start. An integer that is the number of the bar/rthm-seq where the process is to begin. Default = 1.
- :end. An integer that is the number of the bar/rthm-seq where the process is to end. NIL = process all bars/rthm-seqs. Default = NIL.
- :print. T or NIL to indicate whether to print the rthm-seq ID and the number repetitions to the listener. T = print. Default = NIL.
- :repeat-rest-seqs. T or NIL to indicate whether sequences consisting of



just rests should be repeated also. This will need the :palette in order to work. Default = T.

- :palette. The rthm-seq-palette to check that sequences are not rest sequences, if about to repeat them and repeat-rest-seqs is NIL.

**RETURN VALUE:**

An integer that is the number of sequences added.

**EXAMPLE:**

;;; Straightforward usage, additionally printing the DATA slot before and after  
 ;;; applying the method

```
(let ((mrsms
      (make-rthm-seq-map
       'rsm-test
       '((1 ((vn (1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1))))))
      :palette (make-rsp
                 'rs-pal
                 '((1 (((2 4) q e s s))))
                 (2 (((2 4) e s s q))))
                 (3 (((2 4) s s q e)))))))
  (print (get-data-data '(1 vn) mrsms))
  ;; so there'll be a repeat after two events three times in a row, then after
  ;; three events twice in a row. The number of repeats will be 5 eight times
  ;; in a row, then 8 twice in a row.
  (add-repeats mrsms '((2 3) (3 2)) '((5 3) (8 2)))
  (print (get-data-data '(1 vn) mrsms)))
```

=>

```
(1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1)
(1 2 3 3 3 3 2 1 1 1 1 1 3 1 1 1 1 3 2 3 3 3 3 3 3 3 1 2 1 1 1 1 1 1
 1 1 3 1 1 1 1 1 3 2 2 2 2 2 1)
```

;;; Using the :start, :end, and :print arguments

```
(let ((mrsms
      (make-rthm-seq-map
       'rsm-test
       '((1 ((vn (1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1))))))
      :palette (make-rsp
                 'rs-pal
                 '((1 (((2 4) q e s s))))
                 (2 (((2 4) e s s q))))
                 (3 (((2 4) s s q e)))))))
  (print (get-data-data '(1 vn) mrsms))
  (add-repeats mrsms '((1 6) (2 6)) '((11 6) (23 3)))
```

```

                :start 3
                :end 11
                :print t)
(print (get-data-data '(1 vn) mrsrm)))

=>
(1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1)
2 x 11
1 x 11
3 x 11
1 x 11
3 x 11
2 x 11
1 x 23
(1 2 3 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 3 3 3 3 3 3 3 3 3 3 1
 1 1 1 1 1 1 1 1 1 1 3 3 3 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 3 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 3 1 3 2 1)

```

**SYNOPSIS:**

```

(defmethod add-repeats ((rsm rthm-seq-map) repeat-every repeats &key
                        (repeat-rest-seqs t) palette
                        (section 1) repeats-indices (start 1) end print)

```

**20.2.300 rthm-seq-map/add-repeats-simple**

[ *rthm-seq-map* ] [ *Methods* ]

**DESCRIPTION:**

Add repeats of a specified rthm-seq within the given rthm-seq-map object a specified number of times.

**ARGUMENTS:**

- A rthm-seq-map object.
- An integer that is the number of the rthm-seq (position within the rthm-seq-map) to be repeated.
- An integer that is the number of times that rthm-seq is to be repeated.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :section. An integer that is the ID of the section in which the repeat operation is to be performed.

- :print. T or NIL to indicate whether to print the rthm-seq ID and the number repetitions to the listener. T = print. Default = NIL.

#### RETURN VALUE:

Always returns T.

#### EXAMPLE:

;;; Print the DATA of the given rthm-seq-map, apply the method, and print again  
;;; to see the difference.

```
(let ((mrsm
      (make-rthm-seq-map
       'rsm-test
       '((1 ((vn (1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1))))))
      :palette (make-rsp
                  'rs-pal
                  '((1 (((2 4) q e s s)))
                    (2 (((2 4) e s s q)))
                    (3 (((2 4) s s q e)))))))
      (print (get-data-data '(1 vn) mrsm))
      (add-repeats-simple mrsm 3 13)
      (print (get-data-data '(1 vn) mrsm)))

=>
(1 2 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1)
(1 2 3 3 3 3 3 3 3 3 3 3 3 3 2 1 3 1 3 2 3 1 2 1 3 1 3 2 1)
```

#### SYNOPSIS:

```
(defmethod add-repeats-simple ((rsm rthm-seq-map) start-seq repeats &key
                               (section 1) print)
```

#### 20.2.301 rthm-seq-map/check-num-sequences

[ *rthm-seq-map* ] [ *Functions* ]

#### DESCRIPTION:

Check to ensure that each player in each section of the given rthm-seq-map object has the same number of references as every other instrument. If not, drop into the debugger with an error.

NB: This function is called automatically every time make-rthm-seq-map is called so it shouldn't generally be necessary for the user to call this

method. However, if the `rthm-seq-map` is changed somehow, it might be a good idea to recheck.

#### ARGUMENTS:

- A `rthm-seq-map` object.

#### RETURN VALUE:

Returns T if all players have the same number of references in each section, otherwise drops into the debugger with an error.

#### EXAMPLE:

;;; Passes the test:

```
(let ((rsmt (make-rthm-seq-map
  'rsm-test
  '((sec1 ((vn (rs1a rs3a rs2a))
    (va (rs1b rs3b rs2b))
    (vc (rs1a rs3b rs2a))))
    (sec2 ((vn (rs1a rs2a rs1a))
    (va (rs1a rs2a rs1b))
    (vc (rs1a rs2b rs1a))))
    (sec3 ((vn (rs1a rs1a rs3a))
    (va (rs1a rs1a rs3b))
    (vc (rs1a rs1b rs3a))))
    (sec4 ((vn (rs1a rs1a rs1a))
    (va (rs1a rs1a rs1b))
    (vc (rs1a rs1b rs1a)))))))
  (check-num-sequences rsmt))
```

=> T

;;; Doesn't pass the test; drops into debugger with an error.

```
(let ((rsmt (make-rthm-seq-map
  'rsm-test
  '((sec1 ((vn (rs1a rs3a rs2a))
    (va (rs1b rs3b))
    (vc (rs1a rs3b rs2a))))
    (sec2 ((vn (rs1a))
    (va (rs1a rs2a rs1b))
    (vc (rs1a rs2b rs1a))))
    (sec3 ((vn (rs1a rs3a))
    (va (rs1a))
    (vc (rs1a rs1b rs3a)))))))
```

```

      (sec4 ((vn (rs1a))
                (va (rs1a rs1a rs1b))
                (vc (rs1a rs1a))))))
  (check-num-sequences rsmt))

```

=>

```

rthm-seq-map::check-num-sequences: In rthm-seq-map RSM-TEST-5, instrument VA:
Each instrument must have the same number of sequences for any given section:
(RS1B RS3B)
[Condition of type SIMPLE-ERROR]

```

## SYNOPSIS:

```
(defun check-num-sequences (rsm)
```

### 20.2.302 rthm-seq-map/get-map-refs

[ *rthm-seq-map* ] [ *Methods* ]

## DATE:

29-Dec-2010

## DESCRIPTION:

Return the list of rthm-seq-palette references for the given player and section.

## ARGUMENTS:

- A rthm-seq-map object.
- The ID of the section in which the references are sought.
- The ID of the player for whom the references are sought.

## RETURN VALUE:

A list of references (each of which might also be a list).

## EXAMPLE:

```

(let ((rsmt (make-rthm-seq-map
              'rsm-test-5
              '((sec1 ((vn (rs1 rs3 rs2))
                        (va (rs2 rs3 rs1))

```

```

                (vc (rs3 rs1 rs2))))
      (sec2 ((vn (rs1 rs2 rs1))
              (va (rs2 rs1 rs3))
              (vc (rs1 rs3 rs3))))
      (sec3 ((vn (rs1 rs1 rs3))
              (va (rs1 rs3 rs2))
              (vc (rs3 rs2 rs3)))))
    :palette (make-rsp
              'rs-pal
              '((rs1 (((2 4) q e s s))))
              (rs2 (((2 4) e s s q))))
              (rs3 (((2 4) s s q e))))))
    (get-map-refs rsmt 'sec3 'vc))

=> (RS3 RS2 RS3)

```

**SYNOPSIS:**

```
(defmethod get-map-refs ((rsm rthm-seq-map) section player)
```

**20.2.303 rthm-seq-map/get-time-sig-ral**

[ *rthm-seq-map* ] [ *Methods* ]

**DESCRIPTION:**

Collate the IDs of all rthm-seq objects in a given rthm-seq-map into groups based on identical time signatures and return this as a recursive-assoc-list object that has the same structure of the map.

Instead of having the list of rthm-seq references for each section/instrument, the method returns an assoc-list whose keys are the time-sig tags, with the corresponding data being circular-sclists of rthm-seq IDs.

The result is a recursive-assoc-list for each instrument/section that can be queried to find the rthm-seq refs of all rthm-seqs that share the same bar/time-sig structure; e.g., all those that have a 2/4 bar followed by a 3/4 bar etc.

**ARGUMENTS:**

- A rthm-seq-map object.
- A rthm-seq-palette object.

**RETURN VALUE:**

A recursive-assoc-list object.

# EXAMPLE:

```
(let* ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1)))
       :rthm-seq-palette '(((4 4) h q e s s) ((2 4) h))))
      (2 (((4 4) h q e s s)))
      (3 (((4 4) h q e s s)))
      (4 (((4 4) h q q) ((2 4) q q)))
      (5 (((4 4) h q e s s)))
      (6 (((4 4) h q q) ((2 4) q q))))
      :rthm-seq-map '((1 ((sax (1 2 3 5 2 4 6 2 3 1 3 2 3 2 1 3 2))))))
      (tsral (get-time-sig-ral (rthm-seq-map mini) (rthm-seq-palette mini))))
      (get-data-data 1 tsral))
```

=>

```
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                        num-data: 1
                        linked: T
                        full-ref: (1)
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 1, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "sub-ral-of-+MINI+-RTHM-SEQ-MAP", tag: NIL,
data: (
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: (1 SAX), next: NIL
NAMED-OBJECT: id: SAX, tag: NIL,
data: (
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0404-0204", tag: NIL,
data: (4 6 1)
*****
```

CIRCULAR-SCLIST: current 0

```

SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0404", tag: NIL,
data: (5 3 2)
*****
)
*****
)
*****

```

**SYNOPSIS:**

```
(defmethod get-time-sig-ral ((rsm rthm-seq-map) (rsp rthm-seq-palette))
```

**20.2.304 rthm-seq-map/make-rthm-seq-map**

[ *rthm-seq-map* ] [ *Functions* ]

**DESCRIPTION:**

Make a rthm-seq-map object.

**ARGUMENTS:**

- The ID of the rthm-seq-map object to be made.
- A list of nested lists, generally taking the form
 

```
'((section1 ((player1 (rthm-seq ids))
                    (player2 (rthm-seq ids))
                    (etc... (etc...))))
  (section2 ((player1 (rthm-seq ids))
              (player2 (rthm-seq ids))
              (etc...)))
  (etc...))
```

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :palette. A palette object or NIL. If a palette object is specified or defined here, it will be automatically bound to the given rthm-seq-map object. Default = NIL.
- :warn-not-found. T or NIL to indicate whether a warning is printed when an index which doesn't exist is used for look-up.  
T = warn. Default = NIL.
- :replacements. A list of lists in the format  
'(((1 2 vla) 3 20b) ((2 3 vln) 4 16a)) that indicate changes to



individual elements of lists within the given rthm-seq-map object. (Often rthm-seq-map data is generated algorithmically but individual elements of the lists need to be changed.) Each such list indicates a change, the first element of the list being the reference into the rthm-seq-map (the vla player of section 1, subsection 2 in the first example here), the second element is the nth of the data list for this key to change, and the third is the new data. Default = NIL.

- :recurse-simple-data. T or NIL to indicate whether to recursively instantiate a recursive-assoc-list in place of data that appears to be a simple assoc-list (i.e. a 2-element list). If NIL, the data of 2-element lists whose second element is a number or a symbol will be ignored, therefore remaining as a list. For example, this data would normally result in a recursive call: (y ((2 23) (7 28) (18 2))).
- T = recurse. Default = T.

#### RETURN VALUE:

A rthm-seq-map object.

#### EXAMPLE:

```
;;; Straightforward usage
(make-rthm-seq-map 'rsm-test
  '((1 ((vn (1 2 3 4))
        (va (2 3 4 1))
        (vc (3 4 1 2))))
    (2 ((vn (4 5 6))
        (va (5 6 4))
        (vc (6 4 5))))
    (3 ((vn (7 8 9 1 2))
        (va (8 9 1 2 7))
        (vc (9 1 2 7 8))))))
```

=>

```
RTHM-SEQ-MAP: num-players: 3
               players: (VA VC VN)
SC-MAP: palette id: NIL
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                     num-data: 9
                     linked: NIL
                     full-ref: NIL
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: RSM-TEST, tag: NIL,
data: (
[...]
```

```
;;; An example using the :replacements argument and binding directly to a
;;; specified rthm-seq-palette object.
```

```
(make-rthm-seq-map 'rsm-test
  '((1 ((vn (1 2 3 4))
        (va (2 3 4 1))
        (vc (3 4 1 2))))
    (2 ((vn (4 5 6))
        (va (5 6 4))
        (vc (6 4 5))))
    (3 ((vn (7 8 9 1 2))
        (va (8 9 1 2 7))
        (vc (9 1 2 7 8)))))
:palette (make-rsp
  'rs-pal
  '((rs1 (((2 4) q e s s)))
    (rs2 (((2 4) e s s q)))
    (rs3 (((2 4) s s q e)))))
:replacements '(((1 vn) 2 7)
  ((2 va) 1 1)
  ((3 vc) 1 0)))
```

```
=>
```

```
RTHM-SEQ-MAP: num-players: 3
               players: (VA VC VN)
SC-MAP: palette id: RS-PAL
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                     num-data: 9
                     linked: NIL
                     full-ref: NIL
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: RSM-TEST, tag: NIL,
data: (
[...]
```

## SYNOPSIS:

```
(defun make-rthm-seq-map (id rsm &key (palette nil) (warn-not-found nil)
  (replacements nil)
  (recurse-simple-data t))
```

**20.2.305 rthm-seq-map/rsm-count-notes***[ rthm-seq-map ] [ Functions ]***DESCRIPTION:**

Returns the number of notes in the given rthm-seq-map object for the specified player and rthm-seq-palette.

**ARGUMENTS:**

- A rthm-seq-map object.
- The ID of the player whose notes are to be counted.
- The rthm-seq-palette object whose rthm-seq object IDs are referred to by the given rthm-seq-map object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to count just the number of notes that need new events (i.e., not counting tied notes; also not counting chords, since chords need only one event) or the total number of notes in that player's part in the score. T = count just attacked notes. Default = T.

**RETURN VALUE:**

Returns an integer that is the number of notes counted.

**EXAMPLE:**

```
(let ((rsmt (make-rthm-seq-map
  'rsm-test
  '((sec1 ((vn (rs1 rs3 rs2))
    (va (rs2 rs3 rs1))
    (vc (rs3 rs1 rs2))))
    (sec2 ((vn (rs1 rs2 rs1))
    (va (rs2 rs1 rs3))
    (vc (rs1 rs3 rs3))))
    (sec3 ((vn (rs1 rs1 rs3))
    (va (rs1 rs3 rs2))
    (vc (rs3 rs2 rs3)))))))
  (rspt (make-rsp
    'rs-pal
    '((rs1 (((2 4) q (e) s s)))
      (rs2 (((2 4) e +s (s) q)))
      (rs3 (((2 4) (s) s +q e)))))))
```

```

(print (rsm-count-notes rsmt 'vn rspt))
(print (rsm-count-notes rsmt 'va rspt nil)))

=>
23
27

```

**SYNOPSIS:**

```
(defun rsm-count-notes (rthm-seq-map player palette &optional (just-attacks t))
```

**20.2.306 rthm-seq-map/rthm-chain**

[ *rthm-seq-map* ] [ *Classes* ]

**NAME:**

rthm-chain

File: rthm-chain.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map -> rthm-seq-map -> rthm-chain

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Algorithmic generation of rthm-seqs that include  
slower-moving counterpoint and a means to control  
activity development through curves. Here we generate a  
rthm-seq-map and its associated palette algorithmically.

Say we have 9 irregular 1 beat duration patterns; these  
would enter in the sequence defined by (procession x 9)  
where x would be the number of patterns to generate.

Rests are inserted at regular but changing intervals e.g

```

3x every 2 beats (6)
2x every 3 beats (6)
3x every 5 beats (15)
2x every 8 beats (16)

```

e, q, and q. rests are used by default, in a sequence determined by a recurring-event instance.

In order to make music that 'progresses' we have curves with y values from 1-10 indicating how much activity there should be: 1 would mean only 1 in 10 beats would have notes in/on them, 10 would indicate that all do. We use the patterns given in `activity-levels::initialize-instance`, where 1 means 'play', 0 means 'rest'. There are three examples of each level so that if we stick on one level of activity for some time we won't always get the same pattern: these will instead be cycled through.

A slower moving (bass) line is also added that is made up of 2 or 3 beat groups---if the activity curve indicates a rest, then the whole 2-3 beat group is omitted.

There are also 'sticking points' where a rhythm will be repeated a certain number of times (either s, e, e., or q by default). Sticking happens after rests. This can be controlled with an activity envelope too, also indicating one of the 10 patterns above (but also including 0). A 0 or 1 unit here would refer to a certain number of repeats (1) or none (0). How many repeats could be determined by something like: `(procession 34 '(2 3 5 8 13) :peak 1 :expt 3)` There's always a slower group to accompany the sticking points: simply the next in the sequence, repeated for as long as we stick

The harmonic-rthm curve specifies how many slower-rthms will be combined into a rthm-seq (each rthm-seq has a single harmony). The default is 2 bars (slower-rthms) per rthm-seq.

Author: Michael Edwards: [m@michael-edwards.org](mailto:m@michael-edwards.org)

Creation date: 4th February 2010

\$\$ Last modified: 16:17:43 Wed Oct 23 2013 BST

SVN ID: \$Id: rthm-chain.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.307 rthm-chain/add-voice***[ rthm-chain ] [ Methods ]***DESCRIPTION:**

Add a new voice to an existing rthm-chain object based on the rhythmic material and slot values already contained in that object.

The main rthm-chain algorithm generates only two voices. Rather than generate further voices in the same fashion by which the first two were created, this method uses the already created rthm-seqs in the given rthm-chain object to create a new voice.

The challenge here is that each rthm-seq potentially has its own time signature structure: There could be a 2/4 bar followed by 5/4 then 3/16, for example, or any other combination of any meter. So the method first analyses the time-signature structure of the existing rthm-seqs and saves those with the same bar/meter structure together in the order in which they occur. When creating the extra voice then, the method actually starts ahead of the main voice by choosing <offset> number of similar rthm-seqs in advance. NB Your data might well produce only one rthm-seq with a particular metric structure, which might mean that calling this method produces rhythmic doubling instead of an independent part. In that case you might try adding more rhythmic fragments and regenerating your piece.

**ARGUMENTS:**

- A rthm-chain object.
- The reference (key path) of the player within the given rthm-chain object whose rthm-seq-map is to serve as the 'parent voice', e.g. '(1 cl).
- A symbol that will be the ID of the new player.

**OPTIONAL ARGUMENTS:**

- An integer that indicates an offset into the group of similar rthm-seq objects from which the new voice is to begin. (The generated voice will thus be ahead of the main voice). Default = 1.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
(let ((rch
```

```

(make-rthm-chain
 'test-rch 150
 '(((e) e) ; 4 in total
  (- s (s) (s) s -)
  ({ 3 (te) - te te - })
  ((e.) s))
 ({ 3 (te) te (te) }) ; what we transition to
 ({ 3 - te (te) te - })
 ({ 3 (te) - te te - })
 ({ 3 (te) (te) te })))
 '(((q q) ; the 2/4 bars: 5 total
  ((q) q)
  ((q) q)
  ((q) (s) e.)
  (- e e - (e) e))
  ({ 3 te+te te+te te+te }) ; what we transition to
  (q - s e -)
  (q (s) e.)
  (q (s) - s e -)
  ({ 3 te+te te+te - te te - })))
 (((e.) s (e) e (s) e.) ; the 3/4 bars: 4 total
  (- e e - (e) e (q))
  (- e. s - - +e e - (q))
  (q (e.) s (q)))
  ({ 3 (te) (te) te+te te+te } (q)) ; what we transition to
  (- e. s - (q) (s) - s e -)
  ({ 3 te+te te } (q) q)
  ({ 3 - te te te - } (e) e { 3 (te) (te) te })))
 :players '(fl cl)))
 (add-voice rch '(1 cl) 'ob))

```

**SYNOPSIS:**

```
(defmethod add-voice ((rc rthm-chain) parent new-player &optional (offset 1))
```

**20.2.308 rthm-chain/hash-least-used**

[ *rthm-chain* ] [ *Functions* ]

**DESCRIPTION:**

Return the least used key in a hash table. This may be used to retrieve the number of times the keys have been used as indices, for example.

**ARGUMENTS:**

- A hash table. This must be a lisp hash table object whose keys are all integers and whose values are all numbers.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :start. The lowest key value we'll test. Default = 0.
- :end. The highest key value we'll test. Default = number of items in the hash table.
- :ignore. A list of keys to ignore when processing. NIL = process all keys. Default = NIL.
- :auto-inc. T or NIL to determine whether the function will automatically increment the count of the returned key. T = automatically increment. Default = T.

#### RETURN VALUE:

The hash least used.

#### EXAMPLE:

```
(let ((h (make-hash-table)))
  (loop for i below 100 do
    (setf (gethash i h) 10000))
  (setf (gethash 10 h) 5
        (gethash 11 h) 4
        (gethash 12 h) 3
        (gethash 13 h) 2)
  (print (hash-least-used h :auto-inc nil))
  (print (hash-least-used h :auto-inc t))
  (print (hash-least-used h :auto-inc t))
  (print (hash-least-used h :auto-inc nil :start 12))
  (setf (gethash 2 h) 0)
  (print (hash-least-used h :auto-inc nil :start 3 :end 11))
  (print (hash-least-used h :auto-inc nil :end 11))
  (print (hash-least-used h :auto-inc nil :ignore '(2))))
```

=>

```
13
13
12
13
11
2
13
```



**SYNOPSIS:**

```
(defun hash-least-used (hash &key (start 0) end ignore (auto-inc t))
```

**20.2.309 rthm-chain/make-rthm-chain**

[ *rthm-chain* ] [ *Functions* ]

**DESCRIPTION:**

Create an instance of a *rthm-chain* object. The *rthm-chain* class enables the algorithmic generation of a *rthm-seq-map* (with just one section) and its associated *rthm-seq-palette*, which consists in turn of algorithmically generated *rthm-seq* objects.

The rhythm-seq objects are made up of both faster material based on 1-beat groups and slower-moving counterpoint based on 2- or 3-beat groups.

The *rthm-chain* class also allows for control of the degree of activity in the parts over time through user-specified envelopes.

Rests are automatically inserted at regular but changing intervals.

Specified 'sticking points' cause individual rhythms to be repeated a certain number of times. Sticking happens after rests and can also be controlled with an activity envelope.

NB: Because this method uses the procession method internally, each collection of 1-beat-rthms and slower-rthms defined must contain at least four items.

NB: Since this method automatically inserts rests into the chains, the user may like to implement the various tie-over-rests post-generation editing methods. If this is done, the *handle-ties* method may also be recommended, as the *tie-over-rests* methods only affect printed output and not MIDI output.

**ARGUMENTS:**

- A number, symbol, or string that is to be the ID of the new *rthm-chain* object.
- An integer that is the number of beats to be generated prior to adding additional material created from sticking points and the automatic addition of rests. For generating a whole piece this will generally be in the hundreds, not dozens. Lower numbers might create very limited

results or make the use of the add-voice method next to useless.

- A list with sublists of rhythms that are to be the 1-beat rhythms used to construct the faster-moving material of the rthm-seq-palette. Each sublist represents the repertoire of rhythms that will be used by the procession method. Each sublist must contain the same number of rthms but their number and the number of sublists is open. A transition will be made from one group of rhythms to the next over the whole output (i.e. not one unit to another within e.g. the 1-beat rhythms) according to a fibonacci-transition method. NB Here and below, at least two lists are required: what we start with, and what we transition to. If no transition is required you could of course just duplicate the rhythms via a let variable: (list rhythms rhythms).
- A list with sublists of 2-beat and 3-beat full bars of rhythms used to construct the slower-moving counterpoint material of the rthm-seq-palette. This will be turned into a rthm-chain-slow object, and will therefore remain as lists of unparsed rhythms. Each sublist must contain the same number of rthms but their number and the number of sublists is open. A transition will be made from one group of rhythms to the next over the whole output (i.e. not one unit to another within e.g. the 1-beat rhythms) according to a fibonacci-transition method. NB: The rhythm units of slower-rthms must be expressed in single beats; e.g., a 2/4 bar must consist of q+q rather than h. The consolidate-notes method can be called afterwards if desired.

## OPTIONAL ARGUMENTS:

keyword arguments:

- :players. A list of two player IDs. When used in conjunction with a slippery-chicken object (which is the standard usage), these must be IDs as they are defined in that object's ENSEMBLE slot. The first player will play the 1-beat rhythms, the second the slower rhythms.  
Default = '(player1 player2)'.
- :section-id. An integer that will be used as the ID of the rthm-seq-map created. NB: rthm-chain only creates rthm-seq-maps with one section, making it possible to create several different rthm-seq-map objects for different sections in the given piece, and requiring that these be manually assigned IDs. Additionally, any ID given here must match an existing ID within the other maps. Default = 1.
- :activity-curve. A list of break-point pairs with y values from 1 to 10 indicating the amount of activity there should be over the course of the piece. A value of 1 indicates that only 1 in 10 beats will have notes in/on them, and a value of 10 indicates that all beats will have notes. This process uses the patterns given in activity-levels::initialize-instance, where 1 means 'play' and 0 means 'rest'. There are three templates for each level, so that if the curve remains on one level of activity for some time it won't always return the

same pattern; these will be rotated instead. If the activity curve indicates a rest for one of the slower-rhythms groups, the whole 2-3 beat group is omitted. Default = '(0 10 100 10).

- :do-rests. T or NIL to indicate whether to apply the automatic rest-insertion algorithm. T = use. Default = T.
- :rests. A list of rhythmic duration units from which the durations will be drawn when using the automatic rest-insertion algorithm. The specified rests are used in a sequence determined by a recurring-event object. Default = '(e q q. w). NB: Each of these values must not resolve to less than one-quarter of the beat basis, either alone or in combination, as this could result in an attempt to create meters from fractional beats (e.g. 3.25). An error message will be printed in such cases.
- :rest-cycle. A list of 2-item lists that indicate the pattern by which rests of specific rhythmic durations will be selected from the RESTS slot for automatic insertion. The first number of each pair is a 0-based position referring to the list of rests in the RESTS slot, and the second number is the number of times the rest at that particular position should be inserted. (This number does not mean that the selected rest will be inserted that many times at once, but rather that each consecutive time the rest algorithm selects one rest to be inserted, it will insert that specific rest, for the specified number of consecutive times.) For example, (0 3) indicates that for the next three times that the rest algorithm selects one rest to insert, it will select the rest located at position 0 in the list of rests in the RESTS slot (e by default). Default = '((0 3) (1 1) (0 2) (2 1) (1 1) (3 1)).
- :rest-re. A list of 2-item lists that indicate the pattern by which rests will be automatically inserted. The first number of each pair determines how many events occur before inserting a rest, and the second number of each pair determines how many times that period will be repeated. For example, (2 3) indicates that a rest will be inserted every two events, three times in a row. The list passed here will be treated as data for a recurring-event object that will be repeatedly cycled through. Default = '((2 3) (3 2) (2 2) (5 1) (3 3) (8 1)).
- :do-rests-curve. A list of break-point pairs with y values of either 0 or 1 indicating whether the do-rests algorithm is active or disabled. These values are interpolated between each pair, with all values 0.5 and higher being rounded up to 1 and all below 0.5 rounded to 0. Default = NIL.
- :do-sticking. T or NIL to indicate whether the method should apply the sticking algorithm. T = apply. Default = T.
- :sticking-rthms. A list of rhythmic units that will serve as the rhythms employed by the sticking algorithm. These are generated at initialization if not specified here. NB: This list is used to create a list using the procession algorithm at initialization, so it is best to apply something similar to the default if not accepting the default. If a circular-sclist object is provided here, it will be used instead of the default

- procession. Default = '(e e e. q e s).
- :sticking-repeats. A list of integers to indicate the number of repetitions applied in sticking segments. When the values of this list have been exhausted, the method cycles to the beginning and continues drawing from the head of the list again. NB: This list is made into a circular-sclist object when the given rthm-chain object is initialized unless a circular-sclist object is explicitly provided.  
Default = '(3 5 3 5 8 13 21).
  - :sticking-curve. A list of break-point pairs that acts as an activity envelope to control the sticking, which always occurs after rests. As with the activity curve, this curve can take y values up to 10, but also allows 0. A y value of 0 or 1 here refers to either a specific number of repeats (1) or none (0). The number of repeats may be determined, for example, by use of the procession method, such as  
(procession 34 '(2 3 5 8 13) :peak 1 :expt 3). Every sticking point is accompanied by a slower group, which is simply chosen in sequence and repeated for the duration of the sticking period.  
Default = '(0 2 100 2).
  - :do-sticking-curve. A list of break-point pairs that can be used, alternatively, to control whether the sticking algorithm is being applied or not at any given point over the course of the piece. The y values for this curve should be between 0 and 1, and the decimal fractions achieved from interpolation will be rounded. The 1 values resulting from this curve will only be actively applied to if do-sticking is set to T.  
Default = NIL.
  - :harmonic-rthm-curve. A list of break-point pairs that indicates how many slower-rthms will be combined into one rthm-seq (each rthm-seq has a single harmony). The default is 2 bars (slower-rthms) per rthm-seq, i.e. '(0 2 100 2).
  - :split-data. NIL or a two-item list of integers that are the minimum and maximum beat duration of bars generated. If NIL, the bars will not be split. These values are targets only; the method may create bars of different lengths if the data generated cannot be otherwise split.  
NB: The values given here will apply to a different beat basis depending on time signature of each individual bar, rather than on a consistent beat basis, such as quarters or eighths. Since this method produces bars of different lengths with time signatures of differing beat bases (e.g. 16, 8, 4 etc.) before it applies the split algorithm, a minimum value of 4, for example, can result in bars of 4/16, 4/8, 4/4 etc.  
Default = '(2 5)
  - :1-beat-fibonacci. T or NIL to indicate whether the sequence of 1-beat rhythms is to be generated using the fibonacci-transitions method or the processions method. T = use fibonacci-transitions method. Default = NIL.
  - :slow-fibonacci. T or NIL to indicate whether the sequence of the slow rhythms will be generated using the fibonacci-transitions method or the processions method. This affects the order in which each 2- or 3-beat

unit is used when necessary, not the order in which each 2- or 3-beat unit is selected; the latter is decided by the next element in the DATA slot of the rthm-chain-slow object, which simply cycles through '(2 3 2 2 3 2 2 3 3 3). T = use fibonacci-transitions method.  
Default = NIL.

**RETURN VALUE:**

A rthm-chain object.

**EXAMPLE:**

```
;; An example using a number of the keyword arguments.
(make-rthm-chain
 'test-rch 23
 '((((e) e) ; 4 in total
   (- s (s) (s) s -)
   ({ 3 (te) - te te - })
   ((e.) s))
   ({ 3 (te) te (te) }) ; what we transition to
   ({ 3 - te (te) te - })
   ({ 3 (te) - te te - })
   ({ 3 (te) (te) te })))
 '(((q q) ; the 2/4 bars: 5 total
   ((q) q)
   ((q) q)
   ((q) (s) e.)
   (- e e - (e) e))
   ({ 3 te+te te+te te+te }) ; what we transition to
   (q - s e. -)
   (q (s) e.)
   (q (s) - s e -)
   ({ 3 te+te te+te - te te - })))
 (((e.) s (e) e (s) e.) ; the 3/4 bars: 4 total
   (- e e - (e) e (q))
   (- e. s - - +e e - (q))
   (q (e.) s (q)))
   ({ 3 (te) (te) te+te te+te } (q)) ; what we transition to
   (- e. s - (q) (s) - s e -)
   ({ 3 te+te te } (q) q)
   ({ 3 - te te te - } (e) e { 3 (te) (te) te })))
:players '(fl cl)
:slow-fibonacci t
:activity-curve '(0 1 100 10)
:harmonic-rthm-curve '(0 1 100 3)
:do-sticking t
```

```

:do-sticking-curve '(0 1 25 0 50 1 75 0 100 1)
:sticking-curve '(0 0 100 10)
:sticking-repeats '(3 5 7 11 2 7 5 3 13)
:sticking-rthms '(e s. 32 e.)
:split-data '(4 7))

```

=>

```

RTHM-CHAIN: 1-beat-rthms: (((E E) (S S S S) (TE TE TE) (E. S))
                        ((TE TE TE) (TE TE TE) (TE TE TE) (TE TE TE)))
slower-rthms: (((((Q Q) ((Q) Q) ((Q) Q) ((Q) (S) E.)
                  (- E E - (E) E))
                (({ 3 TE+TE TE+TE TE+TE }) (Q - S E. -) (Q (S) E.)
                (Q (S) - S E -) ({ 3 TE+TE TE+TE - TE TE - })))
                (((E.) S (E) E (S) E.) (- E E - (E) E (Q))
                (- E. S - - +E E - (Q)) (Q (E.) S (Q)))
                (({ 3 (TE) (TE) TE+TE TE+TE } (Q))
                (- E. S - (Q) (S) - S E -) ({ 3 TE+TE TE } (Q) Q)
                ({ 3 - TE TE TE - } (E) E { 3 (TE) (TE) TE })))
1-beat-fibonacci: NIL
num-beats: 23
slow-fibonacci: T
num-1-beat-rthms: 4
num-1-beat-groups: 2
sticking-curve: (0.0 0 22 10)
harmonic-rthm-curve: (0.0 1 22 3)
beat: 4
do-sticking: T
do-rests: T
do-sticking-curve: (0.0 1 5.5 0 11.0 1 16.5 0 22 1)
do-rests-curve: NIL
sticking-al: (not printed for brevity's sake)
sticking-rthms: (E S. E S. 32 E 32 E E E. S. 32 S. E. S. 32 S. 32
                E. E)
sticking-repeats: (3 5 3 5 7 3 7 3 3 11 5 7 5 11 5 7 5 7 11 3 7 3 3
                  11 5 7 5 11 3 7 3 7 11 5 7 5 5 11 3 11 3 2 11 2
                  11 2 7 2 7 2 2 5 5 3 5)
activity-curve: (0.0 1 22 10)
main-al: (not printed for brevity's sake)
slower-al: (not printed for brevity's sake)
num-slower-bars: 22
rcs: (not printed for brevity's sake)
rests: (E Q Q. W)
rest-re: (not printed for brevity's sake)
rest-cycle: ((0 3) (1 1) (0 2) (2 1) (1 1) (3 1))
num-rthm-seqs: 19
section-id: 1

```

```

        split-data: (4 7)
RTHM-SEQ-MAP: num-players: 2
              players: (FL CL)
SC-MAP: palette id: RTHM-CHAIN-RSP
[...]
```

**SYNOPSIS:**

```

(defun make-rthm-chain (id num-beats 1-beat-rthms slower-rthms &key
                        (1-beat-fibonacci nil)
                        (slow-fibonacci nil)
                        (players '(player1 player2))
                        (section-id 1)
                        (rests '(e q q. w))
                        (do-rests t)
                        (do-rests-curve nil)
                        (rest-re '((2 3) (3 2) (2 2) (5 1) (3 3) (8 1)))
                        (rest-cycle '((0 3) (1 1) (0 2) (2 1) (1 1) (3 1)))
                        (activity-curve '(0 10 100 10))
                        (sticking-curve '(0 2 100 2))
                        (harmonic-rthm-curve '(0 2 100 2))
                        (do-sticking t)
                        (do-sticking-curve nil)
                        (sticking-repeats '(3 5 3 5 8 13 21))
                        (sticking-rthms '(e e e. q e s))
                        (split-data '(2 5)))
```

**20.2.310 rthm-chain/procession**

[ *rthm-chain* ] [ *Functions* ]

**DATE:**

26-Jan-2010

**DESCRIPTION:**

Generate a list of a specified length consisting of items extrapolated from a specified starting list. All elements of the resulting list will be members of the original list.

The method generates the new list by starting with the first 3 elements of the initial list and successively adding consecutive elements from the initial list until all elements have been added.

**ARGUMENTS:**

- An integer that is the number of items in the list to be generated.
- A list of at least 4 starting items or an integer  $\geq 4$ . If an integer is given rather than a list, the method will process a list of consecutive numbers from 1 to the specified integer.

### OPTIONAL ARGUMENTS:

keyword arguments:

- :peak. A decimal number  $>0.0$  and  $\leq 1.0$ . This number indicates the target location in the new list at which the last element is to finally occur, whereby e.g.  $0.7 = \sim 70\%$  of the way through the resulting list. This is an approximate value only. The last element may occur earlier or later depending on the values of the other arguments. In particular, initial lists with a low number of items are likely to result in new lists in which the final element occurs quite early on, perhaps even nowhere near the specified peak value. Default = 0.7.
- :expt. An exponent (floating point number) to indicate the "curve" that determines the intervals at which each successive element of the initial list is introduced to the new list. A higher number indicates a steeper exponential curve. Default = 1.3.
- :orders. The patterns by which the elements are added. The method cyclically applies these orders, the numbers 1, 2, and 3 representing the three least used elements at each pass. These orders must therefore contain all of the numbers 1, 2, and 3, and those numbers only. Default = '((1 2 1 2 3) (1 2 1 1 3) (1 2 1 3)).

### RETURN VALUE:

Returns two values, the first being the new list, with a secondary value that is a list of 2-item lists that show the distribution of each element in the new list.

### EXAMPLE:

```
(procession 300 30 :peak 0.1)
```

```
=>
```

```
(1 2 1 2 3 4 5 4 4 6 7 8 7 9 10 11 10 11 12 13 14 13 13 15 16 17 16 18 19 20 19
 20 21 22 23 22 22 24 25 26 25 27 28 29 28 29 30 3 5 3 3 6 8 9 8 12 14 15 14
 15 17 18 21 18 18 23 24 26 24 27 1 2 1 2 30 5 6 5 5 7 9 10 9 11 12 16 12 16
 17 19 20 19 19 21 23 25 23 26 27 28 27 28 29 4 6 4 4 30 7 8 7 10 11 13 11 13
 14 15 17 15 15 20 21 22 21 24 25 26 25 26 29 1 2 1 1 30 3 6 3 8 9 10 9 10 12
 14 16 14 14 17 18 20 18 22 23 24 23 24 27 28 29 28 28 30 2 5 2 6 7 8 7 8 11
 12 13 12 12 16 17 19 17 20 21 22 21 22 25 26 27 26 26 29 3 4 3 30 5 6 5 6 9
 10 11 10 10 13 15 16 15 18 19 20 19 20 23 24 25 24 24 27 1 29 1 30 2 4 2 4 7)
```



```

8 9 8 8 11 13 14 13 16 17 18 17 18 21 22 23 22 22 25 27 28 27 29 3 5 3 5 30
6 7 6 6 9 11 12 11 14 15 16 15 16 19 20 21 20 20 23 25 26 25 28 1 29 1 29 30
2 4 2 2 7 9 10 9 12 13 14 13 14 17 18), ((2 12) (20 11) (14 11) (13 11)
(9 11) (6 11) (1 11) (29 10) (25 10) (22 10) (18 10) (17 10) (16 10) (15 10)
(12 10) (11 10) (10 10) (8 10) (7 10) (5 10) (4 10) (3 10) (30 9) (28 9)
(27 9) (26 9) (24 9) (23 9) (21 9) (19 9))

```

```
(procession 300 30 :peak 0.9)
```

```
=>
```

```

(1 2 1 2 3 1 3 1 1 4 2 3 2 4 3 4 3 4 5 2 4 2 2 5 1 3 1 5 3 4 3 4 5 1 5 1 1 6 2
5 2 6 4 5 4 5 6 3 6 3 3 7 5 6 5 7 2 6 2 6 7 6 7 6 6 8 4 7 4 8 7 8 7 8 9 7 8
7 7 9 8 9 8 10 8 9 8 9 10 8 9 8 8 10 9 10 9 11 9 10 9 10 11 10 11 10 10 12
10 11 10 12 11 12 11 12 13 11 12 11 11 13 12 13 12 14 12 13 12 13 14 13 14
13 13 15 13 14 13 15 11 14 11 14 15 14 15 14 14 16 15 16 15 17 15 16 15 16
17 16 17 16 16 18 16 17 16 18 17 18 17 18 19 17 18 17 17 19 18 19 18 20 18
19 18 19 20 19 20 19 19 21 15 20 15 21 20 21 20 21 22 20 21 20 20 22 21 22
21 23 21 22 21 22 23 22 23 22 22 24 23 24 23 25 23 24 23 24 25 24 25 24 24
26 23 25 23 26 25 26 25 26 27 26 27 26 26 28 25 27 25 28 27 28 27 28 29 27
28 27 27 29 28 29 28 30 24 29 24 29 30 26 29 26 26 30 28 29 28 30 19 29 19
29 30 22 25 22 22 30 12 27 12 30 14 16 14 16 30 17), ((8 12) (22 11)
(16 11) (14 11) (12 11) (11 11) (10 11) (4 11) (3 11) (2 11) (26 10)
(19 10) (17 10) (15 10) (13 10) (9 10) (7 10) (6 10) (5 10) (1 10)
(29 9) (28 9) (27 9) (25 9) (24 9) (23 9) (21 9) (20 9) (18 9) (30 8))

```

## SYNOPSIS:

```

(defun procession (num-results items
                  &key
                    ;; what proportion of the way through should we aim to reach
                    ;; the max number of items? NB This is approximate only:
                    ;; you may find the first occurrence of the highest element
                    ;; earlier or later depending on the values of the other
                    ;; arguments. In particular, with a low number of items the
                    ;; highest element will be hit very early on, perhaps
                    ;; nowhere near the peak argument.
                    (peak 0.7)
                    ;; for an exponential curve going from 3 to num <items>
                    (expt 1.3)
                    ;; these are the orders we'll use at the beginning
                    ;; (cyclically). They will then be used when we've gone
                    ;; beyond 3 items by always using the 3 least used items.
                    ;; NB This must contain the numbers 1, 2, and 3 only but
                    ;; there can be 1 or any number of sublists.
                    (orders '((1 2 1 2 3) (1 2 1 1 3) (1 2 1 3))))

```

**20.2.311 rthm-chain/reset***[ rthm-chain ] [ Methods ]***DESCRIPTION:**

Reset the various circular-sclist objects within the given rthm-chain object to their initial state.

**ARGUMENTS:**

- A rthm-chain object.

**OPTIONAL ARGUMENTS:**

(- :where. This argument is ignored by the method as it is only present due to inheritance.)

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
;;; Print the results of applying get-next to the STICKING-RTHMS slot of the
;;; given rthm-chain object, repeat, reset, and print again to see that the
;;; get-next now begins at the beginning of the slot again.
```

```
(let ((rch
      (make-rthm-chain
       'test-rch 150
       '((((e) e) ; 4 in total
         (- s (s) (s) s -)
         ({ 3 (te) - te te - })
         ((e.) s))
        (({ 3 (te) te (te) }) ; what we transition to
         ({ 3 - te (te) te - })
         ({ 3 (te) - te te - })
         ({ 3 (te) (te) te })))
      '((((q q) ; the 2/4 bars: 5 total
        ((q) q)
        ((q) q)
        ((q) (s) e.)
        (- e e - (e) e))
        (({ 3 te+te te+te te+te }) ; what we transition to
```

```

      (q - s e. -)
      (q (s) e.)
      (q (s) - s e -)
      ({ 3 te+te te+te - te te - })))
      (((e.) s (e) e (s) e.) ; the 3/4 bars: 4 total
      (- e e - (e) e (q))
      (- e. s - - +e e - (q))
      (q (e.) s (q)))
      (({ 3 (te) (te) te+te te+te } (q)) ; what we transition to
      (- e. s - (q) (s) - s e -)
      ({ 3 te+te te } (q) q)
      ({ 3 - te te te - } (e) e { 3 (te) (te) te }))))))
(print
  (loop repeat 19
    collect (data (get-next (sticking-rthms rch)))))
(print
  (loop repeat 19
    collect (data (get-next (sticking-rthms rch)))))
(reset rch)
(print
  (loop repeat 19
    collect (data (get-next (sticking-rthms rch)))))

=>
(E E E E E. E E. E E Q E E. E Q E. Q E. Q E)
(E E E E E E. E E. E E Q E E. E Q E. Q E. Q)
(E E E E E. E E. E E Q E E. E Q E. Q E. Q E)

```

**SYNOPSIS:**

```
(defmethod reset ((rc rthm-chain) &optional ignore1 ignore2)
```

**20.2.312 rthm-chain/rthm-chain-gen**

[ *rthm-chain* ] [ *Methods* ]

**DESCRIPTION:**

Generate a chain of rhythms using the procession function (internally).

The basic algorithm for generating a rthm-chain object of two parts is as follows: The user provides an arbitrary number of 1-beat rthms (e.g. s s (e)) and 2-3 beat slower-moving counterpoints. The method generates a sequence from these using the procession function. Next the activity curve is applied to this, and after that the insertion of rests. Then the

'sticking points' are generated: These come after the rests, and the activity curves applied to these count inserted rests not seqs or beats.

NB: Rests are put into the given rthm-seq object mid-sequence, so sticking points won't come directly after the rests, rather, at the end of the seq.

The activity curves that turn notes into rests will be queried every beat, so if an activity level is changed, the method won't wait until the end of the previous level's ten beats.

NB: This method is not generally called by the user (though it can be of course); rather, it's called by the init function.

#### ARGUMENTS:

- A rthm-chain object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :rests. T or NIL to indicate whether rests are to be automatically inserted. T = automatically insert. Default = T.
- :stick. T or NIL to indicate whether to generate the sticking points. T = generate sticking points. Default = T.
- :num-beats. NIL or an integer to indicate how many beats are to be used for the algorithm. NB: The method will generate considerably more beats if also generating sticking points and inserting rests; this number merely refers to the number of standard 1-beat rhythms to be generated. If NIL, the method will obtain the number of beats from the NUM-BEATS slot of the rthm-chain instance. Default = NIL.
- :use-fibonacci. T or NIL to indicate whether to use the fibonacci-transitions method when generating the sequence from the 1-beat rhythms (in which case these will be repeated) or the procession algorithm (in which case they'll be alternated). T = use the fibonacci-transitions method. Default = T.
- :section-id. An integer that is the section ID of the rthm-chain object to be generated. This will determine the section of the rthm-seq-map into which the references will be placed. The rthm-seq objects themselves will also be parcelled up into an object with this ID, so ID conflicts can be avoided if combining two or more sections generated by separate rthm-chain objects. Default = 1.
- :wrap. An integer or NIL to determine the position within the list of 1-beat rhythms and slow rhythms from which the generated rhythm chain will begin. NIL = begin at the beginning. Default = NIL.
- :split. T or NIL to indicate whether to split up longer generated bars

(e.g. 7/4) into smaller bars. If this is a two-element list it represents the min/max number of beats in a bar (where a 6/8 bar is two compound beats). Default = '(2 5).

#### RETURN VALUE:

the number of rthm-seqs we've generated

#### SYNOPSIS:

```
(defmethod rthm-chain-gen ((rc rthm-chain)
                           &key
                           (use-fibonacci t)
                           (rests t)
                           (stick t)
                           (section-id 1)
                           num-beats
                           wrap)
```

#### 20.2.313 rthm-chain/split

[ *rthm-chain* ] [ *Methods* ]

#### DATE:

29-Jan-2011

#### DESCRIPTION:

Split the longer generated bars into smaller ones where possible.

#### ARGUMENTS:

- A rthm-chain object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :min-beats. An integer that is the minimum number of beats in the resulting bars. This is a target-length only, and may not be adhered to strictly if durations do not allow. Default = 2.
- :max-beats. An integer that is the maximum number of beats in the resulting bars. This is a target-length only, and may not be adhered to strictly if durations do not allow. Default = 5.

- :warn. T or NIL to indicate whether to print a warning to the listener if the current bar cannot be split. T = print. Default = NIL.
- :clone. T or NIL to indicate whether the rthm-seq of the given rthm-chain object should be changed in place or changes should be made to a copy of that object. T = create a copy to be changed. Default = T.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
;;; Make a rthm-chain object using make-rthm-chain with the :split-data
;;; argument set to NIL and print the number of bars in each resulting rthm-seq
;;; object. Apply the split method and print the number of bars again to see
;;; the change.
```

```
(let* ((rch
  (make-rthm-chain
    'test-rch 150
    '((((e) e) ; 4 in total
      (- s (s) (s) s -)
      ({ 3 (te) - te te - })
      ((e.) s))
      (({ 3 (te) te (te) }) ; what we transition to
        ({ 3 - te (te) te - })
        ({ 3 (te) - te te - })
        ({ 3 (te) (te) te })))
    '((((q q) ; the 2/4 bars: 5 total
      ((q) q)
      ((q) q)
      ((q) (s) e.)
      (- e e - (e) e))
      (({ 3 te+te te+te te+te }) ; what we transition to
        (q - s e. -)
        (q (s) e.)
        (q (s) - s e -)
        ({ 3 te+te te+te - te te - })))
    (((((e.) s (e) e (s) e.) ; the 3/4 bars: 4 total
      (- e e - (e) e (q))
      (- e. s - - +e e - (q))
      (q (e.) s (q)))
      (({ 3 (te) (te) te+te te+te } (q)) ; what we transition to
        (- e. s - (q) (s) - s e -)
        ({ 3 te+te te } (q) q)
        ({ 3 - te te te - } (e) e { 3 (te) (te) te }))))))
```

```

      :split-data nil)))
(print
 (loop for rs in (data (get-data-data 1 (palette rch)))
       collect (num-bars rs)))
(split rch :min-beats 1 :max-beats 3 :clone nil)
(print
 (loop for rs in (data (get-data-data 1 (palette rch)))
       collect (num-bars rs))))

=>
(1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2
 2 2 2 2 2 2 2 1 1 2 2 1 1 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 2 2
 2 2)
(1 1 4 4 2 7 4 4 3 3 4 4 2 9 7 7 2 5 5 5 2 6 1 1 2 13 3 3 4 4 5 5 2 7 5 5
 7 7 9 9 2 7 2 9 3 3 2 9 1 1 5 5 9 9 3 3 2 7 5 5 4 4 2 11 1 1 2 10 2 9 2 6
 7 7 7 7)

```

**SYNOPSIS:**

```

(defmethod split ((rc rthm-chain) &key
                  (min-beats 2) (max-beats 5) warn (clone t))

```

**20.2.314 rthm-seq-map/set-map-refs**

[ *rthm-seq-map* ] [ *Methods* ]

**DATE:**

30-Dec-2010

**DESCRIPTION:**

Change the reference IDs of the specified rthm-seq objects in the given rthm-seq-map object.

**ARGUMENTS:**

- A rthm-seq-map object.
- The ID of the section in which references are to be set.
- The ID of the player for whom the references are to be set.
- A list of the new rthm-seq IDs (references)

**RETURN VALUE:**

Returns the modified named object whose ID is the specified player.

**EXAMPLE:**

```
(let ((rsmt (make-rthm-seq-map
  'rsm-test-5
  '((sec1 ((vn (rs1 rs3 rs2))
    (va (rs2 rs3 rs1))
    (vc (rs3 rs1 rs2))))
    (sec2 ((vn (rs1 rs2 rs1))
    (va (rs2 rs1 rs3))
    (vc (rs1 rs3 rs3))))
    (sec3 ((vn (rs1 rs1 rs3))
    (va (rs1 rs3 rs2))
    (vc (rs3 rs2 rs3))))))
  :palette (make-rsp
    'rs-pal
    '((rs1 (((2 4) q e s s))))
    (rs2 (((2 4) e s s q))))
    (rs3 (((2 4) s s q e))))))
  (set-map-refs rsmt 'sec2 'vc '(rs2 rs3 rs2)))
```

=&gt;

NAMED-OBJECT: id: VC, tag: NIL,  
data: (RS2 RS3 RS2)

**SYNOPSIS:**

```
(defmethod set-map-refs ((rsm rthm-seq-map) section player new-refs)
```

**20.2.315 sc-map/set-map**

[ *sc-map* ] [ *Classes* ]

**NAME:**

set-map

File: set-map.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> assoc-list -> recursive-assoc-list ->  
sc-map -> set-map

Version: 1.0.4

Project: slippery chicken (algorithmic composition)



Purpose: Implementation of the set-map class for mapping sets for a piece.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 11th 2010

\$\$ Last modified: 20:10:09 Fri Mar 19 2010 GMT

SVN ID: \$Id: set-map.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.316 set-map/gen-midi-chord-seq

[ set-map ] [ Methods ]

#### DESCRIPTION:

Write a midi file with each set in the set-map played as a chord at 1 second intervals.

#### ARGUMENTS:

- A set-map object.
- The path+file-name for the midi file to be written.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((c3 e3 g3 a3 c4 d4 g4 a4 b4 e5))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((2 4) q e s s))
                               :pitch-seq-palette ((1 2 3 4))))
       :rthm-seq-map '((1 ((vn (1 1 1))))))
      (gen-midi-chord-seq (set-map mini) "/tmp/mchsqs.mid"))

=> T
```

#### SYNOPSIS:

```
(defmethod gen-midi-chord-seq ((sm set-map) midi-file)
```

### 20.2.317 recursive-assoc-list/set-data

[ recursive-assoc-list ] [ Methods ]

#### DESCRIPTION:

Replace the named-object associated with a specified key within a given recursive-assoc-list object. This method replaces the whole named-object, not just the data of that object.

#### ARGUMENTS:

- A key present within the given recursive-assoc-list object. This must be a list that is the FULL-REF (path of keys) if replacing a nested named-object. If replacing a named-object at the top level, the key can be given either as a single-item list or an individual symbol.
- A key/data pair as a list.
- The recursive-assoc-list object in which to find and replace the named-object associated with the specified key.

#### RETURN VALUE:

Returns the new named-object.

Returns NIL when the specified key is not found within the given recursive-assoc-list object.

#### EXAMPLE:

```
;;; Replace a named-object at the top level using a single symbol
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                          (violets ((blue velvet)
                              (red ((dragon den)
                                  (viper nest)
                                  (fox hole)))
                              (white ribbon))))))))))
  (set-data 'wild '(makers mark) ral))
```

=>

NAMED-OBJECT: id: MAKERS, tag: NIL,

```
data: MARK
```

```
;; The same can be done stating the top-level key as a single-item list. Apply
;; the get-all-refs method in this example to see the change
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (set-data '(wild) '(makers mark) ral)
  (get-all-refs ral))
```

```
=> ((JIM) (MAKERS) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
     (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED FOX) (FOUR VIOLETS WHITE))
```

```
;; Replace a nested named-object using a list that is the FULL-REF to that
;; object. Print the application of the method as well as the results from
;; applying the get-all-refs method in this example to see the effects
```

```
(let ((ral (make-ral 'mixed-bag
                    '((jim beam)
                      (wild turkey)
                      (four ((roses red)
                            (violets ((blue velvet)
                                       (red ((dragon den)
                                             (viper nest)
                                             (fox hole)))
                                       (white ribbon))))))))))

  (print (set-data '(four violets red fox) '(bee hive) ral))
  (print (get-all-refs ral)))
```

```
=>
```

```
NAMED-OBJECT: id: BEE, tag: NIL,
data: HIVE
```

```
*****
```

```
((JIM) (WILD) (FOUR ROSES) (FOUR VIOLETS BLUE) (FOUR VIOLETS RED DRAGON)
 (FOUR VIOLETS RED VIPER) (FOUR VIOLETS RED BEE) (FOUR VIOLETS WHITE))
```

## SYNOPSIS:

```
(defmethod set-data (key new-value (ral recursive-assoc-list))
```

**20.2.318 assoc-list/replace-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

A convenience method that's essentially the same as `set-data` but without having to pass the new ID in a list along with the new value.

**ARGUMENTS:**

- The key (number, symbol, string) to the existing data.
- The new value to be associated with this key (any data).
- The `assoc-list` object

**RETURN VALUE:**

The named-object for the datum.

**SYNOPSIS:**

```
(defmethod replace-data (key new-value (al assoc-list))
```

**20.2.319 assoc-list/set-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Replace the named-object associated with a specified key within a given `assoc-list` object. This method replaces the whole named-object, not just the data of that object.

**ARGUMENTS:**

- A key present within the given `assoc-list` object.
- A key/data pair as a list.
- The `assoc-list` object in which to find and replace the named-object associated with the specified key.

**RETURN VALUE:**

Returns the new named-object.

Returns NIL when the given key is not present within the given `assoc-list`.

**EXAMPLE:**

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog fido)
                                   (cow bessie)))))
  (set-data 'dog '(dog spot) al))
```

=>

```
NAMED-OBJECT: id: DOG, tag: NIL,
data: SPOT
```

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog fido)
                                   (cow bessie)))))
  (set-data 'pig '(pig wilbur) al))
```

=> NIL

WARNING:

```
assoc-list::set-data: Could not find data with key PIG in assoc-list with id
TEST
```

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog fido)
                                   (cow bessie)))))
  (set-data 'dog '(pig wilbur) al))
```

=>

```
NAMED-OBJECT: id: PIG, tag: NIL,
data: WILBUR
```

**SYNOPSIS:**

```
(defmethod set-data (key new-value (al assoc-list))
```

**20.2.320 assoc-list/set-nth-of-data**

[ *assoc-list* ] [ *Methods* ]

**DESCRIPTION:**

Replace a given member of a given data list within a given assoc-list.

**ARGUMENTS:**

- The key (named-object id) associated with the data to be changed.

- The zero-based integer index of the member of the list to be changed.
- The new value.
- The assoc-list in which the change is to be made.

The data to be modified must already be in the form of a list.

The index integer given must be less than the length of the data list to be modified.

#### RETURN VALUE:

Returns the new value only.

#### EXAMPLE:

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog (fido spot rover))
                                   (cow bessie)))))
  (set-nth-of-data 'dog 0 'snoopy al))
```

=> SNOOPY

```
(let ((al (make-assoc-list 'test '((cat felix)
                                   (dog (fido spot rover))
                                   (cow bessie)))))
  (set-nth-of-data 'dog 0 'snoopy al)
  (get-data 'dog al))
```

=>

```
NAMED-OBJECT: id: DOG, tag: NIL,
data: (SNOOPY SPOT ROVER)
```

#### SYNOPSIS:

```
(defmethod set-nth-of-data (key nth new-value (al assoc-list))
```

#### 20.2.321 circular-sclist/at-start

[ *circular-sclist* ] [ *Methods* ]

#### DESCRIPTION:

Determines whether the pointer for the given circular-sclist object is at the head of its list.

#### ARGUMENTS:

- A circular-sclist object.

#### RETURN VALUE: EXAMPLE:

```
;; At creation the pointer is located at the start of the list
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (at-start cscl))
```

=> T

```
;; Retrieve a number of the items using get-next, then determine whether the
;; pointer is located at the start of the list
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 7 do (get-next cscl))
  (at-start cscl))
```

=> NIL

#### SYNOPSIS:

```
(defmethod at-start ((cscl circular-sclist))
```

#### 20.2.322 circular-sclist/cycle-repeats

[ *circular-sclist* ] [ *Classes* ]

##### NAME:

rthm-chain

File: cycle-repeats.lsp

Class Hierarchy: named-object -> linked-named-object -> scslist ->  
circular-sclist -> cycle-repeats

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: class used in rthm-chain

Author: Michael Edwards: m@michael-edwards.org

Creation date: 4th February 2010

\$\$ Last modified: 12:51:09 Sat Apr 28 2012 BST

SVN ID: \$Id: cycle-repeats.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.323 circular-sclist/get-last

[ *circular-sclist* ] [ *Methods* ]

#### DESCRIPTION:

Return the the most recent item retrieved in a circular-sclist object.

#### ARGUMENTS:

- A circular-sclist object.

#### RETURN VALUE:

An item from the given circular-sclist object.

#### EXAMPLE:

```
;; Retrieves the final item in the list at creation
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (get-last cscl))
```

=> 4

```
;; Get and print a number of items from the list using get-next, then return
;; the most recent item retrieved using get-last
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 7 do (print (get-next cscl)))
  (get-last cscl))
```

=> 1

#### SYNOPSIS:

```
(defmethod get-last ((cscl circular-sclist))
```

### 20.2.324 circular-sclist/get-next

[ *circular-sclist* ] [ *Methods* ]

#### DESCRIPTION:



Get the next item in a given circular-sclist object. The class automatically keeps track of the last item retrieved. If the final item of the given circular-sclist object was the last item retrieved, the method begins again at the beginning of the list.

#### ARGUMENTS:

- A circular-sclist object.

#### RETURN VALUE:

An item from the given circular-sclist object.

#### EXAMPLE:

```
;; Repeatedly calling get-next retrieves each subsequent item from the
;; given circular-sclist object. When the list has been exhausted, retrieval
;; begins again from the head of the list.
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 10
    do (print (get-next cscl))))
```

=>

```
0
1
2
3
4
0
1
2
3
4
```

#### SYNOPSIS:

```
(defmethod get-next ((cscl circular-sclist))
```

#### 20.2.325 circular-sclist/make-cscl

[ circular-sclist ] [ Functions ]

#### DESCRIPTION:

Create a circular-sclist object from a specified list of items. The items themselves may also be lists.

**ARGUMENTS:**

- A list.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. A symbol that will be used as the ID for the created circular-sclist object. Default = NIL.
- :bounds-alert. T or NIL to indicate whether or not to print a warning if when an attempt is made to access the object using an out-of-bounds index number (i.e., not enough elements in the list). T = print a warning. Default = T.
- :copy. T or NIL to indicate whether the given data list should be copied (any slippery-chicken class instances will be cloned), with subsequent modifications being applied to the copy. T = copy. Default = T.

**RETURN VALUE:**

A circular-sclist object.

**EXAMPLE:**

```
;; Returns a circular-sclist object with ID of NIL, bounds-alert=T and copy=T
;; by default
(make-cscl '(1 2 3 4))
```

```
=>
```

```
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 4, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (1 2 3 4)
```

```
;; Can be created using nested lists
(let ((cscl (make-cscl '((1 (4 5 6))
                          (2 (7 8 9))
                          (3 (10 11 12))))))
  (data cscl))
```

```
=> ((1 (4 5 6)) (2 (7 8 9)) (3 (10 11 12)))
```

```
;; Setting the ID
(make-cscl '(1 2 3 4) :id 'test-cscl)
```

```
=>
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 4, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: TEST-CSCL, tag: NIL,
data: (1 2 3 4)

;; By default, attempts to access the object with an out-of-bounds index result
;; in a warning being printed
(let ((cscl (make-cscl '(1 2 3 4))))
  (get-nth 11 cscl))

=>
NIL
WARNING: sclist::sclist-check-bounds: Illegal list reference: 11
(length = 4) (sclist id = NIL)

;; This can be suppressed by creating the object with :bounds-alert set to NIL
(let ((cscl (make-cscl '(1 2 3 4) :bounds-alert nil)))
  (get-nth 11 cscl))

=> NIL
```

**SYNOPSIS:**

```
(defun make-cscl (list &key (id nil) (bounds-alert t) (copy t))
```

**20.2.326 circular-sclist/popcorn**

[ *circular-sclist* ] [ *Classes* ]

**NAME:**

assoc-list

File: popcorn.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
circular-sclist -> popcorn

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Inspired by popping popcorn, generate a series of values

ranging between  $> 0.0$  and  $\leq 1.0$  by (optionally fixed) random selection. Given 1 or more starting values (not zero) we generate tendentially increasing new values until we reach 1.0. This is not a linear process, rather, we get spike values that increase the average value and thus increase the chance of further spikes.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 3rd February 2011 (Ko Lanta, Thailand)

\$\$ Last modified: 17:33:40 Thu Dec 26 2013 WIT

SVN ID: \$Id: popcorn.lsp 4345 2013-12-28 13:11:39Z medward2 \$

### 20.2.327 popcorn/fit-to-length

[ popcorn ] [ Methods ]

#### DESCRIPTION:

Change the length of the list of kernels contained in a given popcorn object by adding or removing items at regular intervals. If adding items, linear interpolation will be used.

NB: The new length must be between 1 and 1 less than double the original length.

#### ARGUMENTS:

- A popcorn object.
- An integer that is the new length of the list of the KERNELS slot of the given popcorn object.

#### RETURN VALUE:

Returns the integer that is the new length of the KERNELS slot.

#### EXAMPLE:

```
(let ((ppcn (make-popcorn '(0.01 0.02) :min-spike 3.0 :max-spike 5.0)))
  (fit-to-length ppcn 100))
```

=> 100

#### SYNOPSIS:

```
(defmethod fit-to-length ((pc popcorn) length)
```

### 20.2.328 popcorn/get-kernel

[ popcorn ] [ Methods ]

#### DESCRIPTION:

Generate the next value for the KERNELS slot of a given popcorn object and change the internal state, with the help of the get-kernel-aux method.

This method is called automatically from within the heat method.

#### ARGUMENTS:

- A popcorn object.

#### RETURN VALUE:

The next value for the given popcorn object's KERNEL slot.  
Returns NIL when the kernel value is > 1.0.

#### SYNOPSIS:

```
(defmethod get-kernel ((pc popcorn))
```

### 20.2.329 popcorn/heat

[ popcorn ] [ Methods ]

#### DESCRIPTION:

Generate a series of values for the KERNELS slot of a popcorn object, ranging between >0.0 and <= 1.0, by (optionally fixed) random selection. If calling heat explicitly on a previously heated object, all kernels and associated data will be deleted before being regenerated.

Taking the one or more starting values of the popcorn object, the method generates tendentially increasing new values until it reaches 1.0. This is not a linear process; rather, the method produces spike values based on the min-spike and max-spike values of the given popcorn object that increase the average value and thus increase the chance of further spikes.

NB: This method is called within the initialize-instance for the popcorn object, and as such is not necessarily needed to be accessed directly by the user.

**ARGUMENTS:**

- An popcorn object.

**RETURN VALUE:**

Returns the popcorn object with a newly generated list of 'kernel' values.

**EXAMPLE:**

```
(let ((ppcn (make-popcorn '(0.01 0.02) :min-spike 3.0 :max-spike 5.0)))
  (print ppcn)
  (setf (min-spike ppcn) 4.0)
  (heat ppcn))
=>
POPCORN: kernels: (0.01 0.02 0.016648924 0.018915312 0.016573396
                   0.017766343 0.018711153 0.017729789 0.017080924
                   0.018266398 0.018132625 0.019022772 0.017662765
  [...])
POPCORN: kernels: (0.01 0.02 0.015828498 0.015408514 0.015781755 0.01670348
                   0.019892192 0.017849509 0.016623463 0.019682804 0.017869182
                   0.019521425 0.017451862 0.017689057 0.01758664 0.01863435
  [...])
```

**SYNOPSIS:**

```
(defmethod heat ((pc popcorn))
```

**20.2.330 popcorn/make-popcorn**

[ popcorn ] [ Functions ]

**DESCRIPTION:**

Make a popcorn object. This method uses the heat method internally to generate a series of decimal values ('kernels'), ranging between >0.0 and <= 1.0, by (optionally fixed) random selection.

Taking the one or more starting values, the method generates tendentially increasing new values until it reaches 1.0. This is not a linear process; rather, the method produces spike values based on the min-spike and max-spike values specified, which increase the average value of the kernels generated so far and thus increase the chance of further spikes.

**ARGUMENTS:**

- A list of at least two decimal numbers from which the 'kernel' values will be generated. These values must be >0.0 and <1.0.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :id. An optional ID for the popcorn object to be created. Default = NIL.
- :fixed-random. T or NIL to indicate whether the 'kernel' values generated by the subsequent heat method are to be based on a fixed random seed. T = fixed random. Default = T.
- :max-spike. A decimal number that is the highest possible 'spike' value that the heat method may produce when generating the 'kernel' values. This is a sudden high value that will itself not be present in the final data, but will go towards skewing the mean, thus increasing the kernel values more rapidly and increasing the chance of more spikes occurring. Default = 4.0.
- :min-spike. A decimal number that is the lowest possible 'spike' value that the heat method may produce when generating the 'kernel' values. This is a sudden high value that will itself not be present in the final data, but will go towards skewing the mean, thus increasing the kernel values more rapidly and increasing the chance of more spikes occurring. Default = 2.0.

#### RETURN VALUE:

- A popcorn object.

#### EXAMPLE:

```
(make-popcorn '(0.02 0.03) :max-spike 4.2 :min-spike 3.7)
```

=>

```
POPCORN: kernels: (0.02 0.03 0.025828497 0.02540851 0.02578175 0.026703479
0.029892191 0.027849507 0.026623461 0.029682804 0.02786918
0.029521424 0.02745186 0.027689056 0.02758664 0.028634349
0.028176062 0.028434621 0.028410202 0.02834666 0.027676953
0.027972711 0.027877634 0.028453272 0.027664827 0.029336458
0.028315568 0.029327389 0.10877271 0.032779325 0.095442966
0.10383448 0.03631042 0.054371007 0.0775562 0.057371408
0.05496178 0.10499479 0.048501145 0.09311144 0.07531821
0.08538791 0.05866453 0.06692247 0.052130517 0.09605096
0.102914646 0.061326876 0.09510137 0.0927515 0.08405721
0.09921508 0.1054862 0.09474778 0.07701611 0.069283865
0.082345024 0.090727165 0.081423506 0.0918279 0.06942183
0.09431985 0.0790893 0.07795428 0.061114937 0.21615848)
```

```

0.17666964 0.09314137 0.11025161 0.1909036 0.23906681
0.17467138 0.22562174 0.1757016 0.16630511 0.23570478
0.18461326 0.2358803 0.14396386 0.121555254 0.082086496
0.094552115 0.08456006 0.10379071 0.113467366 0.12590313
0.2211197 0.2096048 0.19645368 0.17204309 0.18469864
0.14422922 0.20209482 0.11207011 0.1176545 0.22522071
0.23593009 0.13767788 0.1589861 0.23501754 0.14337942
0.14403008 0.3852736 0.19077776 0.15493082 0.15311162
0.31107113 0.10612649 0.36018372 0.31991273 0.17881061
0.2653634 0.26506728 0.31478146 0.31331018 0.33569553
0.3001081 0.1574295 0.4698523 0.12513468 0.2010088
0.17438973 0.24960503 0.27139995 0.31985858 0.14607468
0.34586 0.52092844 0.5461051 0.33965456 0.24476483
0.45786726 0.23932996 0.18096672 0.5287333 0.45701692
0.58791053 0.5219719 0.39459002 0.56624746 0.37368405
0.21688993 0.3374743 0.6648663 0.44353223 0.16596928
0.3590309 0.17943183 0.673855 0.6455428 0.21892962
0.31195784 0.37920266 0.73120433 0.713979 0.5987564
0.29621923 0.5414667 0.64287895 0.56254905 0.514681
0.3153673 0.52838445 0.71745664 0.8074915 0.47637874
0.409207 0.49155992 0.777411 0.6339724 0.3673042 0.5411029
0.6993387 0.3566729 0.49429625 0.89963627 0.36773333
0.575006 0.74177176 0.53539884 0.4392826 0.45671058
0.2824728 0.60876155 0.2798523 0.47930354)

```

```

total: 44.67911, numk: 186, mink: 0.02, maxk: 0.89963627
min-spike: 3.7, max-spike: 4.2, fixed-random: T, mean: 0.24021028
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (0.02 0.03)

```

## SYNOPSIS:

```

(defun make-popcorn (starting-values &key (id nil) (fixed-random t)
                    (max-spike 4.0) (min-spike 2.0))

```

### 20.2.331 popcorn/plot

```
[ popcorn ] [ Methods ]
```

## DESCRIPTION:

Create text and data files suitable for plotting with gnuplot. The file name should be given without extension, as the method will create a .txt



and a .data file, for the command and data files respectively.

The user must then call `gnuplot` in a terminal, in a manner such as "`gnuplot popcorn.txt; open popcorn.ps`".

The method will create files that draw data points connected by lines by default.

#### ARGUMENTS:

- A popcorn object.
- A string that is the directory path and base file name (without extension) of the files to create.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to connect points by lines. T = draw lines. Default = T.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((ppcn (make-popcorn '(0.01 0.02) :min-spike 3.0 :max-spike 5.0)))
  (fit-to-length popcorn 100)
  (plot popcorn "/tmp/ppcn"))
```

then in a terminal:  
`gnuplot popcorn.txt`

this will create the postscript file `ppcn.ps`

#### SYNOPSIS:

```
(defmethod plot ((pc popcorn) file &optional (lines t))
```

#### 20.2.332 popcorn/scale

[ popcorn ] [ Methods ]

#### DESCRIPTION:

Scale the list of number values in the KERNEL slot of a given popcorn object to a new range using specified maximum value and optional minimum value.

NB: This method does not change the internal state of the given popcorn object except for the KERNELS slot.

#### ARGUMENTS:

- A popcorn object.
- A number that is the new maximum value for the scaled list.

#### OPTIONAL ARGUMENTS:

- A number that is the new minimum value for the scaled list.

#### RETURN VALUE:

The new contents of the given popcorn object's KERNELS slot after scaling.

#### EXAMPLE:

```
;; Specifying a new maximum value only
(let ((ppcn (make-popcorn '(0.01 0.02) :min-spike 3.0 :max-spike 5.0)))
  (scale ppcn 10.0))

=> (0.0 0.10578585 0.061657257 0.057214428 0.061162785 0.070913345 0.10464539
    0.08303669 0.07006687 0.102430366 0.08324481 0.1007232 0.07883015
    0.08133934 0.0802559 0.09133919 0.08649117 0.08922634 0.08896804 0.08829583
    0.081211284 0.084339984 0.08333421 0.089423634 0.08108301 0.09876652
    0.08796693 0.09867058 0.6236897 0.1155461 0.5345579 0.59066933 0.13915743
    0.2599228 0.4149548 0.27998555 0.2638731 0.59842795 0.22067288 0.51896775
    0.39999005 0.467323 0.28863218 0.3438505 0.24494135 0.5386234 0.58451873
    0.30643454 0.53227377 0.516561 0.458425 0.55978096 0.60171384 0.52990943
    0.41134343 0.35964036 0.44697618 0.5030249 0.4408143 0.51038516 0.36056283
    0.527048 0.42520615 0.41761667 0.30501738 1.2049319 0.9747751 0.48793882
    0.5876642 1.0577364 0.3861802 0.8744062 1.1359217 0.87969404 0.8314643
    1.1876756 0.92543525 1.1885763 0.7167921 0.60177433 0.39919102 0.46317393
    0.4118872 0.5105933 0.56026125 0.62409085 1.112814 1.0537107 0.98620933
    0.86091584 0.92587364 0.71815413 1.0151639 0.5530894 0.5817527 1.1338633
    1.1888319 0.68452775 0.79389757 1.1841481 0.7137923 0.717132 2.3223429
    1.0770427 0.8475252 0.83587736 1.847246 0.53504527 2.1616995 1.9038564
    1.0004206 1.5545927 1.552697 1.8710022 1.861582 2.004909 1.7770531
    0.86352354 1.5642304 0.63962364 1.0099988 0.8800593 1.2472185 1.353609
    1.5901572 0.7418409 1.7170814 3.3055406 3.700319 2.1952631 1.5035022)
```

```

3.057052 1.4638814 1.0384043 1.1837897 3.0469408 2.803617 3.2614107
2.4135168 3.556123 2.27436 1.2306889 2.0333362 4.5721135 2.941492 0.8966192
2.3189502 0.9958008 4.344239 4.3671365 1.2785082 1.952021 2.438866
4.3924103 4.46023 3.7118216 1.746746 3.3397071 3.9984121 3.4766433 3.165725
1.8711188 3.2547336 4.482818 3.3188024 2.6877654 2.3054938 2.7741609
3.796511 3.5835814 2.064381 3.0545063 3.9559705 2.0038147 2.7878509
3.4762452 1.9495757 2.9715302 3.7937658 2.7762475 2.3023481 2.3882763
1.5292001 3.1379611 1.5162798 2.4996707 4.362247 3.1643825 2.902113
1.5552855 3.569274 3.6554635 3.8193665 3.2386634 5.418084 1.488541
4.5816646 4.1958213 2.411787 2.6187074 3.1729605 2.959683 2.3334894
5.325289 3.2408857 4.67207 3.0460484 6.0358443 6.879726 3.3280933 5.5901675
1.8741251 3.5842674 4.855096 6.005389 1.7205821 3.8116035 3.439082 5.024595
2.205073 4.140361 1.8645307 2.511795 5.744685 2.0451677 2.311025 6.787981
6.533982 3.840785 2.2128632 6.444055 2.7525501 8.19589 7.3742037 2.5753407
8.9812355 3.0030684 5.501138 6.7223954 4.8878922 3.2250557 2.3134975
8.762646 3.072827 7.0158014 7.426256 5.388799 10.0 7.367759 7.078608
8.373905 9.210589 7.072851 2.7709346 7.233898)

```

```
;; Using both a new maximum and new minimum value
```

```
(let ((ppcn (make-popcorn '(0.01 0.02) :min-spike 3.0 :max-spike 5.0)))
  (scale popcn 8.0 5.0))
```

```

=> (5.0 5.031736 5.018497 5.017164 5.0183487 5.021274 5.0313935 5.024911
5.02102 5.0307293 5.0249734 5.030217 5.023649 5.0244017 5.024077 5.027402
5.0259476 5.0267677 5.0266905 5.026489 5.0243635 5.025302 5.025 5.026827
5.024325 5.02963 5.02639 5.029601 5.187107 5.0346637 5.1603675 5.177201
5.041727 5.0779767 5.1244864 5.083996 5.079162 5.179528 5.0662017 5.15569
5.119997 5.140197 5.08659 5.103155 5.0734825 5.161587 5.1753554 5.0919304
5.1596823 5.1549683 5.1375275 5.1679344 5.1805143 5.1589727 5.123403
5.107892 5.134093 5.1509075 5.132244 5.1531157 5.108169 5.1581144 5.127562
5.125285 5.091505 5.3614798 5.292433 5.146382 5.176299 5.317321 5.1158543
5.262322 5.3407764 5.2639084 5.2494392 5.3563027 5.277631 5.356573 5.215038
5.1805325 5.119757 5.1389523 5.123566 5.153178 5.1680784 5.1872272 5.333844
5.3161135 5.2958627 5.2582746 5.277762 5.2154465 5.304549 5.165927
5.1745257 5.340159 5.3566494 5.2053585 5.238169 5.3552446 5.2141376
5.2151394 5.696703 5.323113 5.2542577 5.2507634 5.554174 5.1605134 5.64851
5.571157 5.300126 5.4663777 5.465809 5.5613008 5.5584745 5.601473 5.533116
5.259057 5.4692693 5.191887 5.3029995 5.2640176 5.3741655 5.4060826
5.477047 5.2225523 5.5151243 5.991662 6.110096 5.658579 5.4510508 5.9171157
5.4391646 5.3115215 5.355137 5.9140825 5.8410854 5.978423 5.7240553
6.066837 5.682308 5.369207 5.610001 6.3716345 5.8824477 5.2689857 5.6956854
5.2987404 6.303272 6.310141 5.3835526 5.5856066 5.73166 6.3177233 6.338069
6.1135464 5.524024 6.001912 6.199524 6.042993 5.9497175 5.5613356 5.9764204
6.3448453 5.9956408 5.8063297 5.691648 5.832248 6.138953 6.075074 5.619314
5.916352 6.1867914 5.6011443 5.836355 6.0428734 5.5848727 5.891459

```

```

6.1381297 5.8328743 5.6907043 5.716483 5.4587603 5.9413886 5.454884
5.7499013 6.3086743 5.9493146 5.870634 5.4665856 6.070782 6.096639 6.14581
5.971599 6.6254253 5.4465623 6.3744993 6.258746 5.723536 5.785612 5.951888
5.887905 5.700047 6.5975866 5.9722657 6.401621 5.9138145 6.8107533 7.063918
5.998428 6.6770506 5.5622377 6.07528 6.4565287 6.8016167 5.516175 6.1434813
6.0317245 6.5073786 5.661522 6.2421083 5.559359 5.7535386 6.723406 5.61355
5.6933074 7.0363946 6.9601946 6.1522355 5.663859 6.9332166 5.825765
7.4587674 7.212261 5.772602 7.694371 5.9009204 6.6503415 7.016719 6.4663677
5.967517 5.6940494 7.6287937 5.9218483 7.1047406 7.227877 6.61664 8.0
7.210328 7.123583 7.5121717 7.763177 7.1218557 5.8312807 7.17017)

```

**SYNOPSIS:**

```
(defmethod scale ((pc popcorn) max &optional (min 0.0) ignore1 ignore2)
```

**20.2.333 circular-sclist/recurring-event**

```
[ circular-sclist ] [ Classes ]
```

**NAME:**

```
rthm-chain
```

```
File: recurring-event.lsp
```

```
Class Hierarchy: named-object -> linked-named-object -> sclist ->
circular-sclist -> recurring-event
```

```
Version: 1.0.4
```

```
Project: slippery chicken (algorithmic composition)
```

```
Purpose: class used in rthm-chain
This class allows for the periodic/cyclic return of given
data. It is intended for situations where you want to
do/collect something every several events, but the cycle
period changes. E.g. (the data slot is) something like
'((2 3) (3 2) (5 3) (8 2)) which means every two events
three times, then every 3 events twice, every 5 events
thrice etc.
```

```
If you want to return specific data on these cycle
points, provide it in the return-data slot, with the
indices into this data in the return-data-cycle slot.
```

```

simple example, without return-data
(let* ((re (make-re '((2 3) (3 2) (5 3) (8 2))
                    :return-data nil
                    :return-data-cycle nil)))
  (loop repeat 100 collect (on-it re)))

=> (NIL NIL T NIL T NIL T NIL NIL T NIL NIL T NIL NIL NIL
    NIL T NIL NIL NIL NIL T NIL NIL NIL NIL T NIL NIL NIL
    NIL NIL NIL NIL T NIL NIL NIL NIL NIL NIL T NIL T
    NIL T NIL T NIL NIL T NIL NIL T NIL NIL NIL NIL T NIL
    NIL NIL NIL T NIL NIL NIL NIL T NIL NIL NIL NIL NIL
    NIL NIL T NIL NIL NIL NIL NIL NIL NIL T NIL T NIL T
    NIL T NIL NIL T NIL NIL T NIL)

(let* ((re (make-re '((2 3) (3 2) (5 3) (8 2))
                    ;; the data about to be collected
                    :return-data '(a b c d)
                    ;; the indices into the data; this
                    ;; means we'll return A (nth 0)
                    ;; thrice, D (nth 3) twice, C once,
                    ;; and B 5x
                    :return-data-cycle
                    '((0 3) (3 2) (2 1) (1 5)))))
  (loop repeat 100 collect (get-it re)))

=> (NIL NIL A NIL A NIL A NIL NIL D NIL NIL D NIL NIL NIL
    NIL C NIL NIL NIL NIL B NIL NIL NIL NIL B NIL NIL NIL
    NIL NIL NIL NIL B NIL NIL NIL NIL NIL NIL B NIL B
    NIL A NIL A NIL NIL A NIL NIL D NIL NIL NIL NIL D NIL
    NIL NIL NIL C NIL NIL NIL NIL B NIL NIL NIL NIL NIL
    NIL NIL B NIL NIL NIL NIL NIL NIL B NIL B NIL B
    NIL A NIL NIL A NIL NIL A NIL)

```

Author: Michael Edwards: m@michael-edwards.org

Creation date: 4th February 2010

\$\$ Last modified: 11:19:54 Mon Dec 17 2012 ICT

SVN ID: \$Id: recurring-event.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.334 recurring-event/get-it

[ recurring-event ] [ Methods ]

**DESCRIPTION:**

Get the next element from the return-data. This method is most effective when called repeatedly (e.g. within a loop) when the return-data and return-data-cycle slots have been set. In those cases the return-data-cycle element will be used as look-up into return-data. If no return-data has been specified, then the element itself will be returned.

**ARGUMENTS:**

- A recurring-event object.

**RETURN VALUE:**

Data from the return-data slot (or the return-data-cycle element) when we're on a boundary, otherwise NIL.

**EXAMPLE:**

```
;;; Used together with return-data
(let ((re (make-re '((2 3) (3 2) (5 3) (8 2))
                  :return-data '(a b c d)
                  :return-data-cycle '((0 3) (3 2) (2 1) (1 5)))))
  (loop repeat 50 collect (get-it re)))

=> (NIL NIL A NIL A NIL A NIL NIL D NIL NIL D NIL NIL NIL C NIL NIL NIL NIL
    B NIL NIL NIL NIL B NIL NIL NIL NIL NIL NIL NIL B NIL NIL NIL NIL NIL
    NIL B NIL B NIL A NIL A)

;;; Used without return-data
(let ((re (make-re '((2 3) (3 2) (5 3) (8 2))
                  :return-data-cycle '((0 3) (3 2) (2 1) (1 5)))))
  (loop repeat 50 collect (get-it re)))

=> (NIL NIL 0 NIL 0 NIL 0 NIL NIL 3 NIL NIL 3 NIL NIL NIL 2 NIL NIL NIL NIL
    1 NIL NIL NIL NIL 1 NIL NIL NIL NIL NIL NIL NIL 1 NIL NIL NIL NIL NIL
    NIL 1 NIL 1 NIL 0 NIL 0)
```

**SYNOPSIS:**

```
(defmethod get-it ((re recurring-event))
```

**20.2.335 recurring-event/make-re**

[ *recurring-event* ] [ *Functions* ]

**DESCRIPTION:**

Make an instance of a recurring-event object, which allows for the periodic/cyclic return of given data. The recurring-event object is intended for situations in which the user would like to perform an action or collect data every several events, but with a varying cycle period.

#### ARGUMENTS:

- A list of two-item lists that indicate the period pattern by which the action or data collection is to be performed. For example, a value such as '((2 3) (3 2) (5 3) (8 2))' will result in the action being performed every 2 events three times, then every 3 events twice, every 5 events thrice etc.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :return-data. If the recurring-event object is to be used to collect data, that data can be specified in this slot, with the indices into this data in the return-data-cycle slot. The return-data and return-data-cycle slots must be used together.
- :return-data-cycle. If data is specified using :return-data, the indices into that data must be specified here. For example, the value '((0 3) (3 2) (2 1) (1 5))' will the data item at (nth 0) thrice, that at (nth 3) twice, that at (nth 2) once, and that at (nth 1) five times.
- :id. An optional ID can also be specified for the recurring-event object created.

#### RETURN VALUE:

A recurring-event object.

#### EXAMPLE:

```
;;; Simple usage with no specified data
(make-re '((2 3) (3 2) (5 3) (8 2)))
=>
RECURRING-EVENT: current-period: 2, current-repeats: 3
                  pcount: -1, rcount: 0
                  return-data: NIL, return-data-cycle: NIL
CIRCULAR-SCLIST: current 1
SCLIST: sclist-length: 4, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 3) (3 2) (5 3) (8 2))
```

```
;;; Usage with specified :return-data and :return-data-cycle
(make-re '((2 3) (3 2) (5 3) (8 2))
          :return-data '(a b c d)
          :return-data-cycle '((0 3) (3 2) (2 1) (1 5)))
```

=>

```
RECURRING-EVENT: current-period: 2, current-repeats: 3
                  pcount: -1, rcount: 0
                  return-data: (A B C D), return-data-cycle:
CYCLE-REPEATS: folded: ((0 3) (3 2) (2 1) (1 5))
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 11, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (0 0 0 3 3 2 1 1 1 1 1)
*****
```

```
CIRCULAR-SCLIST: current 1
SCLIST: sclist-length: 4, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 3) (3 2) (5 3) (8 2))
```

## SYNOPSIS:

```
(defun make-re (data &key return-data return-data-cycle id)
```

### 20.2.336 recurring-event/on-it

[ *recurring-event* ] [ *Methods* ]

## DESCRIPTION:

Test to determine whether the method is currently at a period boundary. The object keeps track of its own internal state and position counter. This method is most effective when called repeatedly in a loop.

## ARGUMENTS:

- A recurring-event object.

## RETURN VALUE:

T or NIL.

## EXAMPLE:



```
;;; Straightforward usage
(let ((re (make-re '((2 3) (3 2) (5 3) (8 2))
                   :return-data '(a b c d)
                   :return-data-cycle '((0 3) (3 2) (2 1) (1 5))))))
  (loop repeat 50 collect (on-it re)))

=> (NIL NIL T NIL T NIL T NIL NIL T NIL NIL T NIL NIL NIL T NIL NIL NIL NIL
    T NIL NIL NIL NIL T NIL NIL NIL NIL NIL NIL T NIL NIL NIL NIL NIL NIL
    NIL T NIL T NIL T NIL T)
```

**SYNOPSIS:**

```
(defmethod on-it ((re recurring-event))
```

**20.2.337 circular-sclist/reset**

```
[ circular-sclist ] [ Methods ]
```

**DESCRIPTION:**

Reset the pointer of a given circular-sclist object. The pointer is reset to 0 by default, but the desired index may be specified using the optional argument.

NB: An immediately subsequent `get-next` call will retrieve the item at the index to which the pointer is reset. An immediately subsequent `get-last` call will retrieve the item at the index one-less than the value to which the pointer is set.

**ARGUMENTS:**

- A circular-sclist object.

**OPTIONAL ARGUMENTS:**

- An index integer to which the pointer for the given circular-sclist object should be reset.

**RETURN VALUE:**

Returns T.

**EXAMPLE:**

```
;; Resets to 0 by default. Here: Get a number of items using get-next, reset
;; the pointer, and apply get-next again.
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 8 do (print (get-next cscl)))
  (reset cscl)
  (get-next cscl))
```

=> 0

```
;; Reset to a specified index
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 8 do (print (get-next cscl)))
  (reset cscl 3)
  (get-next cscl))
```

=> 3

```
;; By default, get-last will then retrieve the item at index one less than the
;; reset value
(let ((cscl (make-cscl '(0 1 2 3 4))))
  (loop repeat 8 do (print (get-next cscl)))
  (reset cscl 3)
  (get-last cscl))
```

=> 2

## SYNOPSIS:

```
(defmethod reset ((cscl circular-sclist) &optional where (warn t))
```

### 20.2.338 circular-sclist/rthm-chain-slow

[ *circular-sclist* ] [ *Classes* ]

#### NAME:

rthm-chain

File: rthm-chain-slow.lsp

Class Hierarchy: `named-object -> linked-named-object -> scslst -> circular-sclist -> rthm-chain-slow`

Version: 1.0.4

Project:           slippery chicken (algorithmic composition)

Purpose:            class used in rthm-chain

Author:            Michael Edwards: m@michael-edwards.org

Creation date:     4th February 2010

\$\$ Last modified: 11:20:15 Mon Dec 17 2012 ICT

SVN ID: \$Id: rthm-chain-slow.lsp 4223 2013-10-29 10:57:09Z medward2 \$

### 20.2.339 sclist/combine

[ *sclist* ] [ *Methods* ]

#### DESCRIPTION:

Combine the contents of two given sclist objects into one list. NB This changes the data list of a clone of the first argument by appending a copy of the data list of the second argument i.e. it creates a wholly new sclist object which it then returns.

#### ARGUMENTS:

- A first sclist object.
- A second sclist object.

#### RETURN VALUE:

Returns an sclist object.

#### EXAMPLE:

```
;; Combine the contents of two sclist objects to make a new one
(let ((scl1 (make-sclist '(0 1 2 3 4)))
      (scl2 (make-sclist '(5 6 7 8 9))))
  (combine scl1 scl2))
```

=>

```
SCLIST: sclist-length: 10, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (0 1 2 3 4 5 6 7 8 9)
```

#### SYNOPSIS:

```
(defmethod combine ((scl1 sclist) (scl2 sclist))
```

### 20.2.340 sclist/get-nth

[ *sclist* ] [ *Methods* ]

#### DESCRIPTION:

Get the *nth* element (zero-based) of data in a given *sclist* object.

#### ARGUMENTS:

- An index integer.
- An *sclist* object.

#### RETURN VALUE:

Returns the item at index *n* within the given *sclist* object.

Returns NIL and prints a warning if the specified index is greater than the number of items in the given list (minus 1).

#### EXAMPLE:

```
;; Get the 3th item from the given sclist object
(let ((scl (make-sclist '(cat dog cow pig sheep))))
  (get-nth 3 scl))
```

=> PIG

```
;; Returns NIL and prints a warning when the specified index is beyond the
;; bounds of the given list
(let ((scl (make-sclist '(cat dog cow pig sheep))))
  (get-nth 31 scl))
```

=>

NIL

```
WARNING: sclist::sclist-check-bounds: Illegal list reference: 31
(length = 5) (sclist id = NIL)
```

#### SYNOPSIS:

```
(defmethod get-nth (index (i sclist))
```

**20.2.341** `sclist/intervals-mapper`*[ sclist ] [ Classes ]***NAME:**`intervals-mapper`**File:** `intervals-mapper.lsp`**Class Hierarchy:** `named-object -> linked-named-object -> sclist -> intervals-mapper`**Version:** `1.0.4`**Project:** `slippery chicken (algorithmic composition)`**Purpose:** Implementation of a scale object that can initialize its complete pitch list from the interval structure of a given list of notes. Given the scale, it's a cinch to generate note sequences based on note offset patterns e.g.

```
(let ((s (make-intervals-mapper 'c0 '(d e gs as d ef g a
                                     bf cs d ef gf))))
  (pat '(-1 2 4 3 6 -2 -1 2 6 7 3 6 2)))
(loop for p in pat collect
  (data (intervals-mapper-note s p 4))))
-> (A3 EF4 F4 E4 BF4 F3 A3 EF4 BF4 D5 E4 BF4 EF4)
```

**Author:** `Michael Edwards: m@michael-edwards.org`**Creation date:** `August 3rd 2010 Edinburgh`**\$\$ Last modified:** `16:49:52 Mon Jun 18 2012 BST`**SVN ID:** `$Id: intervals-mapper.lsp 4162 2013-07-12 14:02:32Z medward2 $`**20.2.342** `intervals-mapper/get-pitch-symbols`*[ intervals-mapper ] [ Methods ]***DESCRIPTION:**

Get the pitches contained in a given `intervals-mapper` object returned as a list of note-name symbols.

**ARGUMENTS:**

- An intervals-mapper object.

**RETURN VALUE:**

A list of note-name pitch symbols.

**EXAMPLE:**

```
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (get-pitch-symbols im))

=> (C0 D0 FS0 AF0 C1 CS1 F1 G1 AF1 B1 C2 CS2 E2 FS2 BF2 C3 E3 F3 A3 B3 C4 EF4
    E4 F4 AF4 BF4 D5 E5 AF5 A5 CS6 EF6 E6 G6 AF6 A6 C7 D7 FS7 AF7 C8 CS8 F8 G8
    AF8 B8 C9 CS9 E9 FS9)
```

**SYNOPSIS:**

```
(defmethod get-pitch-symbols ((im intervals-mapper) &optional ignore)
```

**20.2.343 intervals-mapper/get-scale**

[ *intervals-mapper* ] [ *Methods* ]

**DESCRIPTION:**

Create a scale (sequence of pitches) beginning with the specified starting note and extending up to MIDI note 127 by cycling through the interval structure of the STEPS slot.

The scale will only repeat at octaves if the interval structure of the list of pitches passed at initialisation creates that result.

NB: This method is usually only called automatically at initialisation.

**ARGUMENTS:**

- An intervals mapper object.
- A note-name pitch symbol (e.g. 'c0) that is the pitch on which to begin the scale, and which is to be stored in the TONIC slot.

**RETURN VALUE:**

A list of the pitch objects in the new scale. These are also stored in the SCALE-PITCHES slot.

**EXAMPLE:**

```
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (pitch-list-to-symbols (get-scale im 'd4)))

=> (D4 E4 AF4 BF4 D5 EF5 G5 A5 BF5 CS6 D6 EF6 FS6 AF6 C7 D7 FS7 G7 B7 CS8 D8 F8
    FS8 G8 BF8 C9 E9 FS9)
```

**SYNOPSIS:**

```
(defmethod get-scale ((im intervals-mapper) start-note)
```

**20.2.344 intervals-mapper/get-steps**

```
[ intervals-mapper ] [ Methods ]
```

**DESCRIPTION:**

Extract the interval structure of the list of note-name pitch symbols passed as the data to the instance of the intervals-mapper object upon initialization. The interval structure is returned as a list of semitone values.

**ARGUMENTS:**

- An intervals-mapper object.

**RETURN VALUE:**

A list of integers that are the numbers of semitones between each consecutive pitch in the original data list.

**EXAMPLE:**

```
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (get-steps im))

=> (2 4 2 4 1 4 2 1 3 1 1 3)
```

**SYNOPSIS:**

```
(defmethod get-steps ((im intervals-mapper))
```

**20.2.345 intervals-mapper/intervals-mapper-degree**

[ intervals-mapper ] [ Methods ]

**DATE:**

14-Aug-2010

**DESCRIPTION:**

Return the scale degree number of a specified pitch class in relation to a specified octave within the given intervals-mapper object.

To determine the scale degree number, this method begins at the first pitch >= C in the specified octave and passes consecutively through each subsequent pitch in the interval-mapper object's full scale, counting each step until it first encounters the pitch class of the specified pitch.

If there are no more instances of the specified pitch class, the method returns NIL.

The method takes as its pitch class a pitch object, which includes an octave indicator. For the purposes of this method, solely the pitch-class name is extracted from the pitch object.

**ARGUMENTS:**

- An intervals-mapper object.
- An instance of a pitch object whose pitch class is being sought.
- An integer that is the octave in relationship to which the scale degree is sought.

**OPTIONAL ARGUMENTS:**

- T or NIL to indication whether to return the position of the found pitch object within the complete scale list of the given intervals-mapper object rather than the scale degree. T = return the position.  
Default = NIL.

**RETURN VALUE:**

Returns an integer that is either the scale degree of the specified pitch class in relation to the specified octave, counting from 1, or the position of the found pitch object within the interval-mapper object's complete scale.

Returns NIL if no instances of the specified pitch class are found.



**EXAMPLE:**

```
;;; The desired pitch class BF is found within the specified octave
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-degree im (make-pitch 'bf4) 4))
```

```
=> 6
```

```
;;; The desired pitch class B is found outside of the specified octave
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-degree im (make-pitch 'b4) 5))
```

```
=> 20
```

```
;;; Return the position instead
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-degree im (make-pitch 'b4) 5 t))
```

```
=> 45
```

```
;;; The desired pitch class BF is not present in any of the octaves beginning
;;; including and above the specified octave
```

```
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-degree im (make-pitch 'bf4) 5))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod intervals-mapper-degree ((im intervals-mapper) pitch octave
                                     &optional return-nth)
```

**20.2.346 intervals-mapper/intervals-mapper-note**

```
[ intervals-mapper ] [ Methods ]
```

**DESCRIPTION:**

Get the pitch object that constitutes the specified scale degree of the specified octave within an intervals-mapper object; or, if keyword argument `<nth>` is set to T, get the position of this pitch object within the full range of the intervals-mapper object's complete scale.

As there is no concept of a tonic that repeats at octaves, degree 1 in any

given octave is simply the first note  $\geq$  the C in that octave.

If a note-name pitch symbol is given for the keyword argument <tonic>, the given intervals-mapper object's TONIC slot will be changed, and its scale-pitches will be recalculated accordingly before getting the pitch.

#### ARGUMENTS:

- An intervals-mapper object.
- An integer that is the scale degree (1-based) of the desired pitch within the specified octave, counting from the first note of the scale above or on the C in that octave. If this number is higher than the number of pitches in the span of an octave, a pitch from a higher octave will accordingly be returned. Similarly, a negative number can also be given here to indicate that the pitch is to be collected from that many degrees below the specified octave.
- An integer that indicates the octave from which the pitch is to be returned (e.g. 4 for the octave starting on middle C, 5 for the octave starting on the C above that etc.)

#### OPTIONAL ARGUMENTS:

keyword arguments

- :tonic. NIL or a note-name pitch symbol that is the new starting note for above which the intervals-mapper scale is to be re-mapped before the pitch is returned. This will usually be the lowest pitch on which the scale should start. If NIL, no changes will be made to the object's existing scale pitches before returning the desired pitch. Default = NIL.
- :nth. T or NIL to indicate whether instead of returning the pitch object itself, the method should return an integer that is the position of that pitch within the full span of the interval-mapper object's complete scale. T = return the position. Default = NIL.

#### RETURN VALUE:

A pitch object by default, or its position in the scale list if the :nth argument is set to T.

#### EXAMPLE:

```
;;; Returns a pitch object by default
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-note im 3 4))
```

=>

```

PITCH: frequency: 329.628, midi-note: 64, midi-channel: 0
      pitch-bend: 0.0
      degree: 128, data-consistent: T, white-note: E4
      nearest-chromatic: E4
      src: 1.2599211, src-ref-pitch: C4, score-note: E4
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 4, c5ths: 0, no-8ve: E, no-8ve-no-acc: E
      show-accidental: T, white-degree: 30,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: E4, tag: NIL,
data: E4

```

```

;;; Used with negative degree numbers
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (data (intervals-mapper-note im -3 2)))

```

```
=> F1
```

```

;;; Use with a new tonic and setting nth to T to return the position
(let ((im (make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))))
  (intervals-mapper-note im 11 5 :tonic 'd1 :nth t))

```

```
=> 29
```

## SYNOPSIS:

```

(defmethod intervals-mapper-note ((im intervals-mapper) degree octave
  &key tonic nth)

```

### 20.2.347 intervals-mapper/make-intervals-mapper

[ intervals-mapper ] [ Functions ]

#### DESCRIPTION:

Returns an intervals-mapper object starting with the specified pitch ('tonic') and using the interval structure of the specified list of pitches, creating a complete pitch list from the interval structure of list of pitches.

NB The pitches specified aren't necessarily used in the resulting complete

pitch list; rather, their interval structure is mapped above the specified starting pitch and repeated upwards until the method reaches MIDI note 127.

NB The scale will only repeat at octaves if that is the interval structure of the list of pitches it is passed.

#### ARGUMENTS:

- A note-name pitch symbol that is the starting pitch, (e.g. 'c0).
- A list of note-name pitch symbols that provides the interval structure for the resulting scale.

#### RETURN VALUE:

An intervals-mapper object.

#### EXAMPLE:

```
;;; A scale without repeating octaves:
(make-intervals-mapper 'c0 '(d e gs as d ef g a bf cs d ef gf))

=>
INTERVALS-MAPPER: steps: (2 4 2 4 1 4 2 1 3 1 1 3),
scale-pitches (pitch objects): (C0 D0 FS0 AF0 C1 CS1 F1 G1 AF1 B1 C2 CS2 E2 FS2
                                BF2 C3 E3 F3 A3 B3 C4 EF4 E4 F4 AF4 BF4 D5 E5
                                AF5 A5 CS6 EF6 E6 G6 AF6 A6 C7 D7 FS7 AF7 C8
                                CS8 F8 G8 AF8 B8 C9 CS9 E9 FS9)

tonic: C0
SCLIST: sclist-length: -1, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D E GS AS D EF G A BF CS D EF GF)
```

#### SYNOPSIS:

```
(defun make-intervals-mapper (tonic notes)
```

#### 20.2.348 sclist/make-sclist

[ *sclist* ] [ *Functions* ]

#### DESCRIPTION:

Create an sclist object with the specified list.

**ARGUMENTS:**

- A list of numbers or symbols.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. A symbol that will be the ID of the given sclist object.  
Default = NIL.
- :bounds-alert. T or NIL to indicate whether a warning should be issued when a request is given to set or get an out-of-bounds element (i.e. not enough elements in list). T = print warning. Default = NIL.
- :copy. T or NIL to indicate whether the data in the list should be copied (any slippery-chicken class instances will be cloned), with subsequent modifications being applied to the copy. T = copy. Default = T.

**RETURN VALUE:**

Returns an sclist object.

**EXAMPLE:**

```
;; Create a simple object with just a list of numbers
(make-sclist '(1 2 3 4 5 6 7))
```

=>

```
SCLIST: sclist-length: 7, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (1 2 3 4 5 6 7)
```

```
;; Create the same object and assign an ID to it
(make-sclist '(1 2 3 4 5 6 7) :id 'number-list)
```

=>

```
SCLIST: sclist-length: 7, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NUMBER-LIST, tag: NIL,
data: (1 2 3 4 5 6 7)
```

**SYNOPSIS:**

```
(defun make-sclist (list &key (id nil) (bounds-alert t) (copy t))
```

**20.2.349** sclist/pitch-seq*[ sclist ] [ Classes ]***NAME:**

pitch-seq

File: pitch-seq.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
pitch-seq

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the pitch-seq class. This describes  
the pitch curves for a given rhythmic sequence. These  
are normally simple lists of notes indicating pitch  
height (and later mapped onto sets); chords are indicated  
by placing a number in parentheses.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 19th February 2001

\$\$ Last modified: 11:22:06 Sat Nov 9 2013 GMT

SVN ID: \$Id: pitch-seq.lsp 4253 2013-11-09 15:02:53Z medward2 \$

**20.2.350** pitch-seq/get-notes*[ pitch-seq ] [ Methods ]***DESCRIPTION:**

This gets notes from the sets, limiting the notes used to the range of the instrument and any other ranges defined in the slippery-chicken class. If either the instrument or set are missing it just gets the relative pitches we use to display a pitch sequence.

limit-high and limit-low are pitch objects. They are extra range definers that are given to the slippery-chicken object to control the pitch curve of an instrument over the duration of the whole piece. They always refer to sounding pitches.

The order of operations for selecting pitches are as follows:

- 1) Limit the set object to the instrument's range.
- 2) Remove the notes that have already been selected for other instruments. This is where the slippery-chicken slot `:instrument-hierarchy` plays an important role. This can be skipped if the `<avoid-used-notes>` argument is nil.
- 3) If there is a subset with the same ID as the `subset-id` slot for this instrument, use only those pitches common to that subset and those in step 2.
- 4) If the ratio between the number of pitches now available and the number of different numbers in the `pitch-seq` is less than the slippery-chicken slot `pitch-seq-index-scaler-min*`, add notes from those used by other instruments until there are enough; the lowest number in the `pitch-seq` will now select the lowest pitch in the set that is in the instrument's range.

If however there are enough pitches without adding pitches already used by other instruments, then where in the available pitches the lowest number of the `pitch-seq` will be placed depends on whether the `prefers-notes` slot of the instrument has been set to be high or low. If high, then the highest number in the `pitch-seq` will result in the highest pitch in the available pitches that is in the instrument's range. If low, then the lowest number in the `pitch-seq` will result in the lowest pitch in the available pitches that is in the instrument's range. If the user hasn't set this slot, then the range of the `pitch-seq` will correspond to the middle of the available pitches.

There are two caveats here if the instrument's `prefers-notes` slot is NIL: 1) If the lowest number in the `pitch-seq` is 5 or higher, this will have the same effect as the `prefers-notes` slot being high. Similarly, if the lowest number is 1, it will have the same effect as the `prefers-notes` slot being low. These two numbers (5 and 1) are actually global slippery chicken configuration data: `(get-sc-config pitch-seq-lowest-equals-prefers-high)` and `(get-sc-config pitch-seq-lowest-equals-prefers-low)` so can be set using the `set-sc-config` function.

\* The question as to how many pitches are enough pitches before adding used notes is determined by the `pitch-seq-index-scaler-min` argument, which is by default 0.5 (in the slippery-chicken slot that's usually used and passed to this method). As the `pitch-seq` notes must be offset

and scaled before they can be used as indices, there's a minimum scaler that's considered acceptable; anything below this would result in more notes being added.

- 5) If at this point there are no available pitches, the function will trigger an error and exit. This could happen if the value of `set-limits`, both high and low, took the available pitches outside of the instrument's range, for instance.
- 6) The pitch-seq numbers are now offset and scaled, then rounded in order to use them as indices into the pitch list. If a number is in parentheses then this is where the instrument's chord function would be called. As notes are selected, the set marks them as used for the next time around. Also, there's an attempt to avoid melodic octaves on adjacent notes; however, if the set is full of octaves this won't be possible; in that case a warning will be issued and the octave will be used.

#### ARGUMENTS:

- A pitch-seq object.
- An instrument object.
- An sc-set object.
- A hint pitch (ignored for now).
- A pitch-object defining the highest possible note.
- A pitch-object defining the lowest possible note.
- The sequence number (for diagnostics).
- The last note of the previous sequence, as a pitch object.
- The lowest scaler that will be accepted before adding notes from those used; i.e., if the pitch-seq needs 6 notes and only 3 are available, there would be note repetition, but as this would create a scaler of 0.5, that would be acceptable
- Whether to avoid lines jumping an octave in either direction (passed by the slippery chicken slot).
- Whether to remove notes already chosen for other instruments before selecting notes for this one.

#### RETURN VALUE:

Returns a list of pitch objects.

#### SYNOPSIS:

```
(defmethod get-notes ((ps pitch-seq) instrument set hint-pitch limit-high
  limit-low seq-num last-note-previous-seq
  pitch-seq-index-scaler-min avoid-melodic-octaves
  avoid-used-notes)
```



**20.2.351 pitch-seq/invert***[ pitch-seq ] [ Methods ]***DESCRIPTION:**

Invert the pitch sequence contour attached to a given pitch-seq object. The inversion uses only the same numbers from the original pitch contour list.

**ARGUMENTS:**

- A pitch-seq object.

**RETURN VALUE:**

A pitch-seq object.

**EXAMPLE:**

```
(let ((ps (make-pitch-seq '(pseq1 (1 2 1 3 4 7)))))
  (data (invert ps)))
```

```
=> (7 4 7 3 2 1)
```

**SYNOPSIS:**

```
(defmethod invert ((ps pitch-seq))
```

**20.2.352 pitch-seq/make-pitch-seq***[ pitch-seq ] [ Functions ]***DESCRIPTION:**

Create a pitch-seq object.

This function can be either called with one argument, consisting of a two-item list, in which the first item is the pitch-seq ID and the second is a list of numbers representing the pitch curve of the intended pitch sequence; or it can be created with two arguments, the first of which being the list of numbers representing the pitch curve and the second being the pitch-seq's ID.

NB We can assign a pitch-seq exclusively to particular instruments in the ensemble simply by passing their names as symbols along with the curve data. See below for an example.

**ARGUMENTS:**

- A two-item list, of which the first item is a symbol to be used as the object's ID, and the second is a list of integers representing the general contour of the pitch sequence.

**OPTIONAL ARGUMENTS:**

- If the optional argument format is used, the first argument is to be a list of numbers representing the general contour of the pitch sequence, and the second is to be a symbol for the pitch-seq object's ID.

**RETURN VALUE:**

- A pitch-seq object.

**EXAMPLE:**

```
;; The first creation option is using one argument that is a two-item list,
;; whereby the first item is a symbol to be used as the pitch-seq object's ID
;; and the second is a list of numbers representing the general contour of the
;; pitch sequence.
```

```
(make-pitch-seq 'pseq1 (1 2 1 1 3))
```

```
=>
```

```
PITCH-SEQ: notes: NIL
```

```
highest: 3
```

```
lowest: 1
```

```
original-data: (1 2 1 1 3)
```

```
user-id: T
```

```
instruments: NIL
```

```
relative-notes: (not printed for sake of brevity)
```

```
relative-notes-length: 25
```

```
SCLIST: sclist-length: 5, bounds-alert: T, copy: NIL
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: PSEQ1, tag: NIL,
```

```
data: (1 2 1 1 3)
```

```
;; The second creation option uses two arguments, the first of which is a list
;; of numbers representing the general contour of the pitch sequence, the
;; second of which is a symbol which will be used as the pitch-seq object's ID.
```

```
(make-pitch-seq '(2 1 1 3 1) 'pseq2)
```

```
=>
```

```
PITCH-SEQ: notes: NIL
```

```

highest: 3
lowest: 1
original-data: (2 1 1 3 1)
user-id: NIL
instruments: NIL
relative-notes: (not printed for sake of brevity)
relative-notes-length: 25
SCLIST: sclist-length: 5, bounds-alert: T, copy: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: PSEQ2, tag: NIL,
data: (2 1 1 3 1)

```

```

;; An example assigning a pitch-seq only to specific instruments:
(make-pitch-seq '((1 2 1 1 3) violin flute) 'ps1))

```

## SYNOPSIS:

```
(defun make-pitch-seq (id-data &optional (id nil))
```

### 20.2.353 sclist/rthm-seq

[ *sclist* ] [ *Classes* ]

#### NAME:

rthm-seq

File: rthm-seq.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> rthm-seq

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the rthm-seq class which holds the bars and rhythms of a sequence (multiple bars). This will generally be stored in a rthm-seq-palette and referenced later in the rthm-seq-map.

The data used to create such an object will look something like:

```

(rthm1 (((2 4) q (q))
        (s x 4 (e) e)

```

```

((3 8) (e) e (e)))
:pitch-seq-palette '((psp1 (1 2 1 2 3 2 1))
                     (psp2 (3 2 4 6 1 5 7))
                     (psp3 (2 3 4 1 3 4 5))))

```

Author: Michael Edwards: m@michael-edwards.org

Creation date: 14th February 2001

\$\$ Last modified: 12:33:08 Mon Nov 18 2013 GMT

SVN ID: \$Id: rthm-seq.lsp 4297 2013-11-18 12:40:13Z medward2 \$

### 20.2.354 rthm-seq/add-bar

[ *rthm-seq* ] [ *Methods* ]

#### DESCRIPTION:

Add a rthm-seq-bar object to the end of a given rthm-seq object.

NB: If the rthm-seq-bar object is added without specifying a pitch-seq-palette, the method automatically adds data to the existing pitch-seq-palette.

#### ARGUMENTS:

- A rthm-seq object.
- A rthm-seq-bar object.

#### OPTIONAL ARGUMENTS:

- A pitch-seq-palette.

#### RETURN VALUE:

Returns the new value of the DURATION slot of the given rthm-seq object.

#### EXAMPLE:

```

;; Returns the new value of the DURATION slot
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))

```

```

(add-bar rs (make-rthm-seq-bar '(((5 8) e e+32 s. +q))))

=> 10.5

;; Apply the method and print the rhythms objects of the given rthm-seq object
;; to see the changes
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                             :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (add-bar rs (make-rthm-seq-bar '(((5 8) e e+32 s. +q)))
  (print-simple rs))

=>
rthm-seq NIL
(2 4): note Q, note E, note S, note S,
(2 4): rest E, note Q, rest E,
(3 8): note S, note S, note E., note S,
(5 8): note E, note E, note 32, note S., note Q,

;; Apply the method and print the DATA slot of the updated PITCH-SEQ-PALETTE
;; slot to see the new notes that have been automatically added
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                             :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (add-bar rs (make-rthm-seq-bar '(((5 8) e e+32 s. +q)))
  (data (first (data (pitch-seq-palette rs)))))

=> (1 2 3 1 1 2 3 4 3 4 3)

```

**SYNOPSIS:**

```
(defmethod add-bar ((rs rthm-seq) (rsb rthm-seq-bar) &optional psp)
```

**20.2.355 rthm-seq/chop**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Applies the chop method to each rthm-seq-bar object contained in the given rthm-seq object (see rthm-seq-bar::chop for details), returning a list of rthm-seq objects, each of which contains just one of the rthm-seq-bar objects created with chop.

The chop method is the basis for slippery-chicken's feature of intra-phrasal looping.

NB: Since the chop method functions by comparing each beat of a given `rthm-seq-bar` object to the specified `<chop-points>` pattern for segmenting that beat, all `rthm-seq-bar` objects in the given `rthm-seq` object must be evenly divisible by the beat for which the pattern is defined. For example, if the `<chop-points>` argument defines a quarter-note, all bars in the given `rthm-seq` object must be evenly divisible by a quarter-note, and a `rthm-seq` object consisting of a 2/4, a 3/4 and a 3/8 bar would fail at the 3/8 bar with an error.

NB: The `<unit>` argument must be a duplet rhythmic value (i.e. 32, 's, 'e etc.) and cannot be a triplet value (i.e. 'te 'fe etc.).

NB: In order for the resulting chopped rhythms to be parsable by LilyPond and CMN, there can be no triplets (triplets etc.) among the rhythms to be chopped. Such rhythms will result in LilyPond and CMN errors. This has only minimal bearing on any MIDI files produced, however, and these can potentially be imported into notation software.

#### ARGUMENTS:

- A `rthm-seq` object.

#### OPTIONAL ARGUMENTS:

- `<chop-points>`. A list of integer pairs, each of which delineates a segment of the beat of the given `rthm-seq-bar` object measured in the rhythmic unit specified by the `<unit>` argument. See the documentation for `rthm-seq-bar::chop` for more details.
- `<unit>`. The rhythmic duration that serves as the unit of measurement for the chop points. Default = 's.
- `<number-bars-first>`. T or NIL. This argument helps in naming (and therefore debugging) the newly-created bars. If T, the bars in the original `rthm-seq` will be renumbered, starting from 1, and this will be reflected in the tag of the new bars. E.g. if T, a new bar's tag may be `new-bar-from-rs1-b3-time-range-1.750-to-2.000`, if NIL this would be `new-bar-from-rs1-time-range-1.750-to-2.000`. Default = T.

#### RETURN VALUE:

A list of `rthm-seq` objects.

#### EXAMPLE:

```

;; Create a rthm-seq with three bars, all having a quarter-note beat basis,
;; apply chop, and print-simple the resulting list of new rthm-seq-bar
;; objects. The rthm-seq numbers printed with this are the IDs of the rthm-seq
;; objects, not the bar-nums of the individual rthm-seq-bar objects.
(let* ((rs (make-rthm-seq '(seq1 (((2 4) q e s s)
                                   ((e) q (e))
                                   (s s (e) e. s))
                             :pitch-seq-palette ((1 2 3 4 5 6 7 8 9)
                                                  (9 8 7 6 5 4 3 2 1))))))
      (ch (chop rs
                '(((1 1) (1 2) (1 3) (1 4) (2 2) (2 3) (2 4) (3 3) (3 4) (4 4))
                  's)))
      (loop for rs-obj in ch do (print-simple rs-obj)))

=>
rthm-seq 1
(1 16): NIL S,
rthm-seq 2
(1 8): NIL E,
rthm-seq 3
(3 16): NIL E.,
rthm-seq 4
(1 4): NIL Q,
rthm-seq 5
(1 16): rest 16,
rthm-seq 6
(1 8): rest 8,
rthm-seq 7
(3 16): rest 16/3,
rthm-seq 8
(1 16): rest 16,
rthm-seq 9
(1 8): rest 8,
rthm-seq 10
(1 16): rest 16,
rthm-seq 11
(1 16): NIL S,
rthm-seq 12
(1 8): NIL E,
rthm-seq 13
(3 16): NIL E, NIL S,
rthm-seq 14
(1 4): NIL E, NIL S, NIL S,
rthm-seq 15
(1 16): rest 16,
rthm-seq 16

```

(1 8): rest S, NIL S,  
rthm-seq 17  
(3 16): rest S, NIL S, NIL S,  
rthm-seq 18  
(1 16): NIL S,  
rthm-seq 19  
(1 8): NIL S, NIL S,  
rthm-seq 20  
(1 16): NIL S,  
rthm-seq 21  
(1 16): rest 16,  
rthm-seq 22  
(1 8): rest 8,  
rthm-seq 23  
(3 16): rest E, NIL S,  
rthm-seq 24  
(1 4): rest E, NIL E,  
rthm-seq 25  
(1 16): rest 16,  
rthm-seq 26  
(1 8): rest S, NIL S,  
rthm-seq 27  
(3 16): rest S, NIL E,  
rthm-seq 28  
(1 16): NIL S,  
rthm-seq 29  
(1 8): NIL E,  
rthm-seq 30  
(1 16): rest 16,  
rthm-seq 31  
(1 16): rest 16,  
rthm-seq 32  
(1 8): rest 8,  
rthm-seq 33  
(3 16): rest 16/3,  
rthm-seq 34  
(1 4): rest 4,  
rthm-seq 35  
(1 16): rest 16,  
rthm-seq 36  
(1 8): rest 8,  
rthm-seq 37  
(3 16): rest 16/3,  
rthm-seq 38  
(1 16): rest 16,  
rthm-seq 39



```

(1 8): rest 8,
rthm-seq 40
(1 16): rest 16,
rthm-seq 41
(1 16): NIL S,
rthm-seq 42
(1 8): NIL S, NIL S,
rthm-seq 43
(3 16): NIL S, NIL S, rest S,
rthm-seq 44
(1 4): NIL S, NIL S, rest E,
rthm-seq 45
(1 16): NIL S,
rthm-seq 46
(1 8): NIL S, rest S,
rthm-seq 47
(3 16): NIL S, rest E,
rthm-seq 48
(1 16): rest 16,
rthm-seq 49
(1 8): rest 8,
rthm-seq 50
(1 16): rest 16,
rthm-seq 51
(1 16): NIL S,
rthm-seq 52
(1 8): NIL E,
rthm-seq 53
(3 16): NIL E.,
rthm-seq 54
(1 4): NIL E., NIL S,
rthm-seq 55
(1 16): rest 16,
rthm-seq 56
(1 8): rest 8,
rthm-seq 57
(3 16): rest E, NIL S,
rthm-seq 58
(1 16): rest 16,
rthm-seq 59
(1 8): rest S, NIL S,
rthm-seq 60
(1 16): NIL S,

```

```

;; Attempting to apply the method to a rthm-seq object in which not all bars
;; have time-signatures that are divisible by the beat defined in the

```

```
;; <chop-points> argument will result in dropping into the debugger with an
;; error
(let* ((rs (make-rthm-seq '(seq1 (((2 4) q e s s)
                                   ((e) q (e))
                                   ((3 8) (e) e. s))
                           :pitch-seq-palette ((1 2 3 4 5 6 7)
                                                  (9 8 7 6 5 4 3))))))
      (ch (chop rs
                '((1 1) (1 2) (1 3) (1 4) (2 2) (2 3) (2 4) (3 3) (3 4) (4 4))
                's)))
  (loop for rs-obj in ch do (print-simple rs-obj)))
```

=>

```
rthm-seq-bar::get-beats: Can't find an exact beat of rhythms
(dur: 0.75 beat-dur: 0.5)!
[Condition of type SIMPLE-ERROR]
```

## SYNOPSIS:

```
(defmethod chop ((rs rthm-seq) &optional chop-points (unit 's)
                 (number-bars-first t))
```

### 20.2.356 rthm-seq/clear-ties-beg-end

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Deletes ties to the first rhythm(s) of a rthm-seq, making them rests instead of tied notes. Also makes sure the last rhythm is not tied from (into another sequence). Useful if you're making rthm-seqs from other (larger) rthm-seqs or algorithmically.

## ARGUMENTS:

- the rthm-seq object

## RETURN VALUE:

T if any ties were cleared, NIL otherwise.

## SYNOPSIS:

```
(defmethod clear-ties-beg-end ((rs rthm-seq))
```

**20.2.357 rthm-seq/combine***[ rthm-seq ] [ Methods ]***DESCRIPTION:**

Combine two rthm-seqs into one, updating slots for the new object, which is a clone.

NB: The MARKS slot is ignored for now (it is as of yet

NB: This method sets the values of the individual slots but leaves the DATA slot untouched (for cases in which the user might want to see where the new data originated from, or otherwise use the old data somehow, such as in a new rthm-seq object).

**ARGUMENTS:**

- A first rthm-seq object.
- A second rthm-seq object.

**RETURN VALUE:**

- A rthm-seq object.

**EXAMPLE:**

```
;; The method returns a rthm-seq object
(let ((rs1 (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (rs2 (make-rthm-seq '((((4 4) h+e (e) { 3 te te te })
                        ((5 8) e e+32 s. +q)
                        ((3 4) (q) q q))
                        :pitch-seq-palette ((1 2 3 4 1 2 3 1 2))))))
  (combine rs1 rs2))
```

=>

```
RTHM-SEQ: num-bars: 6
          num-rhythms: 25
          num-notes: 17
          num-score-notes: 21
          num-rests: 4
          duration: 15.0
          psp-inversions: NIL
```

```

marks: NIL
time-sigs-tag: NIL
handled-first-note-tie: NIL
(for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 6, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "NIL-NIL", tag: NIL,
data: (((((2 4) Q+E S S) ((E) Q (E)) ((3 8) S S E. S)) PITCH-SEQ-PALETTE
      ((1 2 3 1 1 2 3 4)))
      (((4 4) H+E (E) { 3 TE TE TE }) ((5 8) E E+32 S. +Q) ((3 4) (Q) Q Q))
      PITCH-SEQ-PALETTE ((1 2 3 4 1 2 3 1 2)))

```

;; With the same combine call, print the collected contents of the BARS slot  
 ;; and the PITCH-SEQ-PALETTE slot of the new rthm-seq object

```

(let* ((rs1 (make-rthm-seq '((((2 4) q+e s s)
                               ((e) q (e))
                               ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (rs2 (make-rthm-seq '((((4 4) h+e (e) { 3 te te te })
                          ((5 8) e e+32 s. +q)
                          ((3 4) (q) q q))
                  :pitch-seq-palette ((1 2 3 4 1 2 3 1 2))))))
  (crs (combine rs1 rs2)))
(print-simple crs)
(print (data (get-first (pitch-seq-palette crs)))))

```

=>

```

rthm-seq NIL-NIL
(2 4): note Q, note E, note S, note S,
(2 4): rest E, note Q, rest E,
(3 8): note S, note S, note E., note S,
(4 4): note H, note E, rest E, note TE, note TE, note TE,
(5 8): note E, note E, note 32, note S., note Q,
(3 4): rest 4, note Q, note Q,
(1 2 3 1 1 2 3 4 1 2 3 4 1 2 3 1 2)

```

## SYNOPSIS:

```
(defmethod combine ((rs1 rthm-seq) (rs2 rthm-seq))
```

### 20.2.358 rthm-seq/delete-marks

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Delete all marks from the MARKS slot of the specified rthm-seq object and replace them with NIL.

#### ARGUMENTS:

- A rthm-seq object

#### RETURN VALUE:

NIL

#### EXAMPLE:

```
(let ((mrs (make-rthm-seq '(seq1 (((2 4) q e (s) s))
                                :pitch-seq-palette ((1 2 3))
                                :marks (ff 1 a 1 pizz 1 ppp 2 s 2))))))
  (print (marks mrs))
  (delete-marks mrs)
  (print (marks mrs)))
```

=>

```
((FF 1) (A 1) (PIZZ 1) (PPP 2) (S 2))
NIL
```

#### SYNOPSIS:

```
(defmethod delete-marks ((rs rthm-seq))
```

#### 20.2.359 rthm-seq/get-bar

[ *rthm-seq* ] [ *Methods* ]

#### DESCRIPTION:

Get a specified rthm-seq-bar object from within a rthm-seq object.

#### ARGUMENTS:

- A rthm-seq object.
- An integer that is the 1-based number of the desired bar to return from within the given rthm-seq object.

#### RETURN VALUE:

Returns a rthm-seq-bar object.

**EXAMPLE:**

```
;;; Returns a rthm-seq-bar object
(let ((rs (make-rthm-seq '(seq1 (((2 4) q e s s)
                                   ((e) q (e))
                                   ((3 8) s s e. s)))))))

  (get-bar rs 2))

=>
RTHM-SEQ-BAR: time-sig: 0 (2 4), time-sig-given: NIL, bar-num: -1,
old-bar-nums: NIL, write-bar-num: NIL, start-time: -1.000,
start-time-qtrs: -1.0, is-rest-bar: NIL, multi-bar-rest: NIL,
show-rest: T, notes-needed: 1,
tuplets: NIL, nudge-factor: 0.35, beams: NIL,
current-time-sig: 6, write-time-sig: NIL, num-rests: 2,
num-rhythms: 3, num-score-notes: 1, parent-start-end: NIL,
missing-duration: NIL, bar-line-type: 0,
player-section-ref: NIL, nth-seq: NIL, nth-bar: NIL,
rehearsal-letter: NIL, all-time-sigs: (too long to print)
sounding-duration: NIL,
rhythms: (
[...])

(let ((rs (make-rthm-seq '(seq1 (((2 4) q e s s)
                                   ((e) q (e))
                                   ((3 8) s s e. s)))))))

  (print-simple (get-bar rs 2)))

=> (2 4): rest E, note Q, rest E,
```

**SYNOPSIS:**

```
(defmethod get-bar ((rs rthm-seq) bar-num &optional ignore)
```

**20.2.360 rthm-seq/get-first**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Return the first rhythm/event object in the specified rthm-seq object.

**ARGUMENTS:**

- A rthm-seq object.

**RETURN VALUE:**

A rhythm/event object.

**EXAMPLE:**

```
(let ((mrs (make-rthm-seq '(seq1 (((2 4) q e (s) s))
                                :pitch-seq-palette ((1 2 3))
                                :marks (ff 1 a 1 pizz 1 ppp 2 s 2))))))
  (get-first mrs))

=>
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
        is-whole-bar-rest: NIL,
        score-rthm: 4.0, undotted-value: 4, num-flags: 0, num-dots: 0,
        is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
        is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
        rqq-note: NIL, rqq-info: NIL, marks: (PIZZ A FF), marks-in-part: NIL,
        letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q
```

**SYNOPSIS:**

```
(defmethod get-first ((rs rthm-seq))
```

**20.2.361 rthm-seq/get-last**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Return the last rhythm/event object in the specified rthm-seq object.

**ARGUMENTS:**

- A rthm-seq object.

**RETURN VALUE:**

A rhythm/event object.

**EXAMPLE:**

```
(let ((mrs (make-rthm-seq '(seq1 (((2 4) q e (s) s))
                                :pitch-seq-palette ((1 2 3))
                                :marks (ff 1 a 1 pizz 1 ppp 2 s 2))))))
  (get-last mrs))
```

=>

```
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
        is-whole-bar-rest: NIL,
        score-rthm: 16.0, undotted-value: 16, num-flags: 2, num-dots: 0,
        is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.250,
        is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
        rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
        letter-value: 16, tuplet-scaler: 1, grace-note-duration: 0.05
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: S, tag: NIL,
```

```
data: S
```

## SYNOPSIS:

```
(defmethod get-last ((rs rthm-seq))
```

### 20.2.362 rthm-seq/get-last-attack

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Gets the rhythm object for the last note that needs an attack (i.e. not a rest and not a tied note) in a given rthm-seq object.

## ARGUMENTS:

- A rthm-seq object.

## OPTIONAL ARGUMENTS:

- T or NIL indicating whether to print a warning message if the given index (minus 1) is greater than the number of attacks in the rthm-seq object (default = T). This is a carry-over argument from the get-nth-attack method called within the get-last-attack method and not likely to be needed for use with get-last-attack.

## RETURN VALUE:

A rhythm object.



**EXAMPLE:**

```
;; Returns a rhythm object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-last-attack rs))

=>
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
       score-rthm: 16.0f0, undotted-value: 16, num-flags: 2, num-dots: 0,
       is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.250,
       is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
       rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
       letter-value: 16, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: S, tag: NIL,
data: S
```

**SYNOPSIS:**

```
(defmethod get-last-attack ((rs rthm-seq) &optional (warn t))
```

**20.2.363 rthm-seq/get-last-bar**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Get the last rthm-seq-bar object of a given rthm-seq object.

**ARGUMENTS:**

- A rthm-seq object.

**RETURN VALUE:**

A rthm-seq-bar object.

**EXAMPLE:**

```
;;; The method returns a rthm-seq-bar object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
```

```

((3 8) s s e. s))
:pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
(get-last-bar rs))

=>
RTHM-SEQ-BAR: time-sig: 6 (3 8), time-sig-given: T, bar-num: -1,
[...]
data: ((3 8) S S E. S)

```

**SYNOPSIS:**

```
(defmethod get-last-bar ((rs rthm-seq))
```

**20.2.364 rthm-seq/get-last-event**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Get the last event object (or rhythm object) of a given rthm-seq-bar object.

**ARGUMENTS:**

- A rthm-seq object.

**RETURN VALUE:**

Returns an event (or rhythm) object.

**EXAMPLE:**

```

;; The last event is a rhythm object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-last-event rs))

=>
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
score-rthm: 16.0f0, undotted-value: 16, num-flags: 2, num-dots: 0,
is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.250,
is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
rq-note: NIL, rq-info: NIL, marks: NIL, marks-in-part: NIL,

```

```

        letter-value: 16, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: S, tag: NIL,
data: S

```

```

;; The last event is an event object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. ,(make-event 'c4 's)))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
    (get-last-event rs))

```

```

=>
EVENT: start-time: NIL, end-time: NIL,
[...]
PITCH: frequency: 261.6255569458008, midi-note: 60, midi-channel: NIL
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
NAMED-OBJECT: id: S, tag: NIL,
data: S

```

## SYNOPSIS:

```
(defmethod get-last-event ((rs rthm-seq))
```

### 20.2.365 rthm-seq/get-multipliers

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Get a list of factors by which a specified rhythmic unit must be multiplied in order to create the rhythms of a given rthm-seq object.

NB: The get-multipliers method determines durations in the source rhythmic material based on attacked notes only, so beginning ties will be ignored and rests following an attack will count the same as if the attacked note were tied to another note with the same duration as the rest. For this reason, the results returned by the method when applied to a rthm-seq object that contains multiple bars may differ from applying the method to multiple rthm-seqs with single bars, albeit with the same rhythms when seen as a group (see example below).

## ARGUMENTS:

- A *rthm-seq* object.
- A rhythm unit, either as a number or a shorthand symbol (i.e. 's)

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to round the results. T = round.  
Default = NIL. NB: Lisp always rounds to even numbers, meaning x.5 may sometimes round up and sometimes round down; thus (round 1.5) => 2, and (round 2.5) => 2.

**RETURN VALUE:**

A list of numbers.

**EXAMPLE:**

```
;;; By default the method returns the list of multipliers un-rounded
(let ((rs (make-rthm-seq '(seq1 (((2 4) q e s s))
                               :pitch-seq-palette ((1 2 3 4))))))
  (get-multipliers rs 'e))
```

```
=> (2.0 1.0 0.5 0.5)
```

```
;; Setting the optional argument to T rounds the results before returning
(let ((rs (make-rthm-seq '(seq1 (((2 4) q e s s))
                               :pitch-seq-palette ((1 2 3 4))))))
  (get-multipliers rs 'e t))
```

```
=> (2 1 0 0)
```

```
;;; Applying the method to the a multiple-bar rthm-seq object may return
;;; different results than applying the method to each of the bars contained
;;; within that rthm-seq object as individual one-bar rthm-seq objects, as the
;;; method measures the distances between attacked notes, regardless of ties
;;; and rests.
```

```
(let ((rs1 (make-rthm-seq '(seq1 (((2 4) q +e. s))
                               :pitch-seq-palette ((1 2))))))
  (rs2 (make-rthm-seq '(seq2 (((2 4) (s) e (s) q))
                               :pitch-seq-palette ((1 2))))))
  (rs3 (make-rthm-seq '(seq3 (((2 4) +e. s { 3 (te) te te } ))
                               :pitch-seq-palette ((1 2 3))))))
  (rs4 (make-rthm-seq '(seq4 (((2 4) q +e. s)
                               ((s) e (s) q)
                               (+e. s { 3 (te) te te } ))
                               :pitch-seq-palette ((1 2 3 4 5 6 7))))))
```

```

(print (get-multipliers rs1 'e))
(print (get-multipliers rs2 'e))
(print (get-multipliers rs3 'e))
(print (get-multipliers rs4 'e)))

=>
(3.5 0.5)
(1.5 2.0)
(1.1666666666666665 0.6666666666666666 0.6666666666666666)
(3.5 1.0 1.5 3.5 1.1666666666666665 0.6666666666666666 0.6666666666666666)

```

**SYNOPSIS:**

```
(defmethod get-multipliers ((rs rthm-seq) rthm &optional round ignore)
```

**20.2.366 rthm-seq/get-nth-attack**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Gets the rhythm object for the *nth* note in a given *rthm-seq* object that needs an attack, i.e. not a rest and not tied.

**ARGUMENTS:**

- The zero-based index number indicating which attack is sought.
- The given *rthm-seq* object in which to search.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print an error message if the given index is greater than the number of attacks (minus 1) in the *rthm-seq* object (default = T).

**RETURN VALUE:**

A rhythm object.

**EXAMPLE:**

```
;; The method returns a rhythm object when successful
(let ((rs (make-rthm-seq '(((2 4) q+e s s)
                          ((e) q (e))
```

```

((3 8) s s e. s))
:pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
(get-nth-attack 4 rs))

=>
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
score-rthm: 16.0f0, undotted-value: 16, num-flags: 2, num-dots: 0,
is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.250,
is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
rq-note: NIL, rq-info: NIL, marks: NIL, marks-in-part: NIL,
letter-value: 16, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: S, tag: NIL,
data: S

```

```

;; By default, the method drops into the debugger with an error when the
;; specified index is greater than the number of items in the given rthm-seq
;; object.

```

```

(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                           ((e) q (e))
                           ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-nth-attack 11 rs))

```

```

=>
rthm-seq::get-nth-attack: Couldn't get attack with index 11
[Condition of type SIMPLE-ERROR]

```

```

;; This error can be suppressed, simply returning NIL, by setting the optional
;; argument to NIL.

```

```

(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                           ((e) q (e))
                           ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-nth-attack 11 rs nil))

```

```

=> NIL, 0, NIL

```

## SYNOPSIS:

```

(defmethod get-nth-attack (index (rs rthm-seq)
                           &optional (error t))

```

**20.2.367 rthm-seq/get-nth-bar***[ rthm-seq ] [ Methods ]***DESCRIPTION:**

Get the nth rthm-seq-bar object from a given rthm-seq object.

**ARGUMENTS:**

- A rthm-seq object.
- An index number (zero-based).

**RETURN VALUE:**

Returns a rthm-seq-bar object if successful.

Returns NIL and prints a warning if the specified index number is greater than the number of rthm-seq-bar objects (minus one) in the given rthm-seq object.

**EXAMPLE:**

;; The method returns a rthm-seq-bar object when successful

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-nth-bar 1 rs))
```

=>

```
RTHM-SEQ-BAR: time-sig: 0 (2 4), time-sig-given: NIL, bar-num: -1,
[...]
NAMED-OBJECT: id: "NIL-bar2", tag: NIL,
data: ((E) Q (E))
```

;; Returns a warning and prints NIL when the specified index number is greater  
;; than the number of rthm-seq-bar objects in the given rthm-seq object

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-nth-bar 11 rs))
```

=> NIL

```
WARNING: rthm-seq::rthm-seq-check-bounds: Illegal list reference: 11
```

**SYNOPSIS:**

```
(defmethod get-nth-bar (nth (rs rthm-seq))
```

**20.2.368 rthm-seq/get-nth-non-rest-rhythm**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Get the *nth* non-rest rhythm object stored in the given *rthm-seq* object.

**ARGUMENTS:**

- The zero-based index number indicating which non-rest-rhythm is sought.
- The given *rthm-seq* object in which to search.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print an error message if the given index is greater than the number of non-rest rhythms (minus 1) in given *rthm-seq* object. (Default = T.)

**RETURN VALUE:**

A rhythm object.

Returns NIL if the given index is higher than the highest possible index of non-rest rhythms in the given *rthm-seq-bar* object.

**EXAMPLE:**

```
;; The method returns a rhythm object when successful
(let ((rs (make-rthm-seq '((((2 4) q e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3 4))))))
  (get-nth-non-rest-rhythm 4 rs))
```

```
=>
```

```
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
        score-rthm: 4.0f0, undotted-value: 4, num-flags: 0, num-dots: 0,
        is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
        is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
        rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
```



```

letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q

```

```

;; By default, the method drops into the debugger with an error when the
;; specified index is greater than the number of items in the given rthm-seq
;; object.

```

```

(let ((rs (make-rthm-seq '((((2 4) q e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3 4))))))
  (get-nth-non-rest-rhythm 11 rs))

```

```
=>
```

```

rthm-seq::get-nth-non-rest-rhythm: Couldn't get non-rest rhythm with index 11
[Condition of type SIMPLE-ERROR]

```

```

;; This error can be suppressed, simply returning NIL, by setting the optional
;; argument to NIL.

```

```

(let ((rs (make-rthm-seq '((((2 4) q e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3 4))))))
  (get-nth-non-rest-rhythm 11 rs nil))

```

```
=> NIL
```

## SYNOPSIS:

```

(defmethod get-nth-non-rest-rhythm (index (rs rthm-seq)
                                       &optional (error t))

```

### 20.2.369 rthm-seq/get-nth-rhythm

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Gets the rhythm (or event) object for the *nth* note in a given *rthm-seq* object.

## ARGUMENTS:

- The zero-based index number indicating which attack is sought.
- The given *rthm-seq* object in which to search.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print an error message if the given index is greater than the number of attacks (minus 1) in the rthm-seq object (default = T).

**RETURN VALUE:**

A rhythm or event object.

**EXAMPLE:**

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (get-nth-rhythm 4 rs))
```

=>

```
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: T,
        score-rthm: 8.0f0, undotted-value: 8, num-flags: 1, num-dots: 0,
        is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.500,
        is-grace-note: NIL, needs-new-note: NIL, beam: NIL, bracket: NIL,
        rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
        letter-value: 8, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
*****
```

**SYNOPSIS:**

```
(defmethod get-nth-rhythm (index (rs rthm-seq) &optional (error t))
```

**20.2.370 rthm-seq/get-rhythms**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Get the rhythm objects in a given rthm-seq object, contained in a list.

**ARGUMENTS:**

- A `rthm-seq` object.

# RETURN VALUE:

A list.

# EXAMPLE:

```
;; Returns a list of rhythm objects
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (get-rhythms rs))

=>
(
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
[...]
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: NIL,
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: T,
[...]
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
[...]
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: T,
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
RHYTHM: value: 5.333, duration: 0.750, rq: 3/4, is-rest: NIL,
[...]
RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: NIL,
[...]
)

;; Get just the rhythm labels from the same rthm-seq object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (get-rhythm-labels rs))

=>
(
q
q
s s e. s
)

```

```
(loop for r in (get-rhythms rs) collect (data r)))

=> ("Q" "E" S S E Q E S S E. S)
```

**SYNOPSIS:**

```
(defmethod get-rhythms ((rs rthm-seq))
```

**20.2.371 rthm-seq/get-time-sigs**

```
[ rthm-seq ] [ Methods ]
```

**DESCRIPTION:**

Return a list of time-sig objects for each of the rthm-seq-bar objects in a given rthm-seq object.

One time signature is returned for each rthm-seq-bar object, even if two or more consecutive objects have the same time signature.

Optionally, this method can return a list of time signatures in list form (e.g. ((2 4) (3 4)) etc.) rather than a list of time-sig objects.

**ARGUMENTS:**

- A rthm-seq object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to return the time signatures as time-sig objects or a list of two-item lists. T = time-sig objects. Default = T.

**RETURN VALUE:**

Returns a list of time-sig objects by default. Optionally a list of time signatures as two-item lists can be returned instead.

**EXAMPLE:**

```
;; Return a list of time-sig objects, one for each rthm-seq-bar object even if
;; consecutive rthm-seq-bar objects have the same time signature
(let ((rs (make-rthm-seq '(((2 4) q+e s s)
                           ((e) q (e))
                           ((3 8) s s e. s)))
```

```

                                :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (get-time-sigs rs))

=> (
TIME-SIG: num: 2, denom: 4, duration: 2.0, compound: NIL, midi-clocks: 24, num-beats: 2
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0204", tag: NIL,
data: (2 4)
*****

TIME-SIG: num: 2, denom: 4, duration: 2.0, compound: NIL, midi-clocks: 24, num-beats: 2
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0204", tag: NIL,
data: (2 4)
*****

TIME-SIG: num: 3, denom: 8, duration: 1.5, compound: T, midi-clocks: 24, num-beats: 1
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0308", tag: NIL,
data: (3 8)
*****
)

;; Return the same as a list of two-item lists instead
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                             :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (get-time-sigs rs t))

=> ((2 4) (2 4) (3 8))

```

**SYNOPSIS:**

```
(defmethod get-time-sigs ((rs rthm-seq) &optional as-list)
```

**20.2.372 rthm-seq/insert-bar**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Insert a `rthm-seq-bar` object into the given `rthm-seq` object and re-initialize it. If there's a `pitch-seq/pitch-seq-palette` given (list of numbers, or list of lists), splice this in at the appropriate location.

NB: This method sets the values of the individual slots but leaves the `DATA` slot untouched (for cases in which the user might want to see where the new data originated from, or otherwise use the old data somehow, such as in a new `rthm-seq` object).

#### ARGUMENTS:

- A `rthm-seq` object.
- A `rthm-seq-bar` object.
- A bar number (integer). This argument is the bar number of the bar to be inserted, relative to the `rthm-seq` and 1-based; e.g., if 3, then it will come before the present third bar.

#### OPTIONAL ARGUMENTS:

- A `pitch-seq` object.
- (three ignore arguments for `sc-internal` use only)

#### RETURN VALUE:

Returns `T` if successful.

Drops into the debugger with an error if the specified `bar-number` argument is greater than the number of `rthm-seq-bar` objects in the given `rthm-seq`.

#### EXAMPLE:

```
;; The method returns T when successful
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (insert-bar rs (make-rthm-seq-bar '((3 4) q. e e s s)) 3))

=> T
```

```
;; Create a rthm-seq object with three rthm-seq-bars and print the contents of
;; the NUM-BARS slot to confirm that it contains 3 objects. Insert a bar before
;; the third item and print the value of the NUM-BARS slot again to confirm
;; that there are now 4 objects. Use print-simple and get-nth-bar to confirm
;; that the 3rd object (with a zero-based index of 2) is indeed the one
```

```
;; inserted.
```

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
      :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (print (num-bars rs))
  (insert-bar rs (make-rthm-seq-bar '((3 4) q. e e s s)) 3)
  (print (num-bars rs))
  (print-simple (get-nth-bar 2 rs)))
```

```
=>
```

```
3
```

```
4
```

```
(3 4): note Q., note E, note E, note S, note S,
```

```
;; Attempting to insert a bar with an index number greater than the number of
;; objects currently in the rthm-seq object drops into the debugger with an
;; error
```

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
      :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (insert-bar rs (make-rthm-seq-bar '((3 4) q. e e s s)) 11))
```

```
=>
```

```
rthm-seq::insert-bar: only 3 bars in rthm-seq!
[Condition of type SIMPLE-ERROR]
```

```
;; Inserting a rthm-seq-bar using the optional pitch-seq argument splices the
;; specified value of that argument into the existing pitch-seq-palette
```

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
      :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (insert-bar rs (make-rthm-seq-bar '((3 4) q. e e s s)) 3 '((1 2 3 4 5)))
  (data (get-first (pitch-seq-palette rs))))
```

```
=> (1 2 3 1 1 2 3 4 5 1 2 3 4)
```

## SYNOPSIS:

```
(defmethod insert-bar ((rs rthm-seq) (rsb rthm-seq-bar) bar-num
  &optional pitch-seq ignore1 ignore2 ignore3)
```

**20.2.373 rthm-seq/make-rhythms***[ rthm-seq ] [ Functions ]***DATE:**

11 Feb 2010

**DESCRIPTION:**

Initialize a group of rhythms, taking advantage of rthm-seq's ability to add tuplet and beaming info.

**ARGUMENTS:**

- A list of rhythms equalling one full bar
- The time signature of that bar as a list (e.g (2 4))

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to divide the resulting list into sublists, each of which are the equivalent of one beat long. Default = NIL.

**RETURN VALUE:**

- A list

**EXAMPLE:**

```
;; Apply the function and test that the result is a list
(let ((rs (make-rhythms '(q e s s) '(2 4))))
  (listp rs))
```

=&gt; T

```
;; Apply the function and see that we've created a list with 4 elements
(let ((rs (make-rhythms '(q e s s) '(2 4))))
  (length rs))
```

=&gt; 4

```
;; Apply the function with the optional split-into-beats argument set to T and
;; see that we now have two lists, each equalling one beat in combined
;; length. Print the data of the contents.
(let ((rs (make-rhythms '(q e s s) '(2 4) t)))
```



```

(print (length rs))
(print (loop for b in rs collect (length b)))
(print (loop for b in rs
          collect (loop for r in b
                        collect (data r)))))

=>
2
(1 3)
((Q) (E S S))

;; Apply the function using beam indications then print the BEAM slots of the
;; individual rhythm objects contained in the result
(let ((rs (make-rhythms '(q - e s s -) '(2 4))))
  (loop for r in rs collect (beam r)))

=> (NIL 1 NIL 0)

;; Apply the function using tuplet indications then print the BRACKET slots of
;; the individual rhythms objects contained in the result
(let ((rs (make-rhythms '({ 3 te te te } - e s s -) '(2 4))))
  (loop for r in rs collect (bracket r)))

=> (((1 3)) (-1) (1) NIL NIL NIL)

```

**SYNOPSIS:**

```
(defun make-rhythms (bar time-sig &optional split-into-beats)
```

**20.2.374 rthm-seq/make-rthm-seq**

[ *rthm-seq* ] [ *Functions* ]

**DESCRIPTION:**

Creates a rthm-seq object from a list of at least bars and generally also a list of pitch sequences.

**ARGUMENTS:**

- A list with the following items:
  - A symbol that will be used as the ID of the seq
  - Another list, containing two items:
    - A list of rthm-seq-bars and
    - A list of pitch-seqs attached to the :pitch-seq-palette accessor

**OPTIONAL ARGUMENTS:**

keyword argument  
 - :psp-inversions. T or NIL to indicate whether to also automatically generate and add inverted forms of the specified pitch-seq objects.  
 T = generate and add. Default = NIL.

**RETURN VALUE:**

Returns a rthm-seq object.

**EXAMPLE:**

```
;; Make a rthm-seq object with the ID seq1 that contains one 2/4 bar of
;; rhythms and one pitch sequence in the pitch-seq-palette
(make-rthm-seq '(seq1 (((2 4) q e s s))
                  :pitch-seq-palette ((1 2 3 4)))))

=>
RTHM-SEQ: num-bars: 1
          num-rhythms: 4
          num-notes: 4
          num-score-notes: 4
          num-rests: 0
          duration: 2.0
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
          (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SEQ1, tag: NIL,
data: (((2 4) Q E S S)) PITCH-SEQ-PALETTE (1 2 3 4))

;; A rthm-seq object with two bars of rhythms and two pitch-seqs in the
;; pitch-seq-palette. There must be as many items in each pitch-seq list as
;; there are rhythms in each rthm-seq-bar.
(make-rthm-seq '(seq1 (((2 4) q e s s)
                        ((e) q (e)))
                  :pitch-seq-palette ((1 2 3 4 5)
                                       (2 4 6 8 10)))))

=>
RTHM-SEQ: num-bars: 2
```

```

    num-rhythms: 7
    num-notes: 5
    num-score-notes: 5
    num-rests: 2
    duration: 4.0
    psp-inversions: NIL
    marks: NIL
    time-sigs-tag: NIL
    handled-first-note-tie: NIL
    (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SEQ1, tag: NIL,
data: (((2 4) Q E S S) ((E) Q (E))) PITCH-SEQ-PALETTE
      ((1 2 3 4 5) (2 4 6 8 10)))

```

```

;; The pitch-seq-palette may be omitted, and time signatures may be changed
(make-rthm-seq '(seq1 (((2 4) q e s s)
                        ((e) q (e))
                        ((3 8) s s e. s)))))

```

=>

```

RTHM-SEQ: num-bars: 3
          num-rhythms: 11
          num-notes: 9
          num-score-notes: 9
          num-rests: 2
          duration: 5.5
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
    (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 1, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SEQ1, tag: NIL,
data: (((2 4) Q E S S) ((E) Q (E)) ((3 8) S S E. S))

```

```

;;; With :psp-inversions set to T, the inverted forms of the specified
;;; pitch-seq are automatically generated and added
(let ((mrs
      (make-rthm-seq '(seq1 (((2 4) q e s s)
                              :pitch-seq-palette ((1 2 3 4)))
                              :psp-inversions t)))
      (data (pitch-seq-palette mrs)))

```

```
=> (
PITCH-SEQ: notes: NIL
          highest: 4
          lowest: 1
          original-data: (1 2 3 4)
          user-id: NIL
          instruments: NIL
          relative-notes: (not printed for sake of brevity)
          relative-notes-length: 25
SCLIST: sclist-length: 4, bounds-alert: T, copy: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "rthm-seq-SEQ1-pitch-seq-palette-ps-1", tag: NIL,
data: (1 2 3 4)
*****

PITCH-SEQ: notes: NIL
          highest: 4
          lowest: 1
          original-data: (4 3 2 1)
          user-id: NIL
          instruments: NIL
          relative-notes: (not printed for sake of brevity)
          relative-notes-length: 25
SCLIST: sclist-length: 4, bounds-alert: T, copy: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "rthm-seq-SEQ1-pitch-seq-palette-ps-1-inverted", tag: NIL,
data: (4 3 2 1)
*****
)
```

**SYNOPSIS:**

```
(defun make-rthm-seq (rs &key (psp-inversions nil))
```

**20.2.375 rthm-seq/make-rthm-seq-from-fragments**

```
[ rthm-seq ] [ Functions ]
```

**DATE:**

Jan-2010

**DESCRIPTION:**

Make a rthm-seq object from a predefined list of rhythm fragments.

NB: No pitch-seqs can be passed as yet.

### ARGUMENTS:

- The ID of the rthm-seq object to be made.
- A list of rhythm lists (fragments) paired with key IDs. The rhythm lists take the form of rthm-seq-bar definitions without the time signatures.
- A list of lists containing any combination of the key IDs from the list of fragments. These will be collated to create the resulting rthm-seq object. Each element will make up one whole bar.
- A list of meters. These can be given either as single numerators, whereby the optional <default-beat> argument will then be the denominator) or two-item lists consisting of (num denom). There must be one meter for each item in the list of references, and the meters must correspond to the number of beats in the corresponding item from the list of references.

### RETURN VALUE:

A rthm-seq object.

### EXAMPLE:

```
(let ((frags '((1 (- s s - (e)))
                (2 (s (s) (s) s))
                (3 ((s) - s e -))
                (4 (- s s (s) s -))
                (5 ((e) - s s -))
                (6 ((q))))))
    (make-rthm-seq-from-fragments
      'test-rs frags
      '((1 2 3) (1 4) (6 1) (5 6))
      '((3 4) (2 4) (2 4) (2 4))))

=>
RTHM-SEQ: num-bars: 4
          num-rhythms: 25
          num-notes: 15
          num-score-notes: 15
          num-rests: 10
          duration: 9.0
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
```

(for brevity's sake, slots pitch-seq-palette and bars are not printed)  
 SCLIST: sclist-length: 1, bounds-alert: T, copy: T  
 LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL  
 NAMED-OBJECT: id: TEST-RS, tag: NIL,  
 data: (((3 4) - S S - (E) S (S) (S) S (S) - S E -)  
 ((2 4) - S S - (E) - S S (S) S -) ((Q) - S S - (E)) ((E) - S S - (Q))))

**SYNOPSIS:**

```
(defun make-rthm-seq-from-fragments (id fragments references meters
                                   &optional (default-beat 4))
```

**20.2.376 rthm-seq/make-rthm-seq-from-unit-multipliers**

[ *rthm-seq* ] [ *Functions* ]

**DESCRIPTION:**

Given a rhythmic unit, e.g. 32, a list of multipliers (e.g. '(7 9 16)), and a time signature (e.g. '(4 4)), return a rthm-seq object made up of bars whose rhythms are multiples of the specified unit by the numbers in the multipliers list.

At this point the unit should be a whole number divisor of the beat in the time signature, i.e. quintuple eighths won't work in 4/4.

NB: Setting the auto-beam keyword argument to T can result in errors if creating durations longer than 1 beat, as auto-beam will call get-beats. :auto-beam is therefore set to NIL by default.

**ARGUMENTS:**

- A rhythmic duration unit.
- A list of multipliers.
- A time signature.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :tag. A symbol that is another name, description etc. for the given object. The tag may be used for identification but not for searching purposes. Default = NIL.
- :auto-beam. T or NIL. When T, the function will attempt to automatically set beaming indicators among the resulting rthm-seq-bar objects. This can result in errors if the resulting rhythms have a duration of more than 1

```

beat. Default = NIL.
- :id. A symbol that will be the ID of the given object.
  Default = "from-multipliers".
- :tuplet. An integer or NIL. If an integer, the function will
  automatically place tuplet brackets of that value above beats consisting
  of tuplet rhythms. NB: This function will only place the same value over
  all tuplets. Default = NIL.

```

**RETURN VALUE:**

Returns a `rthm-seq` object.

**EXAMPLE:**

```

;; Make a rthm-seq object using the rhythmic unit of a 16th-note, rhythms that
;; are 4, 2, 2, 4 and 4 16th-notes long, and a time signature of 2/4; then
;; print-simple the object returned to see the results.
(let ((rs (make-rthm-seq-from-unit-multipliers 's '(4 2 2 4 4) '(2 4))))
  (print-simple rs))

```

```

=>
rthm-seq from-multipliers
(2 4): note Q, note E, note E,
(2 4): note Q, note Q,

```

```

;; Make a rthm-seq object using the rhythmic unit of a 32nd note, combinations
;; of irregular duration, and a time signature of 4/4; then print-simple the
;; returned object to see the results.
(let ((rs (make-rthm-seq-from-unit-multipliers 32 '(7 9 16) '(4 4))))
  (print-simple rs))

```

```

=>
rthm-seq from-multipliers
(4 4): note E., note 32, note Q, note H

```

```

;; The print-simple output of the above example disregards the ties. We can
;; check to make sure that there are only three attacked rhythms in the result
;; by reading the values of the IS-TIED-FROM and IS-TIED-TO slots, which show
;; that the 32 is tied to the Q
(let ((rs (make-rthm-seq-from-unit-multipliers 32 '(7 9 16) '(4 4))))
  (loop for b in (bars rs)
        collect (loop for r in (rhythms b) collect (is-tied-from r))
        collect (loop for r in (rhythms b) collect (is-tied-to r))))

=> ((NIL T NIL NIL) (NIL NIL T NIL))

```

```

;;; Using with a tuplet rhythm ('te) and setting the :tuplet option to 3 so
;;; that triplet brackets are automatically placed.
(let ((rs (make-rthm-seq-from-unit-multipliers 'te '(7 9 16) '(4 4)
                                              :tuplet 3)))
  (loop for b in (bars rs)
        collect (loop for r in (rhythms b) collect (bracket r))))

=> ((NIL NIL ((1 3)) (1) NIL) (NIL ((1 3)) (1) NIL NIL)
     (NIL NIL ((1 3)) (1) NIL))

```

**SYNOPSIS:**

```

(defun make-rthm-seq-from-unit-multipliers (unit multipliers time-sig
                                           &key
                                           ;; a number for brackets over
                                           ;; each beat.
                                           (tuplet nil)
                                           (tag nil)
                                           (auto-beam nil) ; see above
                                           (id "from-multipliers"))

```

**20.2.377 rthm-seq/rs-subseq**

[ *rthm-seq* ] [ *Methods* ]

**DATE:**

30th September 2013

**DESCRIPTION:**

Extract a new *rthm-seq* object from the bars of an existing *rthm-seq*.

NB other *-subseq* methods are more like Lisp's *subseq* but as this is for the end user it's a little different in the use of its indices.

**ARGUMENTS:**

- the original *rthm-seq* object
- the start bar (1-based)

**OPTIONAL ARGUMENTS:**

- the end bar (1-based and (unlike Lisp's *subseq* function) inclusive). If NIL, we'll use the original end bar. Default = NIL.



**RETURN VALUE:**

A new `rthm-seq` object.

**EXAMPLE: SYNOPSIS:**

```
(defmethod rs-subseq ((rs rthm-seq) start &optional end)
```

**20.2.378 rthm-seq/scale**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Scale the durations of the rhythm objects in a given `rthm-seq` object by the specified factor.

NB: As is evident in the examples below, this method does not replace the original data in the `rthm-seq` object's `DATA` slot.

**ARGUMENTS:**

- A `rthm-seq` object.
- A real number that is the scaling factor.

**RETURN VALUE:**

Returns a `rthm-seq` object.

**EXAMPLE:**

```
;; The method returns a rthm-seq object.
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (scale rs 3))
```

=>

```
RTHM-SEQ: num-bars: 3
          num-rhythms: 11
          num-notes: 8
          num-score-notes: 9
          num-rests: 2
          duration: 16.5
```

```

    psp-inversions: NIL
    marks: NIL
    time-sigs-tag: NIL
    handled-first-note-tie: NIL
    (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (((2 4) Q+E S S) ((E) Q (E)) ((3 8) S S E. S)) PITCH-SEQ-PALETTE
      ((1 2 3 1 1 2 3 4)))

```

```

;; Create a rthm-seq object, scale the durations by 3 times using the scale
;; method, and print-simple the corresponding slots to see the results
(let ((rs (make-rthm-seq '(((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                        :pitch-seq-palette ((1 2 3 1 1 2 3 4))))))
  (print-simple (scale rs 3)))

```

=>

```

rthm-seq NIL
(6 4): note H., note Q., note E., note E.,
(6 4): rest Q., note H., rest Q.,
(9 8): note E., note E., note E., note E.,

```

## SYNOPSIS:

```

(defmethod scale ((rs rthm-seq) scaler
                  &optional ignore1 ignore2 ignore3)

```

### 20.2.379 rthm-seq/set-nth-attack

[ *rthm-seq* ] [ *Methods* ]

## DESCRIPTION:

Sets the value of the *nth* rhythm object of a given *rthm-seq* object that needs an attack; i.e., not a rest and not a tied note.

NB: This method does not check to ensure that the resulting *rthm-seq* bars contain the right number of beats.

## ARGUMENTS:

- A zero-based index number for the attacked note to change.

- An event.
- A rthm-seq object.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print an error message if the given index is greater than the number of attacks (minus 1) in the rthm-seq object (default = T).

**RETURN VALUE:**

- An event object.

**EXAMPLE:**

```
;; The method returns an event object
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (set-nth-attack 2 (make-event 'c4 'q) rs))

=>
EVENT: start-time: NIL, end-time: NIL,
[...]
  pitch-or-chord:
PITCH: frequency: 261.6255569458008, midi-note: 60, midi-channel: NIL
[...]
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: C4, tag: NIL,
data: C4
[...]
  written-pitch-or-chord: NIL
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
[...]
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q

;; Create a rthm-seq object, apply set-nth-attack, print the corresponding
;; slots to see the change
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
```

```

(set-nth-attack 2 (make-event 'c4 'q) rs)
(print-simple rs))

=>
rthm-seq NIL
(2 4): note Q, note E, note S, C4 Q,
(2 4): rest E, note Q, rest E,
(3 8): note S, note S, note E., note S,

;; By default, the method drops into the debugger with an error when the
;; specified index is greater than the number of items in the given rthm-seq
;; object.
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (set-nth-attack 11 (make-event 'c4 'q) rs))

=>
rthm-seq::set-nth-attack: Can't set attack 11 as only 8 notes in the rthm-seq
[Condition of type SIMPLE-ERROR]

;; This error can be suppressed, simply returning NIL, by setting the optional
;; argument to NIL.
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                             ((e) q (e))
                             ((3 8) s s e. s))
                           :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
  (set-nth-attack 11 (make-event 'c4 'q) rs nil))

=> NIL

```

**SYNOPSIS:**

```

(defmethod set-nth-attack (index (e event) (rs rthm-seq)
                          &optional (error t))

```

**20.2.380 rthm-seq/set-nth-bar**

[ *rthm-seq* ] [ *Methods* ]

**DESCRIPTION:**

Change the contents of the *nth* *rthm-seq-bar* object in the given *rthm-seq*.

**ARGUMENTS:**

- A zero-based index number for the bar to change.
- A `rthm-seq-bar` object containing the new bar.
- A `rthm-seq` object.

**RETURN VALUE:**

A `rthm-seq-bar` object.

**EXAMPLE:**

;; The method returns what is passed to it as the new-bar argument (generally a  
;; `rthm-seq-bar` object.

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
    (set-nth-bar 1 (make-rthm-seq-bar '((2 4) (s) e (s) q)) rs))
```

=>

```
RTHM-SEQ-BAR: time-sig: 0 (2 4), time-sig-given: T, bar-num: -1,
[...]
data: ((2 4) (S) E (S) Q)
```

;; Create a `rthm-seq` object, change the second bar (index 1) using the  
;; `set-nth-bar` method, and print the contents of the rhythms data to see the  
;; changes.

```
(let ((rs (make-rthm-seq '((((2 4) q+e s s)
                          ((e) q (e))
                          ((3 8) s s e. s))
                          :pitch-seq-palette ((1 2 3 4 1 1 2 3))))))
    (set-nth-bar 1 (make-rthm-seq-bar '((2 4) (s) e (s) q)) rs)
    (print-simple rs))
```

=>

```
rthm-seq NIL
(2 4): note Q, note E, note S, note S,
(2 4): rest S, note E, rest S, note Q,
(3 8): note S, note S, note E., note S,
```

**SYNOPSIS:**

```
(defmethod set-nth-bar (index new-bar (rs rthm-seq))
```

**20.2.381 rthm-seq/split**

[ *rthm-seq* ] [ *Methods* ]

**DATE:**

27 Jan 2011

**DESCRIPTION:**

Splits the `rthm-seq-bar` objects of a given `rthm-seq` object into multiple smaller `rthm-seq-bar` objects, creating a new `rthm-seq` object with a greater number of bars than the original. This will only work if the given `rthm-seq-bar` objects can be split into whole beats; e.g., a 4/4 bar will not be split into  $5/8 + 3/8$ .

The keyword arguments `:min-beats` and `:max-beats` serve as guidelines rather than strict cut-offs. In some cases, the method may only be able to effectively split the given `rthm-seq-bar` by dividing it into segments that slightly exceed the length stipulated by these arguments (see example below).

Depending on the `min-beats/max-beats` arguments stipulated by the user or the rhythmic structure of the given `rthm-seq-bar` objects, the given `rthm-seq-bar` or `rthm-seq` objects may not be splittable, in which case `NIL` is returned. If the keyword argument `:warn` is set to `T`, a warning will be also printed in such cases.

NB: This method sets the values of the individual slots but leaves the `DATA` slot untouched (for cases in which the user might want to see where the new data originated from, or otherwise use the old data somehow, such as in a new `rthm-seq` object).

**ARGUMENTS:**

- A `rthm-seq` object.

**OPTIONAL ARGUMENTS:**

keyword arguments

- `:min-beats`. This argument takes an integer value to indicate the minimum number of beats in any of the new `rthm-seq-bar` objects created. This serves as a guideline only and may occasionally be exceeded in value by the method. Default value = 2.
- `:max-beats`. This argument takes an integer value to indicate the maximum number of beats in any of the new `rthm-seq-bar` objects created. This serves as a guideline only and may occasionally be exceeded in value by the method. Default value = 5.
- `:warn`. Indicates whether to print a warning if the `rthm-seq-bar` object is unsplittable. Value `T` = print a warning. Defaults to `NIL`.

**RETURN VALUE:**

A `rthm-seq` object.

**EXAMPLE:**

```
;; The method returns a new rthm-seq object
(let ((rs (make-rthm-seq '((((4 4) q e s s (e) e e (e))
                          ((3 4) s s e s e s e. s)
                          ((5 4) h q. e e s s))
                          :pitch-seq-palette ((1 2 3 4 5 6 1 2 3 4 5 6 7 8 1 2
                                                3 4 5 6)))))))

(split rs))

=>

RTHM-SEQ: num-bars: 5
          num-rhythms: 22
          num-notes: 20
          num-score-notes: 20
          num-rests: 2
          duration: 12.0
          psp-inversions: NIL
          marks: NIL
          time-sigs-tag: NIL
          handled-first-note-tie: NIL
          (for brevity's sake, slots pitch-seq-palette and bars are not printed)
SCLIST: sclist-length: 3, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (((4 4) Q E S S (E) E E (E)) ((3 4) S S E S E S E. S)
        ((5 4) H Q. E E S S))
        PITCH-SEQ-PALETTE ((1 2 3 4 5 6 1 2 3 4 5 6 7 8 1 2 3 4 5 6)))

;; Without setting the :min-beats and :max-beats arguments, the following
;; rthm-seq object is broken down from 3 to 5 rthm-seq-bar objects
(let* ((rs (make-rthm-seq '((((4 4) q e s s (e) e e (e))
                          ((3 4) s s e s e s e. s)
                          ((5 4) h q. e e s s))
                          :pitch-seq-palette ((1 2 3 4 5 6 1 2 3 4 5 6 7 8 1 2
                                                3 4 5 6)))))))

  (rssplt (split rs)))
(print-simple rssplt))

=>

rthm-seq NIL
```

```

(2 4): note Q, note E, note S, note S,
(2 4): rest E, note E, note E, rest E,
(3 4): note S, note S, note E, note S, note E, note S, note E., note S,
(2 4): note H,
(3 4): note Q., note E, note E, note S, note S,

;; Setting :min-beats to 4 affects the resulting subdivisions to larger bars
(let* ((rs (make-rthm-seq '((((4 4) q e s s (e) e e (e))
                             ((3 4) s s e s e s e. s)
                             ((5 4) h q. e e s s))
                             :pitch-seq-palette ((1 2 3 4 5 6 1 2 3 4 5 6 7 8 1 2
                                                    3 4 5 6))))))
      (rssplt (split rs :min-beats 4)))
(print-simple rssplt))

=>
rthm-seq NIL
(4 4): note Q, note E, note S, note S, rest E, note E, note E, rest E,
(3 4): note S, note S, note E, note S, note E, note S, note E., note S,
(5 4): note H, note Q., note E, note E, note S, note S,

;; Even though :max-beats is set to 2, an occasional 3/4 bar is constructed
(let* ((rs (make-rthm-seq '((((4 4) q e s s (e) e e (e))
                             ((3 4) s s e s e s e. s)
                             ((5 4) h q. e e s s))
                             :pitch-seq-palette ((1 2 3 4 5 6 1 2 3 4 5 6 7 8 1 2
                                                    3 4 5 6))))))
      (rssplt (split rs :max-beats 2)))
(print-simple rssplt))

=>
rthm-seq NIL
(2 4): note Q, note E, note S, note S,
(2 4): rest E, note E, note E, rest E,
(3 4): note S, note S, note E, note S, note E, note S, note E., note S,
(2 4): note H,
(3 4): note Q., note E, note E, note S, note S,

```

**SYNOPSIS:**

```

(defmethod split ((rs rthm-seq)
                  &key (min-beats 2) (max-beats 5) warn (clone t))

```



**20.2.382 rthm-seq/split-into-single-bars***[ rthm-seq ] [ Methods ]***DESCRIPTION:**

Split a rthm-seq into single bar rthm-seqs. The pitch-seq-palette will be used to set the pitch-seqs of the new rthm-seqs.

**ARGUMENTS:**

- a rthm-seq object

**OPTIONAL ARGUMENTS:**

- whether to clone each bar or just the original. Default = T = clone.

**RETURN VALUE:**

a list of rthm-seq objects

**SYNOPSIS:**

```
(defmethod split-into-single-bars ((rs rthm-seq) &optional (clone t))
```

**20.2.383 sclist/rthm-seq-bar***[ sclist ] [ Classes ]***NAME:**

rthm-seq-bar

File: rthm-seq-bar.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist ->  
rthm-seq-bar

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the rthm-seq-bar class, objects of which make up the individual bars that reside in a rhythmic sequence. This class is responsible for parsing

lists containing rhythms and time signatures (but not parsing these things themselves--that is done by separate classes).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 13th February 2001

\$\$ Last modified: 13:50:57 Sun Dec 29 2013 CIT

SVN ID: \$Id: rthm-seq-bar.lsp 4346 2013-12-30 12:46:28Z medward2 \$

### 20.2.384 rthm-seq-bar/all-rests?

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Test whether all rhythms in a rthm-seq-bar object are rests.

#### ARGUMENTS:

- A rthm-seq-bar object.

#### RETURN VALUE:

T if all rhythms are rests, otherwise NIL

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((2 4) (q) (e) (s) (s)))))
  (all-rests? rsb))
```

=> T

```
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (all-rests? rsb))
```

=> NIL

#### SYNOPSIS:

```
(defmethod all-rests? ((rsb rthm-seq-bar))
```

**20.2.385 rthm-seq-bar/auto-beam***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Automatically add beaming indications to the rhythm objects of the given rthm-seq-bar object. This will only set one beam group per beat.

NB: This method does not modify the DATA slot of the rthm-seq-bar object itself. Instead, it modifies the BEAM value for the individual RHYTHMs.

**ARGUMENTS:**

- A rthm-seq-bar object.

**OPTIONAL ARGUMENTS:**

- The beat basis for the given rthm-seq-bar. This will affect which notes get beamed together. This value can be either numeric (4, 8 16 etc.) or alphabetic (q, e, s etc). If no beat is given, the method defaults this value to NIL and takes the beat from the current time signature.
- Check-dur. This argument can be set to T or NIL. If T, the method will make sure there is a complete beat of rhythms for each beat of the bar. Default = T.

**RETURN VALUE:**

Returns the rthm-seq-bar-object

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((2 4) e e s s s))))
  (auto-beam rsb))
```

```
=> NIL
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) e e s s s))))
  (auto-beam rsb)
  (loop for r in (rhythms rsb) collect (beam r)))
```

```
=> (1 0 1 NIL NIL 0)
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) e e s s s))))
  (auto-beam rsb 8))
```

```

(loop for r in (rhythms rsb) collect (beam r)))

=> (NIL NIL 1 0 1 0)

(let ((rsb (make-rthm-seq-bar '((2 4) e e s s s s))))
  (auto-beam rsb 8 t)
  (loop for r in (rhythms rsb) collect (beam r)))

=> (NIL NIL 1 0 1 0)

(let ((rsb (make-rthm-seq-bar '((2 4) e e s s s s))))
  (auto-beam rsb 8 nil)
  (loop for r in (rhythms rsb) collect (beam r)))

=> (NIL NIL 1 0 1 0)

```

**SYNOPSIS:**

```
(defmethod auto-beam ((rsb rthm-seq-bar) &optional (beat nil) (check-dur t))
```

**20.2.386 rthm-seq-bar/auto-put-tuplet-bracket-on-beats**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Given a *rthm-seq-bar* object with tuplet rhythms and an indication of which tuplet value to place, this method will automatically add the appropriate tuplet bracket to the beats of the bar in the printed score output. If the TUPLET argument is set to NIL, the method will proceed on the basis of best-guessing rules.

NB: This method may produce results that encapsulate an entire beat when applying brackets to a portion of that beat. Thus bracketing the rhythm (e ts ts ts) will return { 3 e. ts ts ts } rather than ( e { 3 ts ts ts } )

**ARGUMENTS:**

- A *rthm-seq-bar* object
- An integer indicating the tuplet value (e.g. 3 for triplets, 5 for quintuplets etc.)

**RETURN VALUE:**

Returns T.

#### OPTIONAL ARGUMENTS:

- An integer indicating beat basis for the bar, or NIL. If NIL (default), the beat is taken from the time signature.
- An integer indicating the beat number within the bar to look for tuplets, or T. If T (default), all beats in the bar will be examined for possible tuplets.
- T or NIL to indicate whether to delete the tuplet bracket indicators already present in the given rthm-seq-bar object. T = delete. Default = T.

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((2 4) te te te q))))
  (tuplets rsb))
```

=> NIL

```
(let ((rsb (make-rthm-seq-bar '((2 4) te te te q))))
  (loop for r in (rhythms rsb) collect (bracket r)))
```

=> (NIL NIL NIL NIL)

```
(let ((rsb (make-rthm-seq-bar '((2 4) te te te q))))
  (auto-put-tuplet-bracket-on-beats rsb 3))
```

=> T

```
(let ((rsb (make-rthm-seq-bar '((2 4) te te te q))))
  (auto-put-tuplet-bracket-on-beats rsb 3)
  (print (tuplets rsb))
  (print (loop for r in (rhythms rsb) collect (bracket r))))
```

=>

```
((3 0 2))
(((1 3)) (-1) (1) NIL)
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) te te te q))))
  (auto-put-tuplet-bracket-on-beats rsb nil)
  (tuplets rsb))
```

=> ((3 0 2))

;;; The method may bracket the entire beat, returning ((3 1 4)) rather than

```

;;; ((3 2 4))
(let ((rsb (make-rthm-seq-bar '((2 4) q e ts ts ts))))
  (auto-put-tuplet-bracket-on-beats rsb 3)
  (tuplets rsb))

=> ((3 1 4))

```

**SYNOPSIS:**

```

(defmethod auto-put-tuplet-bracket-on-beats ((rsb rthm-seq-bar) tuplet
                                             &optional
                                             (beat nil)
                                             ;; can be a beat number or t for
                                             ;; all
                                             (beat-number t)
                                             ;; delete the tuplets already
                                             ;; there?
                                             (delete t))

```

**20.2.387 rthm-seq-bar/auto-tuplets**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Automatically place the data necessary for tuplet brackets in rthm-seq-bar objects that contain tuplet rhythms.

**ARGUMENTS:**

- A rthm-seq-bar object.

**OPTIONAL ARGUMENTS:**

- A function to be performed on fail. Default = #'error.

**RETURN VALUE:**

Returns T if successful.

**EXAMPLE:**

```

;;; Make a rthm-seq-bar object and print the values of the BRACKET slots for
;;; the rhythm objects it contains. Then apply auto-brackets and print the same

```

```
;;; again to see the change.
(let ((rsb (make-rthm-seq-bar '((4 4) tq tq tq +q fs fs fs fs fs))))
  (print (loop for r in (rhythms rsb) collect (bracket r)))
  (auto-tuplets rsb)
  (print (loop for r in (rhythms rsb) collect (bracket r))))

=>
(NIL NIL NIL NIL NIL NIL NIL NIL NIL)
(((1 3)) (-1) (1) NIL ((2 5)) (-2) (-2) (-2) (2))
```

**SYNOPSIS:**

```
(defmethod auto-tuplets ((rsb rthm-seq-bar) &optional (on-fail #'error))
```

**20.2.388 rthm-seq-bar/check-beams**

```
[ rthm-seq-bar ] [ Methods ]
```

**DESCRIPTION:**

Check the BEAM slots of the event objects within a specified rthm-seq-bar object to ensure that every beginning beam indication (slot value of 1) is coupled with a corresponding closing beam indication (slot value of 0), and print a warning and return NIL if this is not the case.

**ARGUMENTS:**

- A rthm-seq-bar object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :auto-beam. T or NIL to indicate the method should apply the auto-beam algorithm to the given bar after the check has determined that the beaming is wrong (and :on-fail is not NIL). T = auto-beam. Default = NIL.
- :print. T or NIL to indicate whether the method should print feedback of the checking process to the Lisp listener. T = print feedback. Default = NIL.
- :on-fail. The function that should be applied when the check does not pass. May be NIL for no warning/error or #'error if processing should stop. Default = #'warn.

**RETURN VALUE:**

T if the check passes, otherwise NIL.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))))
       :instrument-change-map '(((1 ((sax ((1 alto-sax) (3 tenor-sax))))
                                     (2 ((sax ((2 alto-sax) (5 tenor-sax))))
                                     (3 ((sax ((3 alto-sax) (4 tenor-sax)))))))
       :set-palette '(((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '(((1 (1 1 1 1 1))
                    (2 (1 1 1 1 1))
                    (3 (1 1 1 1 1))))
       :rthm-seq-palette '(((1 (((4 4) h e (s) (s) e+s+s))
                                :pitch-seq-palette ((1 2 3))))))
       :rthm-seq-map '(((1 ((sax (1 1 1 1 1))))
                        (2 ((sax (1 1 1 1 1))))
                        (3 ((sax (1 1 1 1 1)))))))
      (check-beams (get-bar mini 1 'sax)))
```

=&gt; T

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))))
       :instrument-change-map '(((1 ((sax ((1 alto-sax) (3 tenor-sax))))
                                     (2 ((sax ((2 alto-sax) (5 tenor-sax))))
                                     (3 ((sax ((3 alto-sax) (4 tenor-sax)))))))
       :set-palette '(((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '(((1 (1 1 1 1 1))
                    (2 (1 1 1 1 1))
                    (3 (1 1 1 1 1))))
       :rthm-seq-palette '(((1 (((4 4) h e (s) (s) e+s+s))
                                :pitch-seq-palette ((1 2 3))))))
       :rthm-seq-map '(((1 ((sax (1 1 1 1 1))))
                        (2 ((sax (1 1 1 1 1))))
                        (3 ((sax (1 1 1 1 1)))))))
      (setf (beam (nth 1 (rhythms (get-bar mini 1 'sax)))) 1)
      (check-beams (get-bar mini 1 'sax)))
```

=&gt; NIL

**SYNOPSIS:**

```
(defmethod check-beams ((rsb rthm-seq-bar) &key auto-beam print
```



```
(on-fail #'warn))
```

### 20.2.389 rthm-seq-bar/check-tuplets

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Check the qualities of the tuplets brackets in a given rthm-seq-bar object to make sure they are all formatted properly (i.e. each starting tuple bracket has a closing tuple bracket etc.). If an error is found, the method will try to fix it, then re-check, and only issue an error then if another is found.

#### ARGUMENTS:

- A rthm-seq-bar object.

#### OPTIONAL ARGUMENTS:

- The function to use if something is not ok with the tuplets. This defaults to #'error, but could also be #'warn for example

#### RETURN VALUE:

T if all tuplets brackets are ok, otherwise performs the on-fail function and returns NIL.

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((4 4) { 3 te te te } q q q))))
  (setf (bracket (get-nth-event 2 rsb)) nil)
  (check-tuplets rsb #'warn))
```

```
=> rthm-seq-bar::check-tuplets: got a nil bracket when brackets still open.
```

#### SYNOPSIS:

```
(defmethod check-tuplets ((rsb rthm-seq-bar) &optional (on-fail #'error))
```

### 20.2.390 rthm-seq-bar/chop

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Creates a list of new `rthm-seq-bar` objects, with new time signatures, which are formed by systematically chopping the bar represented by the current `rthm-seq-bar` into segments.

The method creates these segments based on chop-point pairs specified in the `<chop-points>` argument, which is a list of 2-element lists, each of which specifies the start and end points of a rhythmic span within the bounds of a given beat, measured in the unit specified by the `<unit>` argument.

The chop points specified are used to individually process each beat in the given `rthm-seq-bar` object; thus, chop-points specified for the subdivisions of a quarter-note will not work if applied to a 5/8 bar.

The method fills each newly created `rthm-seq-bar` object with one rhythmic duration that is equal to the length of the bar. If the beginning of the given chop segment coincides with an attack in the original bar, the result is a sounding note; if not, the result is a rest. NB: In this abstraction of the class for the sake of this documentation, sounding notes will appear as NIL.

The chop method is the basis for slippery-chicken's feature of intra-phrasal looping.

NB: The `<unit>` argument must be a duplet rhythmic value (i.e. 32, 's, 'e etc.) and cannot be a tuplet value (i.e. 'te 'fe etc.).

NB: In order for the resulting chopped rhythms to be parsable by LilyPond and CMN, there can be no tuplets (triplets etc.) among the rhythms to be chopped. Such rhythms will result in LilyPond and CMN errors. This has only minimal bearing on any MIDI files produced, however, and these can potentially be imported into notation software.

#### ARGUMENTS:

- A `rthm-seq-bar` object.

#### OPTIONAL ARGUMENTS:

- `<chop-points>` A list of integer pairs, each of which delineates a segment of the beat of the given `rthm-seq-bar` object measured in the rhythmic unit specified by the `<unit>` argument. Thus, if all possible spans of sixteenth-notes within a quarter-note, starting from the first sixteenth, were delineated, they would span from 1 to 4 (the full quarter), 1 to 3 (the first dotted 8th of the quarter), 1 to 2 (the first 8th) and 1 to 1 (the first 16th of the quarter); the process could continue then with all

rhythmic durations contained within the bounds of the same quarter starting on the second 16th, etc. The default chop-points for a quarter are '((1 4) (1 3) (1 2) (2 4) (2 3) (3 4) (1 1) (2 2) (3 3) (4 4)).

- <unit>. The rhythmic duration that serves as the unit of measurement for the chop points. Default = 's.
- <rthm-seq-id>. A symbol that will be the ID for the list created.

**RETURN VALUE:**

A list of rthm-seq-bar objects.

**EXAMPLE:**

```
;; Systematically subdivide each quarter-note of a 2/4 bar containing two ;
;; quarter-notes into all possible segments whose durations are multiples of a ;
;; sixteenth-note unit, and print-simple the resulting list. The quarter-note ;
;; subdivision is re-specified here slightly differently to the default for the ;
;; sake of systematic clarity. Only those segments whose start point coincide ;
;; with an attack in the original bar, i.e. those that begin on the first ;
;; sixteenth of each beat, will be assigned a NIL (which will later become ;
;; a sounding note); all others are assigned a rest. ;
```

```
(let* ((rsb (make-rthm-seq-bar '((2 4) q q)))
      (ch (chop rsb
                '((1 4) (1 3) (1 2) (1 1)
                  (2 4) (2 3) (2 2)
                  (3 4) (3 3)
                  (4 4))
                's)))
  (loop for b in ch do (print-simple b)))
```

=>

```
(1 4): NIL Q,
(3 16): NIL E.,
(1 8): NIL E,
(1 16): NIL S,
(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(1 8): rest 8,
(1 16): rest 16,
(1 16): rest 16,
(1 4): NIL Q,
(3 16): NIL E.,
(1 8): NIL E,
(1 16): NIL S,
```

```

(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(1 8): rest 8,
(1 16): rest 16,
(1 16): rest 16,

;; The same thing, but returning all possible segments within the bounds of a ;
;; quarter-note whose durations that are multiple of an 8th-note unit ;
(let* ((rsb (make-rthm-seq-bar '((2 4) q q)))
      (choprbsb (chop rsb
                     '((1 2) (1 1) (2 2))
                     'e)))
  (loop for b in choprbsb do (print-simple b)))

=>
(1 4): NIL Q,
(1 8): NIL E,
(1 8): rest 8,
(1 4): NIL Q,
(1 8): NIL E,
(1 8): rest 8,

;; Adapt the 16th-note example above to a starting rthm-seq-bar object with ;
;; more complex rhythmic content. Note here, too, that the rthm-seq-bar object ;
;; being segmented contains rhythmic durations smaller than the <unit> ;
;; argument.
;
(let* ((rsb (make-rthm-seq-bar '((4 4) - (s) (32) 32 (s) s - - +s+32 (32) (e) -
                                (q) (s) s (e))))
      (choprbsb (chop rsb
                     '((1 4) (1 3) (1 2) (1 1)
                       (2 4) (2 3) (2 2)
                       (3 4) (3 3)
                       (4 4))
                     's)))
  (loop for b in choprbsb do (print-simple b)))

=>
(1 4): rest S, rest 32, NIL 32, rest S, NIL S,
(3 16): rest S, rest 32, NIL 32, rest S,
(1 8): rest S, rest 32, NIL 32,
(1 16): rest 16,
(3 16): rest 32, NIL 32, rest S, NIL S,
(1 8): rest 32, NIL 32, rest S,
(1 16): rest 32, NIL 32,
(1 8): rest S, NIL S,

```

```

(1 16): rest 16,
(1 16): NIL S,
(1 4): rest 4,
(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(1 8): rest 8,
(1 16): rest 16,
(1 16): rest 16,
(1 4): rest 4,
(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(3 16): rest 16/3,
(1 8): rest 8,
(1 16): rest 16,
(1 8): rest 8,
(1 16): rest 16,
(1 16): rest 16,
(1 4): rest S, NIL S, rest E,
(3 16): rest S, NIL S, rest S,
(1 8): rest S, NIL S,
(1 16): rest 16,
(3 16): NIL S, rest E,
(1 8): NIL S, rest S,
(1 16): NIL S,
(1 8): rest 8,
(1 16): rest 16,
(1 16): rest 16,

;; The same again with a <unit> of eighths ;
(let* ((rsb (make-rthm-seq-bar '((4 4) - (s) (32) 32 (s) s - - +s+32 (32) (e) -
                                (q) (s) s (e))))
      (choprsb (chop rsb
                    '((1 2) (1 1) (2 2))
                    'e)))
  (loop for b in choprsb do (print-simple b)))

=>
(1 4): rest S, rest 32, NIL 32, rest S, NIL S,
(1 8): rest S, rest 32, NIL 32,
(1 8): rest S, NIL S,
(1 4): rest 4,

```

```
(1 8): rest 8,
(1 8): rest 8,
(1 4): rest 4,
(1 8): rest 8,
(1 8): rest 8,
(1 4): rest S, NIL S, rest E,
(1 8): rest S, NIL S,
(1 8): rest 8,
```

**SYNOPSIS:**

```
(defmethod chop ((rsb rthm-seq-bar)
                 &optional chop-points (unit 's) rthm-seq-id)
```

**20.2.391 rthm-seq-bar/consolidate-notes**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Combine consecutive tied notes into one (or a few) notes of a longer rhythmic duration.

NB: This method is the core method that is called for rthm-seq objects or slippery-chicken objects, at which point it takes ties (and perhaps another couple of things) into consideration, after the tie slots etc. have been updated. As such, though it will work to a certain degree when called directly on a rthm-seq-bar object, it should primarily be used when getting a rthm-seq-bar from within a rthm-seq object or slippery-chicken object.

**ARGUMENTS:**

- A rthm-seq-bar object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether the method sure make sure that an exact beat's worth of rhythms is handled. T = check durations. Default = NIL.

**RETURN VALUE:**

A rthm-seq-bar object.

**EXAMPLE:**

```
;;; Create a slippery-chicken object, print-simple a bar from that object,
;;; apply the consolidate-notes method to that bar, and print-simple that bar
;;; again to see the changes.
```

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :set-palette '((1 ((gs4 af4 bf4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e +e +e +e e +s +s +s e.))
                                :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vn (1 1 1)))))))
      (print-simple (get-bar mini 2 'vn))
      (consolidate-notes (get-bar mini 2 'vn))
      (print-simple (get-bar mini 2 'vn)))
```

```
=>
```

```
(4 4): GS4 E+, +GS4 E+, +GS4 E+, +GS4 E, AF4 E+, +AF4 S+, +AF4 S+, +AF4 S,
BF4 E.,
(4 4): GS4 H, AF4 Q+, +AF4 S, BF4 E.,
```

## SYNOPSIS:

```
(defmethod consolidate-notes ((rsb rthm-seq-bar)
                               ;; MDE Wed Nov 28 11:40:59 2012 -- added auto-beam
                               &optional check-dur beat (auto-beam t))
```

### 20.2.392 rthm-seq-bar/consolidate-rests

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Consolidate two or more consecutive rests into one longer rhythmic unit. This method works on the basis of beats, striving to consolidate into beats first.

NB: The user may find it helpful to adjust the `:beat` and `:min` values, and even to call the method more than once consecutively. For multiple calls, the method `consolidate-rests-max` may also be useful.

#### ARGUMENTS:

- A `rthm-seq-bar` object.

**OPTIONAL ARGUMENTS:**

keyword arguments

- :beat. The beat basis into which rests are to be consolidated. If no value is given for this option, the method will take the beat from the time signature.
- :min. A seldom-used argument that will only make a difference when there are a number of rests of the same duration followed by a note. This is then the minimum duration that such rests may have if they are to be consolidated. Default = NIL.
- :warn. T or NIL to indicate whether the method should print a warning to the Lisp listener if it is mathematically unable to consolidate the rests. T = print warning. Default = NIL.

**RETURN VALUE:**

A list of rhythm/event objects.

**EXAMPLE:**

```
;;; Returns a list of rhythm/event objects
(let ((rsb (make-rthm-seq-bar '((4 4) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests rsb))

=>
(
  EVENT: start-time: NIL, end-time: NIL,
  [...]
  data: 4
  [...]
  EVENT: start-time: NIL, end-time: NIL,
  [...]
  data: 4
  [...]
  EVENT: start-time: NIL, end-time: NIL,
  [...]
  data: 4
  [...]
  RHYTHM: value: 16.000, duration: 0.250, rq: 1/4, is-rest: T,
  [...]
  data: S
  [...]
  RHYTHM: value: 5.333, duration: 0.750, rq: 3/4, is-rest: NIL,
  [...]
  data: E.
```



```

)

;;; Consolidating on the basis of the time-signature's beat by default
(let ((rsb (make-rthm-seq-bar '((4 4) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests rsb)
  (loop for r in (rhythms rsb) collect (data r)))

=> (4 4 4 S E.)

;;; Changing the :beat may effect the outcome
(let ((rsb (make-rthm-seq-bar '((4 4) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests rsb :beat 2)
  (loop for r in (rhythms rsb) collect (data r)))

=> (2 E E S E.)

;;; Calling multiple times may further consolidate the results
(let ((rsb (make-rthm-seq-bar '((2 2) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests rsb)
  (print (loop for r in (rhythms rsb) collect (data r)))
  (consolidate-rests rsb)
  (print (loop for r in (rhythms rsb) collect (data r))))

=>
(2 E E S E.)
(2 Q S E.)

```

**SYNOPSIS:**

```
(defmethod consolidate-rests ((rsb rthm-seq-bar) &key beat min warn)
```

**20.2.393 rthm-seq-bar/consolidate-rests-max**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Similar to `consolidate-rests`, but calls that method repeatedly until no more changes can be made to the given `rthm-seq-bar` object.

NB This will still only reduce rests down to a maximum of a beat. If you need e.g. two quarter rests reduced to a single half rest in a 4/4 bar, specify `:beat 2`

**ARGUMENTS:**

- A `rthm-seq-bar` object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- `:beat`. The beat basis into which rests are to be consolidated. If no value is given for this option, the method will take the beat from the time signature.
- `:min`. A seldom-used argument that will only make a difference when there are a number of rests of the same duration followed by a note. This is then the minimum duration that such rests may have if they are to be consolidated. Default = `NIL`.
- `:warn`. `T` or `NIL` to indicate whether the method should print a warning to the Lisp listener if it is mathematically unable to consolidate the rests. `T` = print warning. Default = `NIL`.

**RETURN VALUE:**

Returns a list of event/rhythm objects.

**EXAMPLE:**

```
;;; Two examples with the same result; the first calling consolidate-rests
;;; twice, the second calling consolidate-rests-max
(let ((rsb (make-rthm-seq-bar '((2 2) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests rsb)
  (consolidate-rests rsb)
  (loop for r in (rhythms rsb) collect (data r)))

=> (2 Q S E.)

(let ((rsb (make-rthm-seq-bar '((2 2) (e) (e) (e) (e) (e) (s) (s) (s) e))))
  (consolidate-rests-max rsb)
  (loop for r in (rhythms rsb) collect (data r)))

=> (2 Q S E.)
```

**SYNOPSIS:**

```
(defmethod consolidate-rests-max ((rsb rthm-seq-bar) &key beat min warn)
```

**20.2.394 rthm-seq-bar/delete-beams**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Remove any beaming indications from the rthm-seq-bar object.

NB: This method changes the data for the rthm-seq-bar object's BEAMS slot and the individual BEAM slots of the RHYTHMS contained within the rthm-seq-bar's RHYTHMS slot. It does not change the value of the rthm-seq-bar's DATA slot.

NB: Neither the presence nor absence of beams are not reflected in the output of the print-simple method.

#### ARGUMENTS:

- A rthm-seq-bar object.

#### RETURN VALUE:

Returns T.

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((2 4) - s s - s - s s s - s s)))
      (delete-beams rsb))
```

=> T

```
(let ((rbs (make-rthm-seq-bar '((2 4) - s s - s - s s s - s s)))
      (delete-beams rsb)
      (beams rsb))
```

=> NIL

```
(let ((rsb (make-rthm-seq-bar '((2 4) - s s - s - s s s - s s)))
      (delete-beams rsb)
      (loop for r in (rhythms rbs) collect (beam r)))
```

=> (NIL NIL NIL NIL NIL NIL NIL NIL)

```
(let ((rbs (make-rthm-seq-bar '((2 4) - s s - s - s s s - s s)))
      (delete-beams rsb)
      (print rsb))
```

=>

```
RTHM-SEQ-BAR: time-sig: 1 (2 4)
               time-sig-given: T
               bar-num: -1
```

```

        old-bar-nums: NIL
        write-bar-num: NIL
        start-time: -1.0
        start-time-qtrs: -1.0
        is-rest-bar: NIL
        multi-bar-rest: NIL
        show-rest: T
        notes-needed: 8
        tuplets: NIL
        nudge-factor: 0.35
        beams: NIL
[...]
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 4) - S S - S - S S S - S S)

```

**SYNOPSIS:**

```
(defmethod delete-beams ((rsb rthm-seq-bar))
```

**20.2.395 rthm-seq-bar/delete-marks**

*[ rthm-seq-bar ] [ Methods ]*

**DESCRIPTION:**

Delete all marks from the rhythm (or event) objects contained within a given rthm-seq-bar object.

**ARGUMENT**

- A rthm-seq-bar object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```

;; Create a rthm-seq-bar object and print the contents of the MARKS slots of
;; the contained event objects to see they're set to NIL by default. Fill them
;; each with a 's (staccato) mark and print the results. Apply the delete-marks
;; method and print the results again to see that the values have been reset to
;; NIL.
(let ((rsb (make-rthm-seq-bar
            (list
              '(3 8)

```

```

      (make-event 'cs4 'e)
      (make-event 'cs4 'e)
      (make-event 'cs4 'e))))
    (print (loop for e in (rhythms rsb) collect (marks e)))
    (loop for e in (rhythms rsb) do (add-mark-once e 's))
    (print (loop for e in (rhythms rsb) collect (marks e)))
    (delete-marks rsb)
    (print (loop for e in (rhythms rsb) collect (marks e))))

=>
(NIL NIL NIL)
((S) (S) (S))
(NIL NIL NIL)

```

**SYNOPSIS:**

```
(defmethod delete-marks ((rsb rthm-seq-bar))
```

**20.2.396 rthm-seq-bar/delete-tuplets**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Removes all indications for tuplet brackets from a given *rthm-seq-bar* object.

NB: This method does not alter the tuplet rhythmic durations; it only removes the tuplet bracket from the score.

**ARGUMENTS:**

- A *rthm-seq-bar*.

**RETURN VALUE:**

NIL

**EXAMPLE:**

```

(let ((rsb (make-rthm-seq-bar '((2 4) { 3 te te te } q))))
  (tuplets rsb))

=> ((3 0 2))

```

```
(let ((rsb (make-rthm-seq-bar '((2 4) { 3 te te te } q))))
  (delete-tuplets rsb))
```

=> NIL

```
(let ((rsb (make-rthm-seq-bar '((2 4) { 3 te te te } q))))
  (delete-tuplets rsb)
  (tuplets rsb))
```

=> NIL

```
(let ((rsb (make-rthm-seq-bar '((2 4) { 3 te te te } q))))
  (loop for r in (rhythms rsb) collect (bracket r)))
```

=> (((1 3)) (-1) (1) NIL)

```
(let ((rsb (make-rthm-seq-bar '((2 4) { 3 te te te } q))))
  (delete-tuplets rsb)
  (loop for r in (rhythms rsb) collect (bracket r)))
```

=> (NIL NIL NIL NIL)

## SYNOPSIS:

```
(defmethod delete-tuplets ((rsb rthm-seq-bar))
```

### 20.2.397 rthm-seq-bar/delete-written

[ *rthm-seq-bar* ] [ *Methods* ]

## DESCRIPTION:

Delete the contents of the WRITTEN-PITCH-OR-CHORD slot of a pitch object within a given event object and reset to NIL.

## ARGUMENTS:

- A rthm-seq-bar object.

## RETURN VALUE:

Always returns NIL.

## EXAMPLE:

```
;; Create a rthm-seq-bar object consisting of events and print the contents of ;
;; the WRITTEN-PITCH-OR-CHORD slots to see they're set to NIL. Apply the ;
;; set-written method with a value of -2 and print the contents of the ;
;; WRITTEN-PITCH-OR-CHORD slots to see the data of the newly created pitch ;
;; objects. Apply the delete-written method and print the contents of the ;
;; WRITTEN-PITCH-OR-CHORD slots to see they're empty. ;
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)))))
  (print (loop for p in (rhythms rsb)
    collect (written-pitch-or-chord p)))
  (set-written rsb -2)
  (print (loop for p in (rhythms rsb)
    collect (get-pitch-symbol p)))
  (delete-written rsb)
  (print (loop for p in (rhythms rsb)
    collect (written-pitch-or-chord p))))

=>
(NIL NIL NIL)
(B3 B3 B3)
(NIL NIL NIL)
```

**SYNOPSIS:**

```
(defmethod delete-written ((rsb rthm-seq-bar))
```

**20.2.398 rthm-seq-bar/enharmonic**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Change the pitches of the events within a given rthm-seq-bar object to their enharmonic equivalents.

In its default form, this method only applies to note names that already contain an indication for an accidental (such as DF4 or BS3), while "white-key" note names (such as B3 or C4) will not produce an enharmonic equivalent. In order to change white-key pitches to their enharmonic equivalents, set the :force-naturals argument to T.

**ARGUMENTS:**

- A `rthm-seq-bar` object.

### OPTIONAL ARGUMENTS:

keyword arguments:

- `:written`. T or NIL to indicate whether the test is to handle the written or sounding pitch in the event. T = written.  
Default = NIL.
- `:force-naturals`. T or NIL to indicate whether to force "natural" note names that contain no F or S in their name to convert to their enharmonic equivalent (e.g. B3 = CF4). Default = NIL.
- `:pitches`. All sharp/flat pitches are changed by default but if a list of pitch objects or symbols is given, then only those pitches will be changed. Note that if written is T, then this pitch list should be the written not sounding pitches.  
Default = NIL.

### RETURN VALUE:

Always returns T.

### EXAMPLE:

;; The method returns T.

```
(let ((rsb (make-rthm-seq-bar
              (list '(3 8)
                    (make-event 'cs4 'e)
                    (make-event 'cs4 'e)
                    (make-event 'cs4 'e)))))
      (enharmonic rsb))
```

=> T

;; Create a `rthm-seq-bar` object with events, apply the `enharmonic` method, and

;; print the corresponding slots to see the changes ;

```
(let ((rsb (make-rthm-seq-bar
              (list
                '(3 8)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)))))
      (enharmonic rsb)
      (loop for p in (rhythms rsb)
            collect (get-pitch-symbol p)))
```



```
=> (DF4 DF4 DF4)
```

```
;; By default, the method will not change white-key pitches
```

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'c4 'e)
    (make-event 'c4 'e)
    (make-event 'c4 'e))))))
  (enharmonic rsb)
  (loop for p in (rhythms rsb)
    collect (get-pitch-symbol p)))
```

```
=> (C4 C4 C4)
```

```
;; This can be forced by setting the :force-naturals argument to T
```

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'c4 'e)
    (make-event 'c4 'e)
    (make-event 'c4 'e))))))
  (enharmonic rsb :force-naturals t)
  (loop for p in (rhythms rsb)
    collect (get-pitch-symbol p)))
```

```
=> (BS3 BS3 BS3)
```

```
;; Apply the set-written method to fill the WRITTEN-PITCH-OR-CHORD slot, print
;; its contents, apply the enharmonic method with the :written keyword argument
;; set to T, then print the pitch data of the same slot again to see the
;; change.
```

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (set-written rsb -3)
  (print (loop for p in (rhythms rsb)
    collect (get-pitch-symbol p)))
  (enharmonic rsb :written t)
  (print (loop for p in (rhythms rsb)
    collect (get-pitch-symbol p))))
```

```
=>
```

```
(BF3 BF3 BF3)
(AS3 AS3 AS3)
```

**SYNOPSIS:**

```
(defmethod enharmonic ((rsb rthm-seq-bar) &key written force-naturals
                        ;; MDE Wed Apr 18 11:34:01 2012
                        pitches)
```

**20.2.399 rthm-seq-bar/fill-with-rhythms**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Any rhythms (or event objects) in the existing *rthm-seq-bar* object will be deleted, and then rhythm (or event) objects will be taken one by one from the *<rhythms>* argument until the bar is full.

If too few rhythm or event objects are given, a warning will be printed that there are too few beats in the bar.

If there are too many and the last rhythm or event object to be placed in the bar fills out the bar evenly, no warning is printed and the remaining rhythm or event objects are discarded. If the last rhythm or event object that the method attempts to place in the bar is too long to fit evenly into the bar, the method will drop into the debugger with an error.

The *:transposition*, *:midi-channel*, and *:microtones-midi-channel* arguments can only be used in conjunction with event objects.

The number of rhythms (or event objects) used is returned.

NB: This method does not change the DATA slot of the *rthm-seq-bar* object itself to reflect the new rhythms. Instead, it changes the contents of the RHYTHMS slot within that object and changes the DATA of the *rthm-seq-bar* object to NIL. It also assigns the ID of the named-object to "rhythms-inserted-by-fill-with-rhythms".

**ARGUMENTS:**

- A *rthm-seq-bar* object.
- A list of rhythm objects or event objects.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :transposition. An integer or NIL to indicate the transposition in semitones for written pitches of any event objects passed. If NIL, no written-pitches will be created. Default = NIL.
- :midi-channel. An integer that will be used to set the MIDI-CHANNEL slot of any event objects passed. Default = 0.
- :microtones-midi-channel. An integer that is the MIDI channel that will be assigned to event objects for microtonal MIDI pitches. NB: This value is only set when attached to event objects within a slippery-chicken object. Default = 0. NB: See `player.lsp/make-player` for details on microtones in MIDI output.
- :new-id. An optional ID for new rhythm or event objects added. Default = "rhythms-inserted-by-fill-with-rhythms".
- :warn. T or NIL to indicate whether a warning should be printed if there are not enough rhythms to create a full bar. T = warn. Default = T.
- :is-full-error. T or NIL to indicate whether the last rhythm or event object that the method attempts to add to the bar is too long to fit evenly into the bar. T = drop into the debugger with an error if this is the case. Default = T.

#### RETURN VALUE:

The number of rhythm or event objects used.

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((3 4) q q q))))
  (fill-with-rhythms rsb (loop for r in '(e e e e e e)
                              collect (make-rhythm r))))
```

=> 6

```
(let ((rsb (make-rthm-seq-bar '((3 4) q q q))))
  (fill-with-rhythms rsb (loop for r in '(e e e e e e)
                              collect (make-rhythm r)))
  (print-simple rsb))
```

=> NIL

(3 4): note E, note E, note E, note E, note E, note E,

```
(let ((rsb (make-rthm-seq-bar '((3 4) q q q))))
  (fill-with-rhythms rsb (loop for r in '(e e e e e e)
                              collect (make-rhythm r)))
  (print rsb))
```

=>

```

RTHM-SEQ-BAR: time-sig: 0 (3 4)
               time-sig-given: T
               bar-num: -1
               old-bar-nums: NIL
               write-bar-num: NIL
               start-time: -1.0
               start-time-qtrs: -1.0
               is-rest-bar: NIL
               multi-bar-rest: NIL
               show-rest: T
               notes-needed: 6
               triplets: NIL
               nudge-factor: 0.35
               beams: NIL
               current-time-sig: 0
               write-time-sig: T
               num-rests: 0
               num-rhythms: 6
               num-score-notes: 6
               rhythms: (
RHYTHM: value: 8.0, duration: 0.5, rq: 1/2, is-rest: NIL, score-rthm: 8.0,
         undotted-value: 8, num-flags: 1, num-dots: 0, is-tied-to: NIL,
         is-tied-from: NIL, compound-duration: 0.5, is-grace-note: NIL,
         needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
         rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 8,
         triplet-scaler: 1, grace-note-duration: 0.05,
LINKED-NAMED-OBJECT: previous: NIL
                     this: NIL
                     next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
[...]
NAMED-OBJECT: id: "rhythms-inserted-by-fill-with-rhythms", tag: NIL,
data: NIL

```

```

;;; Using the :transpositions and :midi-channel arguments
(let ((rsb (make-rthm-seq-bar '((4 4) q q q q))))
  (fill-with-rhythms rsb (loop for r in '(h q e s s)
                                for p in '(c4 dqs4 e4 ggf4 a4)
                                collect (make-event p r))
    :microtones-midi-channel 12
    :transposition -14
    :midi-channel 11)
  (print
    (loop for e in (rhythms rsb)
      collect (data (pitch-or-chord e))))

```

```

(print
  (loop for e in (rhythms rsb)
        collect (data (written-pitch-or-chord e))))
(print
  (loop for e in (rhythms rsb)
        collect (midi-channel (pitch-or-chord e)))))

=>
(C4 DQS4 E4 GQF4 A4)
(D5 EQS5 FS5 AQF5 B5)
(11 12 11 12 11)

```

**SYNOPSIS:**

```

(defmethod fill-with-rhythms ((rsb rthm-seq-bar) rhythms
                              &key
                                ;; 24.3.11 add this too to make sure written
                                ;; pitch is set--this is the instrument
                                ;; transposition e.g. -14 for bass clarinet
                                transposition
                                (midi-channel 0)
                                (microtones-midi-channel 0)
                                (new-id "rhythms-inserted-by-fill-with-rhythms")
                                (warn t)
                                (is-full-error t))

```

**20.2.400 rthm-seq-bar/force-rest-bar**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Force all rhythms of a rthm-seq-bar object to be replaced by rest.

NB: This method changes the value of the RHYTHMS slot of the rthm-seq-bar but not the value of the rthm-seq-bar DATA slot.

**ARGUMENTS:**

- A rthm-seq-bar object.

**RETURN VALUE:**

Returns a rthm-seq-bar object.

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (force-rest-bar rsb))
```

=>

```
RTHM-SEQ-BAR: time-sig: 1 (2 4)
               time-sig-given: T
               bar-num: -1
               old-bar-nums: NIL
               write-bar-num: NIL
               start-time: -1.0
               start-time-qtrs: -1.0
               is-rest-bar: T
```

[...]

```
RHYTHM: value: 2.0, duration: 2.0, rq: 2, is-rest: T,
```

[...]

```
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 4) Q E S S)
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (force-rest-bar rsb)
  (print-simple rsb))
```

=>

```
(2 4): rest 2,
```

## SYNOPSIS:

```
(defmethod force-rest-bar ((rsb rthm-seq-bar))
```

### 20.2.401 rthm-seq-bar/get-last-attack

[ *rthm-seq-bar* ] [ *Methods* ]

## DESCRIPTION:

Gets the rhythm object for the last note that needs an attack (i.e. not a rest and not a tied note) in a given rthm-seq-bar object.

## ARGUMENTS:

- The given rthm-seq-bar object.

## OPTIONAL ARGUMENTS:

- T or NIL indicating whether to print a warning message if the given index

(minus one) is greater than the number of attacks in the RHYTHMS list (default = T). This is a carry-over argument from the `get-nth-attack` method called within the `get-last-attack` method and not likely to be needed for use with `get-last-attack`.

#### RETURN VALUE:

A rhythm object.

Returns NIL if the given index is higher than the highest possible index of attacks in the given `rthm-seq-bar` object.

Get the rhythm object of the last

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((3 4) q+e (e) s (s) e))))
  (get-last-attack rsb))
```

=>

```
RHYTHM: value: 8.0, duration: 0.5, rq: 1/2, is-rest: NIL, score-rthm: 8.0,
undotted-value: 8, num-flags: 1, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.5, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 8,
tuplet-scaler: 1, grace-note-duration: 0.05,
LINKED-NAMED-OBJECT: previous: NIL
this: NIL
next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
```

#### SYNOPSIS:

```
(defmethod get-last-attack ((rsb rthm-seq-bar) &optional (warn t))
```

#### 20.2.402 rthm-seq-bar/get-last-event

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Get the last event object (or rhythm object) of a given `rthm-seq-bar` object.

#### ARGUMENTS:

- A `rthm-seq-bar` object.

**RETURN VALUE:**

Returns a rhythm object.

**EXAMPLE:**

```
;; Returns a rhythm object.
(let ((rsb (make-rthm-seq-bar '((2 4) s s e q))))
  (get-last-event rsb))

=>
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
score-rthm: 4.0f0, undotted-value: 4, num-flags: 0, num-dots: 0,
is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
rq-note: NIL, rq-info: NIL, marks: NIL, marks-in-part: NIL,
letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q
```

**SYNOPSIS:**

```
(defmethod get-last-event ((rsb rthm-seq-bar))
```

**20.2.403 rthm-seq-bar/get-nth-attack**

```
[ rthm-seq-bar ] [ Methods ]
```

**DESCRIPTION:**

Gets the rhythm object for the `nth` note in a given `rthm-seq-bar` that needs an attack, i.e. not a rest and not tied.

**ARGUMENTS:**

- The zero-based index number indicating which attack is sought.
- The given `rthm-seq-bar` object in which to search.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print a warning message if the given index is greater than the number of attacks in the RHYTHMS list (minus one to compensate for the zero-based indexing) (default = T).



**RETURN VALUE:**

A rhythm object.

Returns NIL if the given index is higher than the highest possible index of attacks in the given rthm-seq-bar object.

**EXAMPLE:**

```
;; The method returns a rhythm object when successful ;
(let ((rsb (make-rthm-seq-bar '((3 4) q+e (e) s (s) e))))
  (get-nth-attack 0 rsb))
```

=>

```
RHYTHM: value: 4.0, duration: 1.0, rq: 1, is-rest: NIL, score-rthm: 4.0,
undotted-value: 4, num-flags: 0, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 1.0, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 4,
tuplet-scaler: 1, grace-note-duration: 0.05,
LINKED-NAMED-OBJECT: previous: NIL
this: NIL
next: NIL
NAMED-OBJECT: id: "Q", tag: NIL,
data: Q
```

```
(let ((rsb (make-rthm-seq-bar '((3 4) q+e (e) s (s) e))))
  (data (get-nth-attack 1 rsb)))
```

=> S

```
(let ((rsb (make-rthm-seq-bar '((3 4) q+e (e) s (s) e))))
  (get-nth-attack 3 rsb))
```

=> NIL

```
WARNING: rthm-seq-bar::get-nth-attack: index (3) < 0 or >= notes-needed (3)
```

```
(let ((rsb (make-rthm-seq-bar '((3 4) q+e (e) s (s) e))))
  (get-nth-attack 3 rsb nil))
```

=> NIL

**SYNOPSIS:**

```
(defmethod get-nth-attack (index (rsb rthm-seq-bar) &optional (warn t))
```

**20.2.404 rthm-seq-bar/get-nth-event***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Get the nth event (rhythm) in the given rthm-seq-bar object. This is a zero-based index.

The method defaults to interrupting with an error if the n-value is greater than the number of items in the rthm-seq-bar. This can be disabled using the optional argument.

**ARGUMENTS:**

- A rthm-seq-bar object.
- An index number.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to interrupt and drop into the debugger with an error. Default = T.

**RETURN VALUE:**

A rhythm object when successful.

Returns NIL when the specified index number is greater than the number of events in the rthm-seq-bar object. Also prints an error in this case by default, which can be suppressed by setting the optional argument to NIL.

**EXAMPLE:**

```
;; Zero-based indexing. Returns a rhythm object when successful. ;
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (get-nth-event 0 rsb))
```

```
=>
```

```
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
score-rthm: 4.0f0, undotted-value: 4, num-flags: 0, num-dots: 0,
is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
rq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
```

```
NAMED-OBJECT: id: Q, tag: NIL,
data: Q
```

```
;; Interrupts with an error and drops into the debugger by default if the ;
;; specified index number is greater than the number of events in the ;
;; rthm-seq-bar. ;
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (get-nth-event 4 rsb))
```

```
=>
```

```
rthm-seq-bar::get-nth-event: Couldn't get event with index 4
[Condition of type SIMPLE-ERROR]
```

```
;; The error can be suppressed by setting the optional argument to NIL ;
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (get-nth-event 4 rsb nil))
```

```
=> NIL
```

## SYNOPSIS:

```
(defmethod get-nth-event (index (rsb rthm-seq-bar)
                           &optional (error t))
```

### 20.2.405 rthm-seq-bar/get-nth-non-rest-rhythm

[ *rthm-seq-bar* ] [ *Methods* ]

## DESCRIPTION:

Get the *nth* non-rest rhythm object stored in the given *rthm-seq-bar*.

## ARGUMENTS:

- The zero-based index number indicating which non-rest-rhythm is sought.
- The given *rthm-seq-bar* object in which to search.

## OPTIONAL ARGUMENTS:

- T or NIL indicating whether to print an error message if the given index is greater than the number of non-rest rhythms in the RHYTHMS list (minus one to compensate for the zero-based indexing). (Default = T).

## RETURN VALUE:

A rhythm object.

Returns NIL if the given index is higher than the highest possible index of non-rest rhythms in the given rthm-seq-bar object.

#### EXAMPLE:

```
;; The method returns a rhythm object when successful ;
(let ((rsb (make-rthm-seq-bar '((2 4) e (e) s s (s) s))))
  (get-nth-non-rest-rhythm 0 rsb))
```

=>

```
RHYTHM: value: 8.0, duration: 0.5, rq: 1/2, is-rest: NIL, score-rthm: 8.0,
undotted-value: 8, num-flags: 1, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.5, is-grace-note: NIL,
needs-new-note: T, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 8,
tuplet-scaler: 1, grace-note-duration: 0.05,
LINKED-NAMED-OBJECT: previous: NIL
this: NIL
next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) e (e) s s (s) s))))
  (data (get-nth-non-rest-rhythm 1 rsb)))
```

=> S

```
(let ((rsb (make-rthm-seq-bar '((2 4) e (e) s s (s) s))))
  (data (get-nth-non-rest-rhythm 4 rsb)))
```

=>

```
Evaluation aborted on #<SIMPLE-ERROR>
rthm-seq-bar::get-nth-non-rest-rhythm: Couldn't get non-rest rhythm with index
4 for bar number -1
[Condition of type SIMPLE-ERROR]
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) e (e) s s (s) s))))
  (get-nth-non-rest-rhythm 4 rsb nil))
```

=> NIL

#### SYNOPSIS:

```
(defmethod get-nth-non-rest-rhythm (index (rsb rthm-seq-bar))
```

&optional (error t))

### 20.2.406 rthm-seq-bar/get-nth-rest

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Gets the rhythm object of the *nth* rest in a given *rthm-seq-bar*.

#### ARGUMENTS:

- The zero-based index number indicating which rest is sought.
- The given *rthm-seq-bar* object in which to search.

#### OPTIONAL ARGUMENTS:

- T or NIL indicating whether to print an error message if the given index is greater than the number of rests in the RHYTHMS list (minus one to compensate for the zero-based indexing) (default = T).

#### RETURN VALUE:

A rhythm object.

Returns NIL if the given index is higher than the highest possible index of rests in the given *rthm-seq-bar* object.

#### EXAMPLE:

```
(let ((rsb (make-rthm-seq-bar '((3 4) e (e) s s (s) s (q)))))
  (get-nth-rest 0 rsb))
```

=>

```
RHYTHM: value: 8.0, duration: 0.5, rq: 1/2, is-rest: T, score-rthm: 8.0,
undotted-value: 8, num-flags: 1, num-dots: 0, is-tied-to: NIL,
is-tied-from: NIL, compound-duration: 0.5, is-grace-note: NIL,
needs-new-note: NIL, beam: NIL, bracket: NIL, rqq-note: NIL,
rqq-info: NIL, marks: NIL, marks-in-part: NIL, letter-value: 8,
tuple-scaler: 1, grace-note-duration: 0.05,
LINKED-NAMED-OBJECT: previous: NIL
this: NIL
next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
```

```
(let ((rsb (make-rthm-seq-bar '((3 4) e (e) s s (s) s (q)))))
  (data (get-nth-rest 2 rsb)))
```

=> Q

```
(let ((rsb (make-rthm-seq-bar '((3 4) e (e) s s (s) s (q)))))
  (get-nth-rest 3 rsb t))
```

Evaluation aborted on #<SIMPLE-ERROR>

rthm-seq-bar::get-nth-rest: Couldn't get rest with index 3  
[Condition of type SIMPLE-ERROR]

```
(let ((rsb (make-rthm-seq-bar '((3 4) e (e) s s (s) s (q)))))
  (get-nth-rest 3 rsb nil))
```

=> NIL

## SYNOPSIS:

```
(defmethod get-nth-rest (index (rsb rthm-seq-bar)
                          &optional (error t))
```

### 20.2.407 rthm-seq-bar/get-pitch-symbols

[ *rthm-seq-bar* ] [ *Methods* ]

## DESCRIPTION:

Return a list of the pitch symbols for the events in the bar.

## ARGUMENTS:

- a rthm-seq-bar object

## RETURN VALUE:

A list of pitch symbols

## EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))))
```

```

      :set-palette '((1 ((gs4 bf4 c4))))
      :set-map '((1 (1 1 1)))
      :rthm-seq-palette '((1 (((4 4) e e e e e e e e)))
                           :pitch-seq-palette ((1 2 1 2 1 1 3 1))))
      :rthm-seq-map '((1 ((vn (1 1 1))))))
      (get-pitch-symbols (get-bar mini 1 'vn))
=>
(C4 GS4 C4 GS4 C4 C4 BF4 C4)

```

**SYNOPSIS:**

```
(defmethod get-pitch-symbols ((rsb rthm-seq-bar) &optional written)
```

**20.2.408 rthm-seq-bar/get-rhythm-symbols**

[ *rthm-seq-bar* ] [ *Methods* ]

**DATE:**

01-May-2012

**DESCRIPTION:**

Return the rhythms of a given *rthm-seq-bar* object as a list of rhythm symbols.

**ARGUMENTS:**

- A *rthm-seq-bar* object.

**RETURN VALUE:**

- A list of rhythm symbols.

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((4 4) q e s s q. e))))
  (get-rhythm-symbols rsb))
```

```
=> (Q E S S Q. E)
```

**SYNOPSIS:**

```
(defmethod get-rhythm-symbols ((rsb rthm-seq-bar))
```

**20.2.409 rthm-seq-bar/get-time-sig***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Return the time-sig object for the given rthm-seq-bar object.

**ARGUMENTS:**

- A rthm-seq-bar object.

**RETURN VALUE:**

A time-sig object.

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (get-time-sig rsb))

=>
TIME-SIG: num: 2, denom: 4, duration: 2.0, compound: NIL, midi-clocks: 24,
num-beats: 2
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0204", tag: NIL,
data: (2 4)
```

**SYNOPSIS:**

```
(defmethod get-time-sig ((rsb rthm-seq-bar) &optional ignore)
```

**20.2.410 rthm-seq-bar/get-time-sig-as-list***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Get the time signature for a given rthm-seq-bar object in list form.

**ARGUMENTS:**

- A rthm-seq-bar object.



**RETURN VALUE:**

A list.

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (get-time-sig-as-list rsb))
```

=> (2 4)

**SYNOPSIS:**

```
(defmethod get-time-sig-as-list ((rsb rthm-seq-bar))
```

**20.2.411 rthm-seq-bar/make-rest-bar**

[ *rthm-seq-bar* ] [ *Functions* ]

**DESCRIPTION:**

Make a rthm-seq-bar object that consists of a bar of rest.

**ARGUMENTS:**

- The time signature of the rthm-seq-bar object to be made, as a quoted list.
- T or NIL instruction on whether to print the time signature in score output.

**OPTIONAL ARGUMENTS:**

- show-rest. This argument indicates whether or not to print the rest in the printed score output (CMN/LilyPond). Default = T.

The remaining optional arguments are set internally by the slippery-chicken class, but can be read by the user for debugging.

- missing-duration: Indicates whether the bar is missing a duration.
- player-section-ref: The current player and section of the given rthm-seq-bar object.
- nth-seq: The current sequenz (with a "z") of the given rthm-seq-bar object.
- nth-bar: The current bar number of the given rthm-seq-bar object.

**RETURN VALUE:**

A `rthm-seq-bar` object.

**EXAMPLE:**

```
(let ((rsb-rb (make-rest-bar '(2 4) nil t)))
  (format t "%time-sig: ~a%is-rest-bar: ~a%write-time-sig: ~
            ~a%show-rest: ~a%"
          (data (get-time-sig rsb-rb))
          (is-rest-bar rsb-rb)
          (write-time-sig rsb-rb)
          (show-rest rsb-rb))
  (print-simple rsb-rb)
  rsb-rb)
```

=>

```
RTHM-SEQ-BAR: time-sig: 0 (2 4), time-sig-given: T, bar-num: -1,
[...]
```

```
time-sig: (2 4)
is-rest-bar: T
write-time-sig: NIL
show-rest: T
(2 4): rest 2,
```

**SYNOPSIS:**

```
(defun make-rest-bar (time-sig write-time-sig &optional
                     (show-rest t)
                     missing-duration
                     player-section-ref nth-seq
                     nth-bar)
```

**20.2.412 `rthm-seq-bar`/make-rthm-seq-bar**

[ *rthm-seq-bar* ] [ *Functions* ]

**DESCRIPTION:**

Public interface for creating a `rthm-seq-bar` object, each instance of which holds one of the individual bars that reside in a rhythmic sequence.

This class is responsible for parsing lists containing rhythms and time signatures, but not for parsing these things themselves--that is done by separate classes.

A { followed by a number means that all the notes from now to the } will be enclosed in a bracket with the number inside. This may be nested. A - indicates beaming: the first - indicates the start of a beam, the second the end of that beam.

#### ARGUMENTS:

- A list of rhythmic durations, which may include ties and dots. Durations may be written as numeric (integer) values or may use the CM/CMN/SCORE alphabetic shorthand s=16, e=8, q=4, h=2, w=1. NB: Repeating rhythms can be indicated using a shorthand notation consisting of a multiplication symbol ('x'), e.g.: (make-rthm-seq-bar '((4 4) s x 16)).

make-rthm-seq-bar requires a time signature. If no time signature is provided, the most recently defined time signature will be used. If one is provided, it must be included as the first element of the data list. The time signature is formulated as a list containing two integers, the first being the number of beats in the bar and the second being the beat unit for the bar.

#### OPTIONAL ARGUMENTS:

- A name (symbol) for the object ID.

#### RETURN VALUE:

Returns a rthm-seq-bar.

#### EXAMPLE:

```
(make-rthm-seq-bar '((2 4) q e s s))
```

```
=>
```

```
RTHM-SEQ-BAR:
```

```
[...]
```

```
NAMED-OBJECT: id: NIL, tag: NIL,
```

```
data: ((2 4) Q E S S)
```

```
(make-rthm-seq-bar '((2 4) q e s s) 'test)
```

```
=>
```

```
RTHM-SEQ-BAR:
```

```
[...]
```

```
NAMED-OBJECT: id: TEST, tag: NIL,
```

```
data: ((2 4) Q E S S)
```

```

(make-rthm-seq-bar '((2 4) q \+16\.+32 e))
=>
RTHM-SEQ-BAR:
[...]
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 4) Q +16.+32 E)

(make-rthm-seq-bar '((2 4) { 3 te te te } q))
=>
RTHM-SEQ-BAR:
[...]
NAMED-OBJECT: id: NIL, tag: NIL,
data: ((2 4) { 3 TE TE TE } Q)

```

**SYNOPSIS:**

```
(defun make-rthm-seq-bar (rhythms &optional name)
```

**20.2.413 rthm-seq-bar/reset-8va**

```
[ rthm-seq-bar ] [ Methods ]
```

**DATE:**

22 Sep 2011

**DESCRIPTION:**

Reset the 8VA slots of all event objects within a given rthm-seq-object to 0 (no ottava/ottava bassa transposition).

**ARGUMENTS:**

- A rthm-seq-bar object

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Create a rthm-seq-bar object consisting of event objects, print the default ;
;; value of the 8VA slots for those events. Set the 8VA slots to 1 and print ;
```

```
;; the value of those slots to see the change. Apply the reset-8va method to ;
;; remove any values and reset the slots to NIL, and print the results. ;
```

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (print (loop for e in (rhythms rsb) collect (8va e)))
  (set-8va rsb 1)
  (print (loop for e in (rhythms rsb) collect (8va e)))
  (reset-8va rsb)
  (print (loop for e in (rhythms rsb) collect (8va e))))
```

```
=>
(0 0 0)
(1 1 1)
(0 0 0)
```

## SYNOPSIS:

```
(defmethod reset-8va ((rsb rthm-seq-bar))
```

### 20.2.414 rthm-seq-bar/respell-bar

[ *rthm-seq-bar* ] [ *Methods* ]

## DESCRIPTION:

Scan the specified rthm-seq-bar object for enharmonically equivalent pitches and unify their spelling. This method won't generally be called by the user directly, rather, it's called by the respell-bars method in the slippery-chicken class.

Clearly, this method will not work if the rthm-seq-bar only contains rhythm objects: it's made to be called when these have been promoted to event objects during the initialization of a slippery-chicken object.

NB: Although this method focuses on just one rthm-seq-bar object, the parent slippery-chicken object and player ID are needed in order to determine ties that may exist into the next bar from the present bar.

NB: The slippery-chicken class version of the method of this name uses pitches from previous bars as well when respelling a given rthm-seq-bar

object, so different results are normal. Users should generally call the slippery-chicken method rather than calling this one directly on individual bars.

#### ARGUMENTS:

- A rthm-seq-bar object.
- A slippery-chicken object.
- A player ID (symbol).

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to process only written or only sounding pitches. T = only written. Default = NIL.
- The last attack (event object) of the previous bar. This is usually supplied by the calling method. Default = NIL.

#### RETURN VALUE:

Returns the rthm-seq-bar object it was passed.

#### EXAMPLE:

```
;;; Create a slippery-chicken object using pitches GS4 and AF4, print the ;
;;; pitches of a specified bar within that object. Apply respell-bar and print ;
;;; the same pitches again to see the difference. ;
```

```
(let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((vn (violin :midi-channel 1))))
:set-palette '((1 ((gs4 af4 bf4))))
:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((4 4) e e e e e e e)))
:pitch-seq-palette ((1 2 1 1 1 1 1 1)))
:rthm-seq-map '((1 ((vn (1 1 1)))))))
(print (loop for r in (rhythms (get-bar mini 2 'vn))
collect (get-pitch-symbol r)))
(respell-bar (get-bar mini 2 'vn) mini 'vn)
(print (loop for r in (rhythms (get-bar mini 2 'vn))
collect (get-pitch-symbol r))))
=>
(GS4 AF4 GS4 GS4 GS4 GS4 GS4 GS4)
(GS4 GS4 GS4 GS4 GS4 GS4 GS4 GS4)
```

#### SYNOPSIS:

```
(defmethod respell-bar ((rsb rthm-seq-bar) sc player
                        &optional written last-attack-previous-bar)
```

### 20.2.415 rthm-seq-bar/scale

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Change the values of a rthm-seq-bar objects rhythm durations by a specified scaling factor.

This method always returns a new rthm-seq-bar object, recreating scaled rhythms with beams etc. where appropriate. See `time-sig::scale` for details on how the new meter is created.

#### ARGUMENTS:

- A rthm-seq-bar object.
- A number that is the scaling factor.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to preserve the original meter (duple, triple, quadruple etc.)
- (two ignore arguments for internal use only)

#### RETURN VALUE:

Returns a rthm-seq-bar object

#### EXAMPLE:

```
;;; Create a rthm-seq-bar object and scale its durations by a fact of ;
;;; 2. Returns a rthm-seq-bar object.    ;
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (scale rsb 2))
```

=>

```
RTHM-SEQ-BAR: time-sig: 19 (2 2), time-sig-given: T, bar-num: -1,
[...]
RHYTHM: value: 2.000, duration: 2.000, rq: 2, is-rest: NIL,
[...]
data: H
[...]
```

```

RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
[...]
data: Q
[...]
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: NIL,
[...]
data: E
[...]
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: NIL,
[...]
data: E
[...]

```

```

;;; Use the print-simple method to see formatted results
(let ((rsb (make-rthm-seq-bar '((2 4) q e s s))))
  (print-simple (scale rsb .5)))

```

=>

```
(2 8): note E, note S, note 32, note 32,
```

```

;;; Set the optional <preserve-meter> argument to NIL to allow the method to
;;; return results in a different metric quality (this returns a quadruple
;;; meter rather than a duple)
(let ((rsb (make-rthm-seq-bar '((6 8) q e q s s))))
  (print-simple (scale rsb 2 nil)))

```

=>

```
(12 8): note H, note Q, note H, note E, note E,
```

## SYNOPSIS:

```

(defmethod scale ((rsb rthm-seq-bar) scaler
  &optional (preserve-meter t) ignore1 ignore2)

```

### 20.2.416 rthm-seq-bar/set-8va

[ *rthm-seq-bar* ] [ *Methods* ]

## DATE:

23-Sep-2011

## DESCRIPTION:

Set the 8VA (ottava) slots of the event objects within a given rthm-seq-bar



object. This number can be positive or negative. Only the values 1, 0 and -1 are valid for the number of octaves to be transposed.

#### ARGUMENTS:

- A rthm-seq-bar object.
- A number indicating the number of octaves to be transposed in either direction (ottava/ottava bassa).

#### RETURN VALUE:

Always returns NIL.

#### EXAMPLE:

;; The method returns NIL

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (set-8va rsb 1))
```

=> NIL

;; Create a rthm-seq-bar object with event objects, set the 8va slot to 1, and  
;; access and print it to see it's new value.

```
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (set-8va rsb 1)
  (loop for e in (rhythms rsb) collect (8va e)))
```

=> (1 1 1)

#### SYNOPSIS:

```
(defmethod set-8va ((rsb rthm-seq-bar) 8va)
```

**20.2.417 rthm-seq-bar/set-amplitudes***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Add a specified amplitude (between 0.0 and 1.0) to all non-rest event objects in a specified rthm-seq-bar object.

**ARGUMENTS:**

- A rthm-seq-bar object.
- A number that is an amplitude value between 0.0 and 1.0.

**RETURN VALUE:**

Returns the amplitude value set.

**EXAMPLE:**

```
(let* ((mini
      (make-slippery-chicken
       '+sc-object+
       :ensemble '(((va (viola :midi-channel 2))))
       :set-palette '((1 ((c3 d3 e3 f3 g3 a3 b3 c4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e (e) e (e) (e) e e e))
                              :pitch-seq-palette ((1 2 3 4 5)))))
       :rthm-seq-map '(((1 ((va (1 1 1)))))))
      (set-amplitudes (get-bar mini 2 'va) 0.9)
      (cmn-display mini)))
```

**SYNOPSIS:**

```
(defmethod set-amplitudes ((rsb rthm-seq-bar) amp)
```

**20.2.418 rthm-seq-bar/set-dynamics***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Add a specified dynamic mark to all attacked event objects (i.e. not rests and not notes that are tied to) in a specified rthm-seq-bar-object. This method was created mainly to make it easy to set amplitudes for a range of

notes (e.g. with map-over-bars), so that they are, for example, reflected in MIDI velocities. If used over many notes the score will probably then be littered with extraneous dynamic marks. These can then be removed, if so desired, with the slippery-chicken class remove-extraneous-dynamics method.

#### ARGUMENTS:

- A rthm-seq-bar object.
- A dynamic mark.

#### RETURN VALUE:

The specified dynamic mark

#### EXAMPLE:

```
(let* ((mini
      (make-slippery-chicken
       '+sc-object+
       :ensemble '(((va (viola :midi-channel 2))))
       :set-palette '((1 ((c3 d3 e3 f3 g3 a3 b3 c4))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) e (e) e (e) (e) e e e))
                               :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((va (1 1 1)))))))
      (set-dynamics (get-bar mini 2 'va) 'ppp))

=> PPP
```

#### SYNOPSIS:

```
(defmethod set-dynamics ((rsb rthm-seq-bar) dynamic)
```

#### 20.2.419 rthm-seq-bar/set-midi-channel

[ *rthm-seq-bar* ] [ *Methods* ]

#### DESCRIPTION:

Set the MIDI-channel and microtonal MIDI-channel for the pitch object of an event object within a given rthm-seq-bar object. Sets the MIDI-CHANNEL slot of all event objects contained in the rthm-seq-bar object to the same channel.

#### ARGUMENTS:

- A `rthm-seq-bar` object.
- A whole number indicating the MIDI channel to be used for the equal-tempered pitch material of the given `rthm-seq-bar` object.
- A whole number indicating the MIDI channel to be used for microtonal pitch material of the given `rthm-seq-bar` object.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Create a rthm-seq-bar using event objects and check the MIDI-CHANNEL slots ;
;; of those event objects to see that they are NIL by default. ;
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (loop for p in (rhythms rsb)
    collect (midi-channel (pitch-or-chord p))))

=> (NIL NIL NIL)
```

```
;; Apply the set-midi-channel method to the rthm-seq-bar object and read and ;
;; print the MIDI-CHANNEL slots of each of the individual events to see that ;
;; they've been set. ;
(let ((rsb (make-rthm-seq-bar
  (list
    '(3 8)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e)
    (make-event 'cs4 'e))))))
  (set-midi-channel rsb 13 14)
  (loop for p in (rhythms rsb)
    collect (midi-channel (pitch-or-chord p))))

=> (13 13 13)
```

**SYNOPSIS:**

```
(defmethod set-midi-channel ((rsb rthm-seq-bar) midi-channel
  microtonal-midi-channel)
```

**20.2.420 rthm-seq-bar/set-nth-attack***[ rthm-seq-bar ] [ Methods ]***DESCRIPTION:**

Sets the value of the *nth* rhythm object of a given *rthm-seq-bar* that needs an attack; i.e., not a rest and not a tied note.

NB: This method does not check to ensure that the resulting *rthm-seq-bar* contains the right number of beats.

**ARGUMENTS:**

- A zero-based index number for the attacked note to change.
- An event.
- A *rthm-seq-bar* object.

**OPTIONAL ARGUMENTS:**

- T or NIL indicating whether to print a warning message if the given index (minus one) is greater than the number of attacks in the RHYTHMS list. Default = T.

**RETURN VALUE:**

An event object.

**EXAMPLE:**

```
(let ((rsb (make-rthm-seq-bar '((2 4) q+e s s))))
  (set-nth-attack 1 (make-event 'e4 'q) rsb))
```

```
=>
```

```
EVENT: start-time: NIL, end-time: NIL,
```

```
[...]
```

```
PITCH: frequency: 329.6275526703903d0, midi-note: 64, midi-channel: NIL
```

```
[...]
```

```
NAMED-OBJECT: id: E4, tag: NIL,
```

```
data: E4
```

```
[...]
```

```
RHYTHM: value: 4.0, duration: 1.0, rq: 1, is-rest: NIL, score-rthm: 4.0,
```

```
[...]
```

```
NAMED-OBJECT: id: Q, tag: NIL,
```

```
data: Q
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) q+e s s))))
  (set-nth-attack 2 (make-event 'e4 'q) rsb)
  (loop for r in (rhythms rsb) collect (data r)))
```

```
=> ("Q" "E" S Q)
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) q+e s s))))
  (set-nth-attack 3 (make-event 'e4 'q) rsb))
```

```
=> NIL
```

```
rthm-seq-bar::set-nth-attack: index (3) < 0 or >= notes-needed (3)
```

```
(let ((rsb (make-rthm-seq-bar '((2 4) q+e s s))))
  (set-nth-attack 3 (make-event 'e4 'q) rsb nil))
```

```
=> NIL
```

## SYNOPSIS:

```
(defmethod set-nth-attack (index (e event) (rsb rthm-seq-bar)
                           &optional (warn t))
```

### 20.2.421 rthm-seq-bar/set-written

[ *rthm-seq-bar* ] [ *Methods* ]

## DATE:

20 Jul 2011 (Pula)

## DESCRIPTION:

Set the written pitch (as opposed to sounding; i.e., for transposing instruments) of an event object within a given rthm-seq-bar object. The sounding pitch remains unchanged as a pitch object in the PITCH-OR-CHORD slot, while the written pitch is added as a pitch object to the WRITTEN-PITCH-OR-CHORD slot.

## ARGUMENTS:

- A rthm-seq-bar-object
- A number (positive or negative) indicating the transposition by semitones. See this method in the event class for more information and examples.

**RETURN VALUE:**

Always returns T.

**EXAMPLE:**

```
;; The method returns NIL
(let ((rsb (make-rthm-seq-bar
              (list
                '(3 8)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)))))
      (set-written rsb -2))
```

=> T

```
;; Set the written pitch transposition to 2 semitones lower, then check the
;; data of the WRITTEN-PITCH-OR-CHORD slot of each event to see the
;; corresponding pitches
(let ((rsb (make-rthm-seq-bar
              (list
                '(3 8)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)
                (make-event 'cs4 'e)))))
      (set-written rsb -2)
      (loop for p in (rhythms rsb)
            collect (get-pitch-symbol p)))
```

=> (B3 B3 B3)

**SYNOPSIS:**

```
(defmethod set-written ((rsb rthm-seq-bar) transposition)
```

**20.2.422 rthm-seq-bar/split**

[ *rthm-seq-bar* ] [ *Methods* ]

**DATE:**

27 Jan 2011

**DESCRIPTION:**

Splits a given `rthm-seq-bar` into multiple smaller `rthm-seq-bar` objects. This will only work if the given `rthm-seq-bar` object can be split into whole beats; e.g. a 4/4 bar will not be split into 5/8 + 3/8.

The keyword arguments `:min-beats` and `:max-beats` serve as guidelines rather than strict cut-offs. In some cases, the method may only be able to effectively split the given `rthm-seq-bar` by dividing it into segments that exceed the length stipulated by these arguments (see example below).

Depending on the `min-beats/max-beats` arguments stipulated by the user or the rhythmic structure of the given `rthm-seq-bar` object, the given `rthm-seq-bar` may not be splittable, in which case `NIL` is returned. If the keyword argument `:warn` is set to `T`, a warning will be also be printed in such cases.

NB The method does not copy over and update bar start-times (this is meant to be done at the `rthm-seq` stage, not once the whole piece has been generated).

#### ARGUMENTS:

- A `rthm-seq-bar` object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- `:min-beats`. This argument takes an integer value to indicate the minimum number of beats in any of the new `rthm-seq-bar` objects created. This serves as a guideline only and may occasionally be exceeded in value by the method. Default value = 2.
- `:max-beats`. This argument takes an integer value to indicate the maximum number of beats in any of the new `rthm-seq-bar` objects created. This serves as a guideline only and may occasionally be exceeded in value by the method. Default value = 5.
- `:warn`. Indicates whether to print a warning if the `rthm-seq-bar` object is unsplittable. Value `T` = print a warning. Defaults to `NIL`.

#### RETURN VALUE:

Returns a list of `rthm-seq-bar` objects if successful, `NIL` if not.

#### EXAMPLE:

```
(let* ((rsb (make-rthm-seq-bar '((7 4) h. e e +e. e. e q)))
      (rsb-splt (split rsb)))
```



```

(loop for i in rsb-splt collect
  (loop for r in (rhythms i) collect (data r))))

=> ((H.) (E E "E." E. E Q))

(let* ((rsb (make-rthm-seq-bar '((7 4) h. e e +e. e. e q)))
  (rsb-splt (split rsb)))
  (loop for i in rsb-splt do (print-simple i)))

=>
(3 4): note H.,
(4 4): note E, note E, note E., note E., note E, note Q,

(let* ((rsb (make-rthm-seq-bar '((7 4) h. e e +e. e. e q)))
  (rsb-splt (split rsb :min-beats 1 :max-beats 3)))
  (loop for i in rsb-splt do (print-simple i)))

=>
(3 4): note H.,
(1 4): note E, note E,
(2 4): note E., note E., note E,
(1 4): note Q,

(let ((rsb (make-rthm-seq-bar '((7 4) h. e e +e. e. e q)))
  (split rsb :max-beats 1 :warn t))

=> NIL
WARNING: rthm-seq-bar::split: couldn't split bar:

```

**SYNOPSIS:**

```

(defmethod split ((rsb rthm-seq-bar) &key
  (min-beats 2) (max-beats 5) warn ignore)

```

**20.2.423 rthm-seq-bar/time-sig-equal**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Check to see if two given rthm-seq-bar objects have the same time signature.

**ARGUMENTS:**

- Two rthm-seq-bar objects.

**RETURN VALUE:**

T if the given rthm-seq-bar objects have the same time signature.  
 NIL if the given rthm-seq-bar objects have different times signatures.

**EXAMPLE:**

```
(let ((rsb1 (make-rthm-seq-bar '((2 4) q e s s)))
      (rsb2 (make-rthm-seq-bar '((2 4) s s e q))))
(time-sig-equal rsb1 rsb2))
```

=> T

```
(let ((rsb1 (make-rthm-seq-bar '((2 4) q e s s)))
      (rsb2 (make-rthm-seq-bar '((3 4) q+e e s s s s))))
(time-sig-equal rsb1 rsb2))
```

=> NIL

**SYNOPSIS:**

```
(defmethod time-sig-equal ((rsb1 rthm-seq-bar) (rsb2 rthm-seq-bar))
```

**20.2.424 rthm-seq-bar/transpose**

[ *rthm-seq-bar* ] [ *Methods* ]

**DESCRIPTION:**

Transpose the pitches of event objects stored in a rthm-seq-bar object by a specified number of semitones (positive for up, negative for down).

**ARGUMENTS:**

- A rthm-seq-bar object.
- A whole number (positive or negative).

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :destructively. Set to T or NIL to indicate whether the slot values of the original rthm-seq-bar object should be changed or not (even though the method always returns a clone). T = change the originals.  
 Default = NIL.
- :chord-function. A function to be used for the transposition of

```

chords. Default = #'transpose.
- :pitch-function. A function to be used for the transposition of
  pitches. Default = #'transpose.

```

### RETURN VALUE:

This method returns a clone of the `rthm-seq-bar` object whether the keyword argument `:destructively` is set to `T` or `NIL`. It does change the corresponding slot values of the original when set to `T` even though it returns the clone.

### EXAMPLE:

```

;; Create a rthm-seq-bar object using make-event, transpose the contained ;
;; pitches destructively, and read the values of the corresponding slots to see ;
;; the change. ;
(let ((rsb (make-rthm-seq-bar
(list
'(3 8)
(make-event 'cs4 'e)
(make-event 'cs4 'e)
(make-event 'cs4 'e))))))
(transpose rsb 3 :destructively 3)
(loop for p in (rhythms rsb)
collect (data (pitch-or-chord p))))

=> (EF4 EF4 EF4)

;; Do the same thing without the :destructively keyword being set to T ;
(let ((rsb (make-rthm-seq-bar
(list
'(3 8)
(make-event 'cs4 'e)
(make-event 'cs4 'e)
(make-event 'cs4 'e))))))
(transpose rsb 3)
(loop for p in (rhythms rsb)
collect (data (pitch-or-chord p))))

=> (C4 C4 C4)

```

### SYNOPSIS:

```

(defmethod transpose ((rsb rthm-seq-bar) semitones
&key

```

```
;; when t, then the events will be replaced by the
;; transposition.
(destructively nil)
;; the default functions are the class methods for pitch
;; or chord.
(chord-function #'transpose)
(pitch-function #'transpose))
```

**20.2.425 sclist/sc-nthcdr**

[ *sclist* ] [ *Methods* ]

**DESCRIPTION:**

Get the tail (rest) of a given sclist object beginning with and including the specified zero-based index number.

NB: This method is destructive and replaces the contents of the given list with the sublist returned by the method.

**ARGUMENTS:**

- An index number.
- An sclist object

**RETURN VALUE:**

Returns a list.

Returns NIL if the specified index is greater (minus 1) than the number of items in the given list.

**EXAMPLE:**

```
;; Create an sclist object and get the tail of the list starting at place
;; 4. The subset returned replaces the data of the original.
```

```
(let ((scl (make-sclist '(0 1 2 3 4 5 6 7 8 9))))
  (sc-nthcdr 4 scl)
  (data scl))
```

```
=> (4 5 6 7 8 9)
```

```
(let ((scl (make-sclist '(0 1 2 3 4 5 6 7 8 9))))
  (sc-nthcdr 14 scl))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod sc-nthcdr (nth (scl sclist))
```

**20.2.426** sclist/sc-set

[ *sclist* ] [ *Classes* ]

**NAME:**

player

File: sc-set.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> sc-set

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the sc-set class which holds pitch set information for harmonic and pitch manipulation.

Author: Michael Edwards: m@michael-edwards.org

Creation date: August 10th 2001

\$\$ Last modified: 09:57:56 Thu Jan 9 2014 GMT

SVN ID: \$Id: sc-set.lsp 4352 2014-01-14 08:42:27Z medward2 \$

**20.2.427** sc-set/add

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Create a new sc-set object from the data of two other specified sc-set objects.

NB: Any subsets contained in the original sc-set objects are lost in the process.

**ARGUMENTS:**

- A first sc-set object.
- A second sc-set object.

**OPTIONAL ARGUMENTS:**

(- optional argument <ignore> is internal only)

**RETURN VALUE: EXAMPLE:**

```
(let ((mscs1 (make-sc-set '(d2 a2 e3 b3 gf4 df5 af5)))
      (mscs2 (make-sc-set '(f2 c3 g3 d4 bf4 f5 c6))))
  (add mscs1 mscs2))
```

=>

```
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 0
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL
```

\*\*\*\* N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```
subsets:
related-sets:
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5 C6)
```

**SYNOPSIS:**

```
(defmethod add ((s1 sc-set) (s2 sc-set) &optional ignore)
```

**20.2.428 sc-set/add-harmonics**

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Adds pitches to the set which are harmonically related to the existing pitches. The keywords are the same as for the `get-harmonics` function. NB This will automatically sort all pitches from high to low (irrespective of the auto-sort slot).

#### ARGUMENTS:

- an `sc-set` object

#### OPTIONAL ARGUMENTS:

keyword arguments:  
see `get-harmonics` function

#### RETURN VALUE:

the same set object as the first argument but with new pitches added.

#### EXAMPLE:

```
;;; treat the existing pitches as fundamentals
(let ((s (make-sc-set '(c4 e4) :id 'test)))
  (add-harmonics s :start-partial 3 :max-results 3))
=>
SC-SET: auto-sort: T, rm-dups: T, warn-dups: T used-notes:
[...]
data: (C4 E4 G5 B5 C6 E6 E6 AF6)

;;; treat the existing pitches as partials and add the fundamentals and
;;; harmonics
(let ((s (make-sc-set '(c4 e4) :id 'test)))
  (add-harmonics s :start-freq-is-partial 3 :max-results 3))
SC-SET: auto-sort: T, rm-dups: T, warn-dups: T used-notes:
[...]
data: (F2 A2 F3 A3 C4 E4)
```

#### SYNOPSIS:

```
(defmethod add-harmonics ((s sc-set) &rest keywords)
```

#### 20.2.429 `sc-set/contains-pitches`

[ *sc-set* ] [ *Methods* ]

#### DESCRIPTION:

Check to see if a given sc-set object contains pitch objects for all of the specified note-names. The method returns NIL if any one of the specified pitches is not found in the given sc-set object.

#### ARGUMENTS:

- An sc-set object.
- A list of note-name symbols. NB: If checking for only one pitch, that pitch must be passed as a single-item list.

#### RETURN VALUE:

T or NIL.

#### EXAMPLE:

```
;; Returns T when all specified pitches are contained in the given sc-set
;; object
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (contains-pitches mscs '(d2 e3 gf4 af5)))
```

=> T

```
;; Returns NIL if any one of the specified pitches is not contained in the
;; given sc-set object.
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (contains-pitches mscs '(d2 e3 gf4 b4 af5)))
```

=> NIL

#### SYNOPSIS:

```
(defmethod contains-pitches ((s sc-set) pitches)
```

#### 20.2.430 sc-set/create-chord

[ *sc-set* ] [ *Methods* ]

#### DESCRIPTION:

Create a chord object from the pitches of the given sc-set object.

#### ARGUMENTS:

- An sc-set object.



**RETURN VALUE:**

A chord object.

**EXAMPLE:**

```
(let ((mscs (make-sc-set '(d2 c3 d4 df5 c6))))
  (create-chord mscs))

=>
CHORD: auto-sort: T, marks: NIL, micro-tone: NIL
SCLIST: sclist-length: 5, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
PITCH: frequency: 73.416, midi-note: 38, midi-channel: 0
[...])
```

**SYNOPSIS:**

```
(defmethod create-chord ((s sc-set))
```

**20.2.431 sc-set/create-event**

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Create an event object (that is a chord) from a given *sc-set* object, specifying a rhythmic value and a start-time (in seconds).

**ARGUMENTS:**

- An *sc-set* object.
- A rhythmic unit, either as a numerical value (32, 16 etc) or a symbol that is an alphabetic shorthand ('e, 's etc).
- A number that is the start time in seconds.

**OPTIONAL ARGUMENTS:**

- A number that is the start-time in quarter-notes rather than seconds (see event class documentation for more details)

**RETURN VALUE:**

An event object.

#### EXAMPLE:

```
;; Create an event from the specified sc-set object that is a quarter-note
;; chord starting at 0.0 seconds
(let ((mscs (make-sc-set '(d2 c3 d4 df5 c6))))
  (create-event mscs 'q 0.0))
```

=>

```
EVENT: start-time: 0.000, end-time: NIL,
       duration-in-tempo: 0.000,
       compound-duration-in-tempo: 0.000,
       amplitude: 0.700
       bar-num: -1, marks-before: NIL,
       tempo-change: NIL
       instrument-change: NIL
       display-tempo: NIL, start-time-qtrs: 0.000,
       midi-time-sig: NIL, midi-program-changes: NIL,
       8va: 0
       pitch-or-chord:
CHORD: auto-sort: T, marks: NIL, micro-tone: NIL
SCLIST: sclist-length: 5, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (
PITCH: frequency: 73.416, midi-note: 38, midi-channel: 0
[...]
```

```
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
       score-rthm: 4.0f0, undotted-value: 4, num-flags: 0, num-dots: 0,
       is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
       is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
       rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
       letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q
```

#### SYNOPSIS:

```
(defmethod create-event ((s sc-set) rhythm start-time &optional start-time-qtrs)
```

#### 20.2.432 sc-set/force-micro-tone

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Change the value of the MICRO-TONE slot of all pitch objects in a given sc-set object to the specified <value>.

NB: Although the MICRO-TONE slot is generally used as a boolean, this method allows the user to force-set it to any value.

**ARGUMENTS:**

- An sc-set object.

**OPTIONAL ARGUMENTS:**

- An item of any type that is to be the new value of the MICRO-TONE slot of all pitch objects in the given sc-set object (generally T or NIL). Default = NIL.

**RETURN VALUE:**

Always returns NIL.

**EXAMPLE:**

```
;; Create an sc-set object that contains micro-tones and print the MICRO-TONE
;; slot of all of the contained pitch objects to see their values:
(let ((mscs (make-sc-set '(d2 cqs3 fs3 cs4 e4 c5 aqf5 ef6))))
  (loop for p in (data mscs) do (print (micro-tone p))))
```

```
=>
NIL
T
NIL
NIL
NIL
NIL
NIL
T
NIL
```

```
;; Now apply the force-micro-tone method to the same set using the default
;; value of NIL and print the results
```

```
(let ((mscs (make-sc-set '(d2 cqs3 fs3 cs4 e4 c5 aqf5 ef6))))
  (force-micro-tone mscs)
  (loop for p in (data mscs) do (print (micro-tone p))))
```

```
=>
NIL
NIL
NIL
NIL
NIL
NIL
NIL
NIL
NIL
```

```
;; Using the same sc-set, force all the values to T
(let ((mscs (make-sc-set '(d2 cqs3 fs3 cs4 e4 c5 aqf5 ef6))))
  (force-micro-tone mscs 't)
  (loop for p in (data mscs) do (print (micro-tone p))))
```

```
=>
T
T
T
T
T
T
T
T
T
```

#### SYNOPSIS:

```
(defmethod force-micro-tone ((s sc-set) &optional value)
```

#### 20.2.433 sc-set/get-chromatic

```
[ sc-set ] [ Methods ]
```

#### DESCRIPTION:

Return those notes of a given sc-set object that are normal chromatic notes (i.e. no microtones).

If a number is given for the <octave> argument, the method will transpose all returned pitches into the specified octave, in which case any duplicate pitches are removed.

#### ARGUMENTS:

- An sc-set object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :octave. NIL or an integer that is the octave designator to which all resulting pitches are to be transposed (i.e. the "4" in "C4" etc.)  
Default = NIL.
- :remove-duplicates. T or NIL to indicate whether any duplicate pitches within an octave that are created by use of the :octave keyword argument are to be removed. T = remove duplicates. Default = NIL.
- :as-symbols. T or NIL to indicate whether to return the results of the method as a list of note-name symbols rather than a list of pitch objects. T = return as note-name symbols. Default = NIL.
- :package. The package in which the pitches are to be handled.  
Default = :sc.
- :invert. Get the micro-tone pitches instead.

**RETURN VALUE:**

Returns a list of pitch objects by default.

When the :as-symbols argument is set to T, a list of note-name symbols is returned instead.

**EXAMPLE:**

```
;;; Returns a list of pitch objects by default
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-chromatic mscs))

=>
(
PITCH: frequency: 73.416, midi-note: 38, midi-channel: 0
      pitch-bend: 0.0
      degree: 76, data-consistent: T, white-note: D2
      nearest-chromatic: D2
      src: 0.28061550855636597, src-ref-pitch: C4, score-note: D2
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 2, c5ths: 0, no-8ve: D, no-8ve-no-acc: D
      show-accidental: T, white-degree: 15,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: D2, tag: NIL,
```

```
data: D2
```

```
PITCH: frequency: 184.997, midi-note: 54, midi-channel: 0
[...]
)
```

```
;; Setting the :as-symbols argument to T returns a list of note-name symbols
;; instead
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-chromatic mscs
    :as-symbols t))
```

```
=> (D2 FS3 CS4 E4 C5 AF5 D6)
```

```
;; Giving an integer as the :octave argument transposes all returned pitches
;; to the specified octave, removing any duplicates by default.
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-chromatic mscs
    :as-symbols t
    :octave 4))
```

```
=> (FS4 CS4 E4 C4 AF4 D4)
```

```
;; Setting the :invert argument to T returns the non-chromatic elements of the
;; given sc-set object instead
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-chromatic mscs
    :as-symbols t
    :invert t))
```

```
=> (CQS3 GQF3 FQS4 BQF5)
```

## SYNOPSIS:

```
(defmethod get-chromatic ((s sc-set)
  &key
  (octave nil)
  (remove-duplicates t) ;; only if octave!
  (as-symbols nil)
  (package :sc)
  (invert nil))
```

### 20.2.434 sc-set/get-degrees

```
[ sc-set ] [ Methods ]
```

**DESCRIPTION:**

Return the pitches contained in the given sc-set object as a list of DEGREES (which default to quarter-tones in slippery chicken).

**ARGUMENTS:**

- An sc-set object.

**RETURN VALUE:**

A list of integers.

**EXAMPLE:**

```
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (get-degrees mscs))

=> (76 82 90 96 104 110 118 124 132 140 146 154 160 168)
```

**SYNOPSIS:**

```
(defmethod get-degrees ((s sc-set))
```

**20.2.435 sc-set/get-freqs**

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Return the pitches of a given sc-set object as a list of Hz frequencies

**ARGUMENTS:**

- An sc-set object.

**RETURN VALUE:**

A list of numbers

**EXAMPLE:**

```
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (get-freqs mscs))
```

```
=> (73.41618871368837 87.30705289160142 109.99999810639679 130.8127784729004
    164.81377633519514 195.99771591817216 246.94163930037348 293.6647548547535
    369.99440456398133 466.1637395092839 554.3652698843016 698.4564231328113
    830.6093584209975 1046.5022277832031)
```

**SYNOPSIS:**

```
(defmethod get-freqs ((s sc-set))
```

**20.2.436 sc-set/get-interval-structure**

```
[ sc-set ] [ Methods ]
```

**DESCRIPTION:**

Get the distances between each pitch in a given sc-set object and the lowest pitch in that object in DEGREES (which default to quarter-tones in slippery chicken). This method assumes that the given sc-set object is sorted from low to high, which is the default action for sc-set objects.

**ARGUMENTS:**

- An sc-set object.

**OPTIONAL**

- T or NIL indicating whether to return values in semitones or default of degrees. Special case: if this argument is 'frequencies, then the interval structure will be returned as frequency differences. T = semitones. Default = NIL.

**RETURN VALUE:**

A list of integers.

**EXAMPLE:**

```
;;; Returns the distances in degrees (which are quarter-tones by default
;;; in slippery chicken--use (in-scale :chromatic) at the top of your code to
;;; set to the chromatic scale):
```

```
(let ((mscs (make-sc-set '(c4 e4 g4))))
  (get-interval-structure mscs))
```

```
=> (8 14)
```



```
;;; Return semitones
(let ((mscs (make-sc-set '(c4 e4 g4))))
  (get-interval-structure mscs t))

=> (4 7)
```

**SYNOPSIS:**

```
(defmethod get-interval-structure ((s sc-set) &optional in-semitones)
```

**20.2.437 sc-set/get-midi**

```
[ sc-set ] [ Methods ]
```

**DESCRIPTION:**

Return the pitches of a given sc-set object as a list of their equivalent MIDI note numbers.

**ARGUMENTS:**

- An sc-set object.

**RETURN VALUE:**

A list of numbers

**EXAMPLE:**

```
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (get-midi mscs))

=> (38 41 45 48 52 55 59 62 66 70 73 77 80 84)
```

**SYNOPSIS:**

```
(defmethod get-midi ((s sc-set))
```

**20.2.438 sc-set/get-non-chromatic**

```
[ sc-set ] [ Methods ]
```

**DESCRIPTION:**

Return those notes of a given sc-set object that are microtones (i.e. no "normal" chromatic notes).

If a number is given for the <octave> argument, the method will transpose all returned pitches into the specified octave, in which case any duplicate pitches are removed.

#### ARGUMENTS:

- An sc-set object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :octave. NIL or an integer that is the octave designator to which all resulting pitches are to be transposed (i.e. the "4" in "C4" etc.)  
Default = NIL.
- :as-symbols. T or NIL to indicate whether to return the results of the method as a list of note-name symbols rather than a list of pitch objects. T = return as note-name symbols. Default = NIL.
- :package. The package in which the pitches are to be handled.  
Default = :sc.

#### RETURN VALUE:

Returns a list of pitch objects by default.

When the :as-symbols argument is set to T, a list of note-name symbols is returned instead.

#### EXAMPLE:

```
;; Returns a list of pitch objects by default
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-non-chromatic mscs))
```

```
=>
```

```
=> (
```

```
PITCH: frequency: 134.646, midi-note: 48, midi-channel: 0
      pitch-bend: 0.5
      degree: 97, data-consistent: T, white-note: C3
      nearest-chromatic: C3
      src: 0.5146511197090149, src-ref-pitch: C4, score-note: CS3
      qtr-sharp: 1, qtr-flat: NIL, qtr-tone: 1,
      micro-tone: T,
```

```

    sharp: NIL, flat: NIL, natural: NIL,
    octave: 3, c5ths: 0, no-8ve: CQS, no-8ve-no-acc: C
    show-accidental: T, white-degree: 21,
    accidental: QS,
    accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: CQS3, tag: NIL,
data: CQS3

PITCH: frequency: 190.418, midi-note: 54, midi-channel: 0
[...]
)

;; Setting :as-symbols to T returns a list of note-names instead
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 d6))))
  (get-non-chromatic mscs
    :as-symbols t))

=> (CQS3 GQF3 FQS4 BQF5)

;; Giving an integer as the :octave argument transposes all returned pitches
;; to the specified octave, removing any duplicates
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 e4 fqs4 c5 af5 bqf5 cqs6 d6))))
  (get-non-chromatic mscs
    :as-symbols t
    :octave 4))

=> (GQF4 FQS4 BQF4 CQS4)

```

**SYNOPSIS:**

```

(defmethod get-non-chromatic ((s sc-set)
  &key
  (octave nil)
  (as-symbols nil)
  (package :sc))

```

**20.2.439 sc-set/get-semitones**

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Get the distances in semitones of each pitch in a given *sc-set* object to a static reference pitch.

Though this method can be used in other contexts, it was devised as an aid for transposing audio samples (sound files), and the reference pitch is therefore generally the perceived fundamental pitch of the audio sample to be transposed.

#### ARGUMENTS:

- An sc-set object.

#### OPTIONAL ARGUMENTS:

- An optional note-name symbol sets the value of the <reference-pitch>, which is the basis pitch to which the resulting number of semitones refer. This will generally be the perceived fundamental pitch of the sample (sound file) being modified ("transposed").
- The optional <offset> argument takes a number that is the number of semitones to add to the pitch of the given set prior to determining its distance in semitones from the reference pitch.

#### RETURN VALUE:

A list of positive and negative numbers.

#### EXAMPLE:

```
;; Chromatic example
(let ((mscs (make-sc-set '(d2 fs3 cs4 c5 af5 d6))))
  (get-semitones mscs))
```

```
=> (-22.0 -6.0 1.0 12.0 20.0 26.0)
```

```
;; Quarter-tone example; results can be decimal fractions of semitone
(let ((mscs (make-sc-set '(d2 cqs3 fs3 gqf3 cs4 fqs4 c5 af5 bqf5 cqs6 d6))))
  (get-semitones mscs))
```

```
=> (-22.0 -11.5 -6.0 -5.5 1.0 5.5 12.0 20.0 22.5 24.5 26.0)
```

#### SYNOPSIS:

```
(defmethod get-semitones ((s sc-set) &optional
  (reference-pitch 'c4)
  (offset 0))
```

**20.2.440 sc-set/get-semitones-from-middle-note***[ sc-set ] [ Methods ]***DESCRIPTION:**

Return a list of numbers that are the distances in semitones of each pitch in a given sc-set object from the middle note of that object.

NB: If the given sc-object contains an even number of pitch objects, the middle note is determined to be the first note of the second half of the set.

**ARGUMENTS:**

- An sc-set object.

**OPTIONAL ARGUMENTS:**

- A symbol that is the key of one of the key/data pairs contained in the SUBSETS slot of the given sc-set object.

**RETURN VALUE:**

A list of positive and negative numbers.

**EXAMPLE:**

```
;; With an odd number of items in the sc-set object, the method returns the
;; same number of positive and negative numbers (non-zero)
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5))))
  (get-semitones-from-middle-note mscs))
```

```
=> (-21.0 -18.0 -14.0 -11.0 -7.0 -4.0 0.0 3.0 7.0 11.0 14.0 18.0 21.0)
```

```
;; With an even number of items in the sc-set object, the middle note is
;; considered to be the first note of the second half of the set
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (get-semitones-from-middle-note mscs))
```

```
=> (-24.0 -21.0 -17.0 -14.0 -10.0 -7.0 -3.0 0.0 4.0 8.0 11.0 15.0 18.0 22.0)
```

```
;; Setting the optional <subset> argument to a symbol that is the key of a
;; given key/data pair in the sc-object's SUBSETS slot applies the method to
;; that subset only
```

```
(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                          :subsets '((f1 (df5 f5 af5 c6))
                                       (va (c3 e3 g3 b3 d4 gf4))))))
  (get-semitones-from-middle-note mscs 'f1))

=> (-7.0 -3.0 0.0 4.0)
```

**SYNOPSIS:**

```
(defmethod get-semitones-from-middle-note ((s sc-set) &optional subset)
```

**20.2.441 sc-set/get-srts**

```
[ sc-set ] [ Methods ]
```

**DESCRIPTION:**

Get the sampling-rate conversion factors for the given sc-set object, whereby 1.0 = unison, 2.0 = one octave higher and 0.5 = one octave lower etc.

**ARGUMENTS:**

- An sc-set object.

**OPTIONAL ARGUMENTS:**

- An optional note-name symbol sets the value of the <reference-pitch>, which is the basis pitch to which the resulting factors refer. This will generally be the perceived fundamental pitch of the sample (sound file) being modified ("transposed").
- The optional <offset> argument takes a number that is the number of semitones to add to the pitch of the given set prior to determining the sampling-rate conversion factors.

**RETURN VALUE:**

Returns a list of numbers.

**EXAMPLE:**

```
;; Returns a list of factors that are the sampling-rate conversion factor
;; compared to a 'C4 by default:
(let ((mscs (make-sc-set '(d2 fs3 cs4 c5 af5 d6))))
```

```

(get-srts mscs))

=> (0.28061550855636597 0.7071067690849304 1.0594631433486938 2.0
    3.17480206489563 4.4898481369018555)

;; Comparing the same set against a higher reference-pitch will return lower
;; values
(let ((mscs (make-sc-set '(d2 fs3 cs4 c5 af5 d6))))
  (get-srts mscs 'd4))

=> (0.25 0.6299605220704482 0.9438743681693953 1.781797458637491
    2.8284271254540463 4.0)

;; Conversely, comparing the same set against the default reference-pitch but
;; with a positive offset will return higher values

(let ((mscs (make-sc-set '(d2 fs3 cs4 c5 af5 d6))))
  (get-srts mscs 'c4 2))

=> (0.3149802585215549 0.7937005124004939 1.1892071699914617 2.244924096618746
    3.563594828739576 5.039684136344879)

```

**SYNOPSIS:**

```

(defmethod get-srts ((s sc-set) &optional
                    (reference-pitch 'c4)
                    (offset 0))

```

**20.2.442 sc-set/make-sc-set**

[ *sc-set* ] [ *Functions* ]

**DESCRIPTION:**

Create an *sc-set* object, which holds pitch-set information for harmonic and pitch manipulation.

**ARGUMENTS:**

- A list of note-name symbols that is to be the set (pitch-set) for the given *sc-set* object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. A symbol that is to be the ID of the given sc-set object.
- :subsets. An assoc-list of key/data pairs, in which the data is a list of note-name symbols that are a subset of the main set. One use for this keyword argument might be to create subsets that particular instruments can play; these could for instance be selected in the chord-function passed to the instrument object. In any case, if the instrument has a subset-id slot, and the current set contains a subset with that ID, the pitches the instrument may play are limited to that subset.
- :related-sets. An assoc-list of key/data pairs, similar to :subsets, only that the pitches given here do not have to be part of the main set. This can be used, for example, for pitches missing from the main set.
- :auto-sort. T or NIL to indicate whether the specified pitches (note-name symbols) are to be automatically sorted from lowest to highest.  
T = sort. Default = T.

**RETURN VALUE:**

An sc-set object.

**EXAMPLE:**

```
;; Simplest usage, with no keyword arguments; returns an sc-set object
(make-sc-set '(d2 cs3 fs3 cs4 e4 c5 af5 ef6))
```

```
=>
```

```
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                        num-data: 0
                        linked: NIL
                        full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL
```

N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```
subsets:
related-sets:
SCLIST: sclist-length: 8, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D2 CS3 FS3 CS4 E4 C5 AF5 EF6)
```



```
;; With keyword arguments
(make-sc-set '(d2 cs3 fs3 cs4 e4 c5 af5 ef6)
  :id 'scs1
  :subsets '((violin (e4 c5 af5 ef6))
             (viola (cs4 e4)))
  :related-sets '((missing (ds2 e2 b3 cs6 d6))))
```

=>

```
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 0
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL
```

N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```
subsets:
VIOLIN: (E4 C5 AF5 EF6)
VIOLA: (CS4 E4)
related-sets:
MISSING: (DS2 E2 B3 CS6 D6)
SCLIST: sclist-length: 8, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: SCS1, tag: NIL,
data: (D2 CS3 FS3 CS4 E4 C5 AF5 EF6)
```

## SYNOPSIS:

```
(defun make-sc-set (sc-set &key id subsets related-sets (auto-sort t))
```

### 20.2.443 sc-set/pitch-symbols

[ *sc-set* ] [ *Methods* ]

## DESCRIPTION:

Return the pitches of a given sc-set object as a list of note-name symbols.

**ARGUMENTS:**

- An sc-set object.

**RETURN VALUE:**

A list of note-name symbols.

**EXAMPLE:**

```
(let ((mscs (make-sc-set '(d2 c3 d4 df5 c6))))
  (pitch-symbols mscs))
```

=> (D2 C3 D4 DF5 C6)

**SYNOPSIS:**

```
(defmethod pitch-symbols ((s sc-set))
```

**20.2.444 sc-set/round-inflections**

[ *sc-set* ] [ *Methods* ]

**DESCRIPTION:**

Get the microtones of a given sc-set object, rounded to the nearest chromatic note.

This method returns only the rounded microtones, and not any of the pitches of the original sc-set that are already chromatic.

By default, this method only gets those microtones that are less than a quarter-tone. This behavior can be changed by setting the :qtr-tones-also argument to T.

An optional argument allows for all pitches to be moved to a specified octave, in which case any duplicate pitches are removed.

**ARGUMENTS:**

- An sc-set object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :qtr-tones-also. T or NIL to indicate whether quarter-tones are also to be rounded to the nearest chromatic pitch and returned. T = round and return. Default = NIL.
- :octave. NIL or an integer that is the octave designator to which all resulting pitches are to be transposed (i.e. the "4" in "C4" etc.) Default = NIL.
- :remove-duplicates. T or NIL to indicate whether any duplicate pitches within an octave that are created by use of the :octave keyword argument are to be removed. T = remove duplicates. Default = NIL.
- :as-symbols. T or NIL to indicate whether to return the results of the method as a list of note-name symbols rather than a list of pitch objects. T = return as note-name symbols. Default = NIL.
- :package. The package in which the pitches are to be handled. Default = :sc.

#### RETURN VALUE:

A list of pitch objects.

#### EXAMPLE:

```
;; First set the *scale* environment of CM (which is used by slippery chicken)
;; to twelfth-tones
(setf cm::*scale* (cm::find-object 'twelfth-tone))
```

```
=> #<tuning "twelfth-tone">
```

```
;; By default the method returns a list of pitch objects.
(let ((mscs (make-sc-set '(c4 cts4 css4 cqs4 cssf4 cstf4 cs4))))
  (round-inflections mscs))
```

```
=>
(
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
PITCH: frequency: 261.626, midi-note: 60, midi-channel: 0
[...]
data: C4
[...]
PITCH: frequency: 277.183, midi-note: 61, midi-channel: 0
[...]
data: CS4
[...]
PITCH: frequency: 277.183, midi-note: 61, midi-channel: 0
```

```

[...]
data: CS4
)

;; Setting the :as-symbols argument to T returns a list of note-name symbols
;; instead
(let ((mscs (make-sc-set '(c4 cts4 css4 cqs4 cssf4 cstf4 cs4))))
  (round-inflections mscs :as-symbols t))

=> (C4 C4 CS4 CS4)

;; Setting the :qtr-tones-also argument to T returns causes quarter-tones to be
;; rounded and returned as well.
(let ((mscs (make-sc-set '(c4 cts4 css4 cqs4 cssf4 cstf4 cs4))))
  (round-inflections mscs
                     :qtr-tones-also T
                     :as-symbols t))

=> (C4 C4 C4 CS4 CS4)

;; Specifying an octave transposes all returned pitches to that octave,
;; removing any duplicates by default
(let ((mscs (make-sc-set '(c2 cts3 css4 cqs5 cssf6 cstf7 cs8))))
  (round-inflections mscs
                     :qtr-tones-also T
                     :octave 4
                     :as-symbols t))

=> (C4 CS4)

;; The removal of the duplicates can be turned off by setting the
;; :remove-duplicates argument to NIL
(let ((mscs (make-sc-set '(c2 cts3 css4 cqs5 cssf6 cstf7 cs8))))
  (round-inflections mscs
                     :qtr-tones-also T
                     :octave 4
                     :remove-duplicates NIL
                     :as-symbols t))

=> (C4 C4 C4 CS4 CS4)

```

**SYNOPSIS:**

```

(defmethod round-inflections ((s sc-set)
                              &key
                              qtr-tones-also

```

```

octave
(remove-duplicates t) ;; only if octave!
(as-symbols nil)
(package :sc))

```

#### 20.2.445 sc-set/set-position

[ *sc-set* ] [ *Methods* ]

##### DESCRIPTION:

Get the position (zero-index) of a specified pitch object within a given sc-set object.

##### ARGUMENTS:

- A pitch object.
- An sc-set object.

##### RETURN VALUE:

An integer.

##### EXAMPLE:

```

(let ((mscs (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))))
  (set-position (make-pitch 'e3) mscs))

```

=> 4

##### SYNOPSIS:

```

(defmethod set-position ((p pitch) (s sc-set))

```

#### 20.2.446 sc-set/stack

[ *sc-set* ] [ *Methods* ]

##### DESCRIPTION:

Extend the pitch content of a given sc-set object by adding new pitch objects which have the same interval structure as the original set.

The method analyzes the interval structure of the original set from the

bottom note to the top and adds new sets to the top and bottom of the original set symmetrically; i.e., with the identical interval structure above the original set and inverted interval structure below.

The optional <num-stacks> argument indicates how many new sets are to be added to both ends.

NB: The method assumes that the pitch content of the original sc-set object is sorted from low to high.

See also: the make-stack method in the complete-set class to make a stack from a simple list of note-name symbols.

#### ARGUMENTS:

- An sc-set object.
- An integer that is the number of new sets to be added to each end of the original set.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :id. A symbol that will be the ID of the new sc-set object. Default NIL.
- :by-freq. If T then use frequencies when calculating the interval structure instead of degrees (semitones if default scale is chromatic). In this case the frequencies of pitches will be retained but their symbolic value will be rounded to the nearest note in the current scale (and pitch bends will be set accordingly). Default NIL.
- :up. Apply the process upwards in pitch space. Default = T.
- :down. Apply the process downwards in pitch space. Default = T.

#### RETURN VALUE:

An sc-set object.

#### EXAMPLE:

```
;; Extends the original set with new sets that have the identical interval
;; structure upwards and inverted interval structure downwards.
(let ((set (make-sc-set '(c4 e4 g4))))
  (stack set 3))
=>
SC-SET: auto-sort: T, used-notes:
[...]
```



```

                                (va (c3 e3 g3 b3 d4 gf4))))))
(subset-get-srts mscs 'fl))
=> (2.1189262866973877 2.669679641723633 3.17480206489563 4.0)

```

**SYNOPSIS:**

```

(defmethod subset-get-srts ((s sc-set) subset &optional
                             (reference-pitch 'c4)
                             (offset 0))

```

**20.2.448 sc-set/tl-set**

[ *sc-set* ] [ *Classes* ]

**NAME:**

tl-set

File: tl-set.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> sc-set  
-> tl-set

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the tl-set class that extends set to incorporate transposition and limiting to certain pitch ranges. NB As of yet, once a set is transposed or limited, it can't be retransposed from its original pitches, only from the current set, i.e these methods are destructive!

Author: Michael Edwards: m@michael-edwards.org

Creation date: 13th August 2001

\$\$ Last modified: 16:09:44 Wed Oct 23 2013 BST

SVN ID: \$Id: tl-set.lsp 4223 2013-10-29 10:57:09Z medward2 \$



**20.2.449 tl-set/complete-set***[ tl-set ] [ Classes ]***NAME:**

complete-set

File: complete-set.lsp

Class Hierarchy: named-object -> linked-named-object -> sclist -> sc-set ->  
tl-set -> complete-set

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the complete-set class which as an  
extension of the tl-set class allows checking for full  
sets: ones in which every note of the current scale is  
present.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 10th August 2001

\$\$ Last modified: 11:30:10 Tue Dec 31 2013 WIT

SVN ID: \$Id: complete-set.lsp 4348 2014-01-01 04:26:25Z medward2 \$

**20.2.450 complete-set/make-complete-set***[ complete-set ] [ Functions ]***DESCRIPTION:**Create a complete-set object, which as an extension of the tl-set class  
allows checking for full sets: ones in which every note of \*standard-scale\*  
is present.**ARGUMENTS:**

- A set of pitches. This can either take the form of a list of note-name symbols or a complete-set, tl-set or sc-set object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. An number, symbol or string that is to be the ID of the given complete-set object (see doc for sc-set).
- :tag. A number, symbol or string that is secondary name, description, tag etc. for the given complete-set object. The :tag serves for identification but not searching purposes (see doc for named-object).
- :subsets. An assoc-list of key/data pairs, in which the data is a list of note-name symbols that are a subset of the main set. One use for this keyword argument might be to create subsets that particular instruments can play; these would then be selected in the chord-function passed to the instrument object (see doc for sc-set).
- :related-sets. An assoc-list of key/data pairs, similar to :subsets, only that the pitches given here do not have to be part of the main set. This can be used, for example, for pitches missing from the main set (see doc for sc-set).
- :auto-sort. T or NIL to indicate whether the specified pitches (note-name symbols) are to be automatically sorted from lowest to highest.  
T = sort. Default = T. (see doc for sc-set)
- :transposition. A number that is the number of semitones by which the pitches of the new complete-set are to be transposed when the object is created. Default = 0. (see doc for tl-set)
- :limit-upper. A note-name symbol or a pitch object to indicate the highest possible pitch in the given complete-set object to be created. (see doc for tl-set)
- :limit-lower. A note-name symbol or a pitch object to indicate the lowest possible pitch in the complete-set object to be created. (see doc for tl-set)
- :complete. T, NIL, or 'CHROMATIC. This argument can be given at init, and if the set is not complete in the sense of T or 'CHROMATIC (all chromatic, equally-tempered notes are present in the set), a warning is printed. If the set is neither T nor 'CHROMATIC at init, then no warning will be issued. In both cases the COMPLETE slot of the given complete-set object will be set after checking the set.

## RETURN VALUE:

A complete-set object.

## EXAMPLE:

```
;; Create a complete set using a list of note-name symbols and the default
;; values for the keyword arguments
(make-complete-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))
```

=>

COMPLETE-SET: complete: NIL

```

        num-missing-non-chromatic: 12
        num-missing-chromatic: 1
        missing-non-chromatic: (BQS BQF AQS AQF GQS GQF FQS EQS EQF DQS
                                DQF CQS)
        missing-chromatic: (EF)
TL-SET: transposition: 0
        limit-upper: NIL
        limit-lower: NIL
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
        num-data: 0
        linked: NIL
        full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL

```

N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```

        subsets:
        related-sets:
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5 C6)

;; A new complete-set object can be created from tl-set and sc-set objects
(let ((mcs (make-complete-set
            (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5))))))
  (pitch-symbols mcs))

=> (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5)

(let ((mcs (make-complete-set
            (make-sc-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5))))))
  (pitch-symbols mcs))

=> (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5)

;; Using the other keyword arguments
(make-complete-set '(d2 f2 a2 e3 g3 b3 d4 gf4 bf4 df5 f5 af5)
  :id 'csset

```

```

      :subsets '((low (d2 f2 a2))
                 (mid (b3 d4)))
      :related-sets '((not-playable (dqs2 eqf3)))
      :transposition 3
      :limit-upper 'g5
      :limit-lower 'e2)

=>
COMPLETE-SET: complete: NIL
              num-missing-non-chromatic: 12
              num-missing-chromatic: 3
              missing-non-chromatic: (BQS BQF AQS AQF GQS GQF FQS EQS EQF DQS
                                      DQF CQS)
              missing-chromatic: (B FS EF)
TL-SET: transposition: 3
        limit-upper:
PITCH: frequency: 783.991, midi-note: 79, midi-channel: 0
[...]
data: G5
      limit-lower:
PITCH: frequency: 82.407, midi-note: 40, midi-channel: 0
[...]
data: E2
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
[...]
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL

```

N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```

      subsets:
LOW: (F2 AF2 C3)
MID: (D4 F4)
      related-sets:
NOT-PLAYABLE: (DQS2 EQF3)
SCLIST: sclist-length: 12, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: CSSET, tag: NIL,
data: (F2 AF2 C3 G3 BF3 D4 F4 A4 CS5 E5)

```

**SYNOPSIS:**

```
(defun make-complete-set (set &key id tag subsets related-sets
                          (transposition 0) (auto-sort t) (warn-dups t)
                          (rm-dups t) limit-upper limit-lower complete)
```

### 20.2.451 complete-set/make-stack

[ *complete-set* ] [ *Functions* ]

#### DESCRIPTION:

Make a complete-set containing stacks based on the given notes. See documentation for the stack method in the sc-set class for details of what this algorithm does.

#### ARGUMENTS:

- an ID for the set to be created (symbol, string, number)
- a list of notes as either symbols or pitch objects
- the number of stacks to create

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :by-freq. Use the frequencies of the pitches to create the stack instead of the interval structure. Default = NIL.
- :up. Apply the process upwards in pitch space. Default = T.
- :down. Apply the process downwards in pitch space. Default = T.

#### RETURN VALUE:

a complete-set object

#### SYNOPSIS:

```
(defun make-stack (id notes num-stacks &key by-freq (up t) (down t))
```

### 20.2.452 tl-set/limit

[ *tl-set* ] [ *Methods* ]

#### DESCRIPTION:

Remove pitch objects from a given tl-set whose pitch content is higher or lower than the pitches specified. Any pitch objects whose pitch content is

equal to the limit pitches specified will be retained.

NB: C0 and B10 are the highest and lowest possible pitches of the quarter-tone scale defined in `scale.lsp` (16.35 and 31608.55 Hz respectively).

NB: The keyword arguments for which the lower and upper limits are to be specified are optional arguments, but are required in order for any effect to be had.

### ARGUMENTS:

- A `tl-set` object.

### OPTIONAL ARGUMENTS:

keyword arguments:

- `:upper`. A note-name symbol that is the upper limit for the limiting process.
- `:lower`. A note-name symbol that is the lower limit for the limiting process.
- `:do-related-sets`. T or NIL to indicate whether the `RELATED-SETS` slot of the given `tl-set` object is to be transposed as well or left unhandled. T = transpose. Default = NIL.

### RETURN VALUE:

A `tl-set` object.

### EXAMPLE:

```
;;; By default the method does not transpose the pitches of the RELATED-SETS
;;; slot
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :subsets '((f1 (df5 f5 af5))
                                   (vla (e3 g3 b3)))
                        :related-sets '((missing (fs2 b5))))))
  (limit mtls :upper 'df5 :lower 'c3))

=>
TL-SET: transposition: 0
      limit-upper:
PITCH: frequency: 554.365, midi-note: 73, midi-channel: 0
[...]
      subsets:
```

```

FL: (DF5)
VLA: (E3 G3 B3)
  related-sets:
MISSING: (FS2 B5)
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (C3 E3 G3 B3 D4 GF4 BF4 DF5)

```

```

;; Setting the :do-related-sets argument to T results in any RELATED-SETS pitch
;; content being transposed as well

```

```

(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                          :subsets '((f1 (df5 f5 af5))
                                       (vla (e3 g3 b3)))
                          :related-sets '((missing (fs2 b5))))))
  (limit mtls :upper 'c6 :lower 'c3 :do-related-sets t))

```

```
=>
```

```

[...]
  subsets:
FL: (DF5 F5 AF5)
VLA: (E3 G3 B3)
  related-sets:
MISSING: (B5)
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5 C6)

```

## SYNOPSIS:

```
(defmethod limit ((tls tl-set) &key upper lower do-related-sets)
```

### 20.2.453 tl-set/limit-for-instrument

[ *tl-set* ] [ *Methods* ]

## DESCRIPTION:

Remove any pitch objects from the given tl-set object which are outside of the range of the specified instrument object.

The pitch objects returned after that operation can then be reduced again by applying further limits specified by the :upper and :lower keyword arguments.

NB: This method returns a list of pitch objects, not a tl-set object, though it does destructively alter the data of the given tl-set object accordingly.

NB: This method will return NIL if the pitch objects of the given tl-set object are microtonal while the given instrument object is set to be a non-microtonal instrument (see example).

#### ARGUMENTS:

- A tl-set object.
- An instrument object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :upper. A pitch object or note-name symbol that is the uppermost possible pitch (inclusive) of the pitch objects returned, as a further limitation after the range of the instrument object has been applied.
- :lower. A pitch object or note-name symbol that is the lowermost possible pitch (inclusive) of the pitch objects returned, as a further limitation after the range of the instrument object has been applied.
- :do-related-sets. T or NIL to indicate whether to apply the specified range restrictions to the RELATED-SETS slot of the given tl-set object as well. NB: These will be modified within the original tl-set object but not returned as part of the resulting list. T = apply to RELATED-SETS as well. Default = NIL.

#### RETURN VALUE:

A list of pitch objects.

#### EXAMPLE:

```
;;; Returns a list of pitch objects, limited only by the range of the given
;;; instrument object by default
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :related-sets '((other-notes (b4 e5 fs5 c6))))))
  (mi (make-instrument 'flute
                      :staff-name "Flute" :staff-short-name "Fl."
                      :lowest-written 'c4 :highest-written 'd7
                      :starting-clef 'treble :midi-program 74 :chords nil
                      :microtones t :missing-notes '(cqs4 dqf4))))
(limit-for-instrument mtls mi))
```



```

=>
(
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 0
[...]
data: D4
[...]
PITCH: frequency: 369.994, midi-note: 66, midi-channel: 0
[...]
data: GF4
[...]
PITCH: frequency: 466.164, midi-note: 70, midi-channel: 0
[...]
data: BF4
[...]
PITCH: frequency: 554.365, midi-note: 73, midi-channel: 0
[...]
data: DF5
[...]
PITCH: frequency: 698.456, midi-note: 77, midi-channel: 0
[...]
data: F5
[...]
PITCH: frequency: 830.609, midi-note: 80, midi-channel: 0
[...]
data: AF5
[...]
PITCH: frequency: 1046.502, midi-note: 84, midi-channel: 0
[...]
data: C6
)

```

```

;;; Further restrict the pitches returned by setting values for the :upper and
;;; :lower keyword arguments and print the new pitch content of the given
;;; tl-set object to see the destructive modification
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :related-sets '((other-notes (b4 e5 fs5 c6))))))
  (mi (make-instrument 'flute
    :staff-name "Flute" :staff-short-name "Fl."
    :lowest-written 'c4 :highest-written 'd7
    :starting-clef 'treble :midi-program 74 :chords nil
    :microtones t :missing-notes '(cqs4 dqf4))))
  (limit-for-instrument mtls mi :upper 'b5 :lower 'c5)
  (pitch-symbols mtls))

=> (DF5 F5 AF5)

```

```

;;; By default the RELATED-SETS slot of the given tl-set object is not affected
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :related-sets '((other-notes (b4 e5 fs5 c6))))))
  (mi (make-instrument 'flute
                      :staff-name "Flute" :staff-short-name "Fl."
                      :lowest-written 'c4 :highest-written 'd7
                      :starting-clef 'treble :midi-program 74 :chords nil
                      :microtones t :missing-notes '(cqs4 dqf4))))
(limit-for-instrument mtls mi :upper 'b5 :lower 'c5)
(loop for nobj in (data (related-sets mtls))
  collect (loop for p in (data nobj)
    collect (data p))))

=> ((B4 E5 FS5 C6))

```

```

;;; Setting the :do-related-sets argument to T will cause the method to be
;;; applied to the RELATED-SETS slot as well.
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :related-sets '((other-notes (b4 e5 fs5 c6))))))
  (mi (make-instrument 'flute
                      :staff-name "Flute" :staff-short-name "Fl."
                      :lowest-written 'c4 :highest-written 'd7
                      :starting-clef 'treble :midi-program 74 :chords nil
                      :microtones t :missing-notes '(cqs4 dqf4))))
(limit-for-instrument mtls mi :upper 'b5 :lower 'c5 :do-related-sets t)
(print (pitch-symbols mtls))
(print (loop for nobj in (data (related-sets mtls))
  collect (loop for p in (data nobj)
    collect (data p)))))

=>
(DF5 F5 AF5)
(E5 FS5)

```

```

;;; The method will return NIL if a set of only microtonal pitches (which
;;; e.g. ring-mod might return) is given in combination with an instrument
;;; object which is not microtone-capable (such as the 'piano object of the
;;; +slippery-chicken-standard-instrument-palette+
(let ((mtls (make-tl-set '(dqs2 fqs2 aqf2 gqs3 bqf3 gqf4 bqf4 dqf5 fqs5)))
  (pno (get-data 'piano
                +slippery-chicken-standard-instrument-palette+)))
  (limit-for-instrument mtls pno :lower 'e5 :upper 'd6))

=> NIL

```

**SYNOPSIS:**

```
(defmethod limit-for-instrument ((tls tl-set) (ins instrument)
                                &key upper lower do-related-sets)
```

**20.2.454 tl-set/make-tl-set**

[ *tl-set* ] [ *Functions* ]

**DESCRIPTION:**

Create a tl-set object, which extends the sc-set class by incorporating transposition and limiting to certain pitch ranges.

NB: As of yet, once a set is transposed or limited, it can't be re-transposed from its original pitches, only from the current set; i.e. these methods are destructive!

**ARGUMENTS:**

- A list of note-name symbols that is to be the set (pitch-set) for the given tl-set object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :id. A symbol that is to be the ID of the given tl-set object.
- :subsets. An assoc-list of key/data pairs, in which the data is a list of note-name symbols that are a subset of the main set. One use for this keyword argument might be to create subsets that particular instruments can play; these would then be selected in the chord-function passed to the instrument object.
- :related-sets. An assoc-list of key/data pairs, similar to :subsets, only that the pitches given here do not have to be part of the main set. This can be used, for example, for pitches missing from the main set.
- :limit-upper. A note-name symbol or a pitch object to indicate the highest possible pitch in the tl-set object to be created.
- :limit-lower. A note-name symbol or a pitch object to indicate the lowest possible pitch in the tl-set object to be created.
- :transposition. A number that is the number of semitones by which the pitches of the new tl-set are to be transposed when the object is created. Default = 0.
- :auto-sort. T or NIL to indicate whether the specified pitches (note-name symbols) are to be automatically sorted from lowest to highest. T = sort. Default = T.

**RETURN VALUE:**

A tl-set object.

**EXAMPLE:**

```
;; Simple usage with default values for keyword arguments
(make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6))
```

```
=>
```

```
TL-SET: transposition: 0
        limit-upper: NIL
        limit-lower: NIL
SC-SET: auto-sort: T, used-notes:
RECURSIVE-ASSOC-LIST: recurse-simple-data: T
                      num-data: 0
                      linked: NIL
                      full-ref: NIL
ASSOC-LIST: warn-not-found T
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 0, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: USED-NOTES, tag: NIL,
data: NIL
```

N.B. All pitches printed as symbols only, internally they are all pitch-objects.

```
subsets:
related-sets:
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5 C6)
```

```
;; Adding subsets and related-sets
(make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
  :subsets '((f1 (df5 f5 af5))
             (vla (e3 g3 b3)))
  :related-sets '((missing (fs2 b5))))
```

```
=>
```

```
TL-SET: transposition: 0
[...]
subsets:
FL: (DF5 F5 AF5)
VLA: (E3 G3 B3)
```

```

    related-sets:
MISSING: (FS2 B5)
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (D2 F2 A2 C3 E3 G3 B3 D4 GF4 BF4 DF5 F5 AF5 C6)

;; Limiting the pitch range of the tl-set object, once using a note-name
;; symbol and once using a pitch object
(make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
              :limit-upper 'g5
              :limit-lower (make-pitch 'd3))

=>
TL-SET: transposition: 0
      limit-upper:
PITCH: frequency: 783.991, midi-note: 79, midi-channel: 0
[...]
      limit-lower:
PITCH: frequency: 146.832, midi-note: 50, midi-channel: 0
[...]
data: (E3 G3 B3 D4 GF4 BF4 DF5 F5)

;; Applying a transposition by semitones
(make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
              :transposition 3)

=>
TL-SET: transposition: 3
[...]
data: (F2 AF2 C3 EF3 G3 BF3 D4 F4 A4 CS5 E5 AF5 B5 EF6)

```

**SYNOPSIS:**

```

(defun make-tl-set (set &key id subsets related-sets
                    limit-upper limit-lower
                    (transposition 0)
                    (auto-sort t))

```

**20.2.455 tl-set/stack**

```
[ tl-set ] [ Methods ]
```

**DESCRIPTION:**

Extend the pitch content of a given sc-set object by adding new pitch

objects which have the same interval structure as the original set.

NB: See documentation for the `stack` method in the `sc-set` class for usage.

## SYNOPSIS:

```
(defmethod stack ((tls tl-set) num-stacks &key id by-freq)
```

### 20.2.456 tl-set/transpose

[ *tl-set* ] [ *Methods* ]

## DESCRIPTION:

Transpose the pitches of a given `tl-set` by a specified number of semitones.

The contents of the `SUBSETS` slot are automatically transposed as well, but the `RELATED-SETS` slot is left untransposed by default. An optional argument allows for `RELATED-SETS` slot to be transposed as well.

## ARGUMENTS:

- A `tl-set` object.
- A positive or negative integer that is the number of semitones by which the pitch content of the given `tl-set` object is to be transposed.

## OPTIONAL ARGUMENTS:

keyword arguments:

- `:do-related-sets`. T or NIL to indicate whether to transpose any contents of the `RELATED-SETS` slot as well. T = transpose. Default = NIL.
- (- additional <ignore> arguments are for internal use only)

## RETURN VALUE:

A `tl-set` object.

## EXAMPLE:

```
;; By default the RELATED-SETS are left untransposed
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :subsets '((f1 (df5 f5 af5))
                                   (vla (e3 g3 b3)))
```

```

                                :related-sets '((missing (fs2 b5))))))
(transpose mtls 3))

=>
TL-SET: transposition: 3
        limit-upper: NIL
        limit-lower: NIL
SC-SET: auto-sort: T, used-notes:
[...]
        subsets:
FL: (E5 AF5 B5)
VLA: (G3 BF3 D4)
        related-sets:
MISSING: (FS2 B5)
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (F2 AF2 C3 EF3 G3 BF3 D4 F4 A4 CS5 E5 AF5 B5 EF6)

;; Set the <do-related-sets> argument to T for the RELATED-SETS contents to be
;; transposed as well
(let ((mtls (make-tl-set '(d2 f2 a2 c3 e3 g3 b3 d4 gf4 bf4 df5 f5 af5 c6)
                        :subsets '((f1 (df5 f5 af5))
                                   (vla (e3 g3 b3)))
                        :related-sets '((missing (fs2 b5))))))
  (transpose mtls 3 :do-related-sets t))

=>
TL-SET: transposition: 3
        limit-upper: NIL
        limit-lower: NIL
SC-SET: auto-sort: T, used-notes:
[...]
        subsets:
FL: (E5 AF5 B5)
VLA: (G3 BF3 D4)
        related-sets:
MISSING: (A2 D6)
SCLIST: sclist-length: 14, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (F2 AF2 C3 EF3 G3 BF3 D4 F4 A4 CS5 E5 AF5 B5 EF6)

```

**SYNOPSIS:**

```
(defmethod transpose ((tls tl-set) semitones
```

```
&key do-related-sets
ignore1 ignore2)
```

**20.2.457** `sclist/sc-subseq`

[ *sclist* ] [ *Methods* ]

**DESCRIPTION:**

Return a subsequence from a given `sclist` based on starting and finishing indices.

NB: This method uses Common Lisp's `subseq` function and thus inherits its attributes, whereby the `START` argument indicates the zero-based index of the first list item to be returned and the `FINISH` argument indicates the zero-based index of the first list item after that NOT to be returned.

**ARGUMENTS:**

- An `sclist` object.
- An integer indicating the zero-based index of the first list item to be returned.
- An integer indicating the zero-based index of the first list item after the `START` item to not be returned.

**OPTIONAL ARGUMENTS:**

- (fun `#'error`). By default an error will be signalled if the requested `subseq` is out of bounds. If you prefer, this could be a warning instead by passing `#'warn`, or nothing at all if `NIL`.

**RETURN VALUE:**

A list.

An error is returned if the user attempts to apply the method with `START` and `FINISH` arguments that are beyond the bounds of the given `sclist` object.

**EXAMPLE:**

```
;; Returns a sublist from the given list. The START argument indicates the
;; zero-based index of the first item in the given list to be returned and the
;; FINISH argument indicates the zero-based index of the first item after that
;; to NOT be returned.
```



```
(let ((scl (make-sclist '(1 2 3 4 5 6 7 8 9))))
  (sc-subseq scl 2 7))
```

```
=> (3 4 5 6 7)
```

```
;; Drops into the debugger with an error if one of the indexing arguments is
;; beyond the bounds of the given sclist object
(let ((scl (make-sclist '(1 2 3 4 5 6 7 8 9))))
  (sc-subseq scl 0 15))
```

```
=>
```

```
sclist::sc-subseq: Illegal indices for above list: 0 15 (length = 9)
[Condition of type SIMPLE-ERROR]
```

```
(let ((scl (make-sclist '(1 2 3 4 5 6 7 8 9))))
  (sc-subseq scl 0 15 NIL))
```

```
=>
```

```
NIL
```

## SYNOPSIS:

```
(defmethod sc-subseq ((scl sclist) start finish &optional (fun #'error))
```

### 20.2.458 sclist/sclist-econs

[ *sclist* ] [ *Methods* ]

## DESCRIPTION:

Add a single item to the end of a given sclist object.

NB: This method destructively modifies the list.

NB: This method adds any element specified as a single item. For combining two lists into one see `sclist/combine`.

NB: Though related to Lisp's `cons` function, remember that the order of arguments here is the other way round i.e. element after list, not before.

## ARGUMENTS:

- An sclist object.
- An item to add to the end of the given sclist object.

## RETURN VALUE:

- The new value (list) of the given sclist object.

**EXAMPLE:**

```
;; Add a single integer to the end of a list of integers
(let ((scl (make-sclist '(0 1 2 3 4))))
  (sclist-econs scl 5))
```

```
=> (0 1 2 3 4 5)
```

**SYNOPSIS:**

```
(defmethod sclist-econs ((scl sclist) element)
```

**20.2.459 sclist/sclist-remove-elements**

```
[ sclist ] [ Methods ]
```

**DESCRIPTION:**

Remove a specified number of consecutive items from a given sclist object.

NB: This is a destructive method and replaces the data of the given sclist object with the newly created sublist.

**ARGUMENTS:**

- An sclist object.
- The index integer within the given list with which to start (inclusive and zero-based).
- An integer that is the number of items to remove.

**RETURN VALUE:**

Returns

**EXAMPLE:**

```
;;; Returns an sclist object.
(let ((scl (make-sclist '(0 1 2 3 4 5 6 7 8 9))))
  (sclist-remove-elements scl 3 4))
```

```
=>
```

```
SCLIST: sclist-length: 6, bounds-alert: T, copy: T
```

```
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: (0 1 2 7 8 9)
```

```
;; Drops into the debugger with an error if the given sclist object has fewer
;; items than specified for the START or HOW-MANY arguments
(let ((scl (make-sclist '(0 1 2 3 4 5 6 7 8 9))))
  (data (sclist-remove-elements scl 3 41)))
```

```
=>
```

```
remove-elements: arguments 2 and 3 must be integers < the length of argument 1:
3 41 10
[Condition of type SIMPLE-ERROR]
```

## SYNOPSIS:

```
(defmethod sclist-remove-elements ((scl sclist) start how-many)
```

### 20.2.460 sclist/set-nth

```
[ sclist ] [ Methods ]
```

## DESCRIPTION:

Set the nth element (zero-based) of a given sclist object.

NB: This doesn't auto-grow the list.

## ARGUMENTS:

- An index integer.
- An sclist object.

## RETURN VALUE:

Returns the item added if successful.

Returns NIL and prints a warning if the specified index number is greater than the number of items in the list (minus 1)

## EXAMPLE:

```
;; Returns the item added
(let ((scl (make-sclist '(cat dog cow pig sheep))))
  (set-nth 3 'horse scl))
```

```
=> HORSE
```

```
;; Access the DATA slot to see the change
(let ((scl (make-sclist '(cat dog cow pig sheep))))
  (set-nth 3 'horse scl)
  (data scl))
```

```
=> (CAT DOG COW HORSE SHEEP)
```

```
;; Returns NIL and prints a warning if the index number is beyond the bounds of
;; the list
(let ((scl (make-sclist '(cat dog cow pig sheep))))
  (set-nth 31 'horse scl))
```

```
=> NIL
```

```
WARNING: sclist::sclist-check-bounds: Illegal list reference: 31
(length = 5) (sclist id = NIL)
```

## SYNOPSIS:

```
(defmethod set-nth (index new-element (i sclist))
```

### 20.2.461 linked-named-object/sndfile

[ *linked-named-object* ] [ *Classes* ]

#### NAME:

sndfile

File: sndfile.lsp

Class Hierarchy: named-object -> linked-named-object -> sndfile

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the sndfile class that holds information about a sound file as well as specifying desired parameters

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 21st 2001

\$\$ Last modified: 18:59:06 Wed Dec 26 2012 ICT

SVN ID: \$Id: sndfile.lsp 4223 2013-10-29 10:57:09Z medward2 \$

## 20.2.462 sndfile/make-sndfile

[ *sndfile* ] [ *Functions* ]

### DESCRIPTION:

Create a `sndfile` object to hold data about an existing sound file, specifying at least the path and file name of that sound file. Optional arguments allow for the specification of segments within the given sound file and its perceived fundamental frequency (for `src`-based transposition).

If the first argument ("path") is a list, then this `sndfile` object has been created from within a `sndfile-palette` object. In this case, the first item in the list will be the full path to the sound file, as defined in the `sndfile-palette` object; the second item in the list is the list given by the user containing the data slots to be used, whereby the first item of that list must be the ID of the object.

NB: This function creates an object of the class `sndfile`, which contains data concerning an existing sound file. It does not create an actual sound file.

### ARGUMENTS:

- A path and file name of an existing sound file; or a list as explained above.

### OPTIONAL ARGUMENTS:

keyword arguments:

- `:id`. An ID for the `sndfile`. Will be set automatically if created from within a `sndfile-palette`. Default `nil`.
- `:data`. The given file name, including path and extension, usually set automatically to be the given path if `nil`. Default `nil`.
- `:duration`. A number in seconds which is the duration of the segment of the specified sound file which the user would like to use. This should not be specified if `:end` has been specified. Default `nil`.
- `:end`. A number in seconds which is the end time within the source sound

- file for the segment of the file which the user would like to use. This should not be specified if :duration has been specified. Default nil.
- :start. A number in seconds which is the start time within the source sound file for the segment of the file which the user would like to use. Defaults to 0.0.
  - :frequency. A number or note-name symbol. This frequency will serve as the reference pitch for any src transpositions of this file. This can be any value, but will most likely be specified if the source sound file has a perceptible fundamental pitch. If given as a number, this number will be handled as a frequency in Hertz. Default = 'C4.
  - :amplitude. An number that is the amplitude which the user would like to designate for this sound file. This number may be of any value, as slippery chicken normalizes all sound file events; however, standard practice would suggest that this should fall between 0.0 and 1.0. Default = 1.0

**RETURN VALUE:**

A sndfile object.

**EXAMPLE:**

```
;; Example specifying the full path, a start and end time, and a base frequency
(make-sndfile "/path/to/sndfile-1.aiff"
  :start 0.3
  :end 1.1
  :frequency 654)
```

=>

```
SNDFILE: path: /path/to/sndfile-1.aiff,
  snd-duration: 3.011043, channels: 1, frequency: 654
  start: 0.3, end: 1.1, amplitude: 1.0, duration 0.8
  will-be-used: 0, has-been-used: 0
  data-consistent: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: /path/to/sndfile-1.aiff
```

```
;; Example using the sndfile-palette list as the first argument
(make-sndfile '("/path/to/sndfile-1.aiff"
  (nil :start 0.3 :end 1.1)))
```

=>

```
SNDFILE: path: /path/to/sndfile-1.aiff,
```

```

    snd-duration: 3.011043, channels: 1, frequency: 261.62555
    start: 0.3, end: 1.1, amplitude: 1.0, duration 0.8
    will-be-used: 0, has-been-used: 0
    data-consistent: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "/Volumes/JIMMY/SlipperyChicken/sndfile-2.aiff", tag: NIL,
data: /path/to/sndfile-1.aiff

```

**SYNOPSIS:**

```

(defun make-sndfile (path &key id data duration end (start 0.0)
                    (frequency 'c4)
                    (amplitude 1.0))

```

**20.2.463 sndfile/reset-usage**

[ *sndfile* ] [ *Methods* ]

**DESCRIPTION:**

Reset the WILL-BE-USED and HAS-BEEN-USED slots of the given sndfile object to 0. These slots keep track of how many times a sound will be used and has been used, which is useful for purposes such as incrementing start-time. These slots are set internally and are not intended to be set by the user.

**ARGUMENTS:**

- A sndfile object.

**RETURN VALUE:**

Returns 0.

**EXAMPLE:**

```

;; First set the values of the WILL-BE-USED and HAS-BEEN-USED slots, as these
;; are 0 when a new sndfile object is created using make-sndfile. Set the
;; values, print them; reset both using reset-usage, and print again to see
;; the change.
(let ((sf-1 (make-sndfile "/path/to/sndfile-1.aiff"))))
  (setf (will-be-used sf-1) 11)
  (setf (has-been-used sf-1) 13)
  (print (will-be-used sf-1))
  (print (has-been-used sf-1))

```

```

(reset-usage sf-1)
(print (will-be-used sf-1))
(print (has-been-used sf-1)))

=>
11
13
0
0

```

**SYNOPSIS:**

```
(defmethod reset-usage ((sf sndfile))
```

**20.2.464 sndfile/sndfile-ext**

[ *sndfile* ] [ *Classes* ]

**NAME:**

sndfile-ext

File: sndfile-ext.lsp

Class Hierarchy: named-object -> linked-named-object -> sndfile ->  
sndfile-ext

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Extension of the sndfile class to hold further properties  
which quantify the character of the sound file, and  
specifies sound files which can follow the current one.  
Specifically created to interface with the sndfilenet  
project in MaxMSP via OSC (see osc.lsp and osc-sc.lsp).

Author: Michael Edwards: m@michael-edwards.org

Creation date: 16th December 2012, Koh Mak, Thailand

\$\$ Last modified: 12:27:59 Fri Jan 4 2013 GMT

SVN ID: \$Id: sndfile-ext.lsp 4223 2013-10-29 10:57:09Z medward2 \$



**20.2.465 sndfile-ext/get-next***[ sndfile-ext ] [ Methods ]***DESCRIPTION:**

Get the next sound file from the <followers> slot.

**ARGUMENTS:**

- A sndfile-ext object.

**RETURN VALUE:**

A sndfile-ext object.

**SYNOPSIS:**

```
(defmethod get-next ((sfe sndfile-ext))
```

**20.2.466 sndfile-ext/make-sndfile-ext***[ sndfile-ext ] [ Functions ]***DESCRIPTION:**

Make a sndfile-ext (extension of sndfile) object which holds the usual sndfile data as well as a host of others to do with the characteristics of the sound file. In addition, the followers slot specifies sound files which can follow the current one. The bitrate, srates, num-frames, and bytes slots will be filled automatically if the path to an existing sound file is given.

**ARGUMENTS:**

See defclass slot descriptions

**RETURN VALUE:**

A sndfile-ext object.

**SYNOPSIS:**

```
(defun make-sndfile-ext (path &key id data duration end (start 0.0)
                        (frequency 'c4) (amplitude 1.0) (cue-num -1))
```

```
(use t) (pitch -1) (pitch-curve -1) (bandwidth -1)
(bandwidth-curve -1) (continuity -1)
(continuity-curve -1) (weight -1) (weight-curve -1)
(energy -1) (energy-curve -1) (harmonicity -1)
(harmonicity-curve -1) (volume -1) (volume-curve -1)
(loop-it nil) (bitrate -1) (srate -1) (num-frames -1)
(bytes -1) followers group-id)
```

## 20.2.467 sndfile-ext/max-cue

[ *sndfile-ext* ] [ *Methods* ]

### DESCRIPTION:

Generate the data necessary to preload the sound file in a MaxMSP sflist~ object.

### ARGUMENTS:

- The sndfile-ext object.

### OPTIONAL ARGUMENTS:

- Whether to issue an error if the cue-num slot has not been set to a value above 1. Default = #'error. Could also be #'warn and NIL.

### RETURN VALUE:

A list of data suitable to be passed via OSC to the sflist~ object.

### EXAMPLE:

```
(let* ((sf1 (make-sndfile-ext
              (concatenate 'string
                            cl-user::+slippery-chicken-home-dir+
                            "test-suite/sndfile-1.aiff")
              :cue-num 2 :start 0.3 :end 1.1 :frequency 653)))
      (max-cue sf1))
```

=>

```
("preload" 2 "/Users/medward2/lisp/sc/test-suite/sndfile-1.aiff" 300.0 1100.0)
```

### SYNOPSIS:

```
(defmethod max-cue ((sfe sndfile-ext) &optional (on-fail #'error))
```

**20.2.468 sndfile-ext/max-play***[ sndfile-ext ] [ Methods ]***DESCRIPTION:**

Generate the data necessary for MaxMSP to play the sndfile using the `sflist~` and `sfplay~`.

NB `fade-dur` could be 0 (= no fade)

**ARGUMENTS:**

- The `sndfile-ext` object.
- The fade (in/out) duration in seconds.
- The maximum loop duration in seconds.
- The time to trigger the next file, as a percentage of the current `sndfile-ext`'s duration.

**RETURN VALUE:**

A list of values to be passed via OSC to `sndfilenet-aux.maxpath:`  
`cue-number number-of-channels loop speed fade-dururation`  
`fade-out-start-time delay-to-next-snfile-start amplitude`

**EXAMPLE:**

```
(let* ((sf1 (make-sndfile-ext
  (concatenate 'string
    cl-user::+slippery-chicken-home-dir+
    "test-suite/sndfile-1.aiff")
  :start 0.3 :end 1.1 :frequency 653)))
  (max-play sf1 20))
```

=>

```
(-1 1 0 1.0 0.32000002 0.48)
```

**SYNOPSIS:**

```
(defmethod max-play ((sfe sndfile-ext) fade-dur max-loop start-next
  &optional ignore)
```

**20.2.469 sndfile-ext/proximity***[ sndfile-ext ] [ Methods ]***DESCRIPTION:**

In terms of the characteristics expressed in the various class slots, evaluate the proximity of one sndfile-ext object to another. The closer they are in character, the closer to 0 the returned value will be. The order of the two sndfile-ext objects passed to the method is unimportant as the return value is always  $\geq 0.0$ . The more slots match, the lower (closer) the result will be, i.e., slots are only compared if they have a value  $\geq 0$  (they default to -1), so it could be that in one comparison 5/6 slots match exactly, and in another 2/3 match; in both cases the non-matching slots is off by 1; in that case the first comparison will return a lower value: 0.067 vs 0.233.

**ARGUMENTS:**

- first sndfile-ext object
- second sndfile-ext object

**RETURN VALUE:**

A floating point number  $\geq 0.0$  where 0.0 indicates an exact match.

**EXAMPLE:**

```
(let ((sf3 (make-sndfile-ext
              nil :pitch 3 :pitch-curve 4 :bandwidth 10 :energy 2
              :harmonicity-curve 0))
      (sf4 (make-sndfile-ext
              nil :pitch 3 :pitch-curve 4 :bandwidth 10 :energy 2
              :harmonicity-curve 1)))
  ;; harmonicity-curve is slightly different so we get a result > 0
  (print (proximity sf3 sf4))
  (set-characteristic sf4 'harmonicity-curve 0)
  ;; now they're the same so we get 0.0
  (proximity sf3 sf4))
```

```
=>
0.12857144
0.0
```

**SYNOPSIS:**

```
(defmethod proximity ((sfe1 sndfile-ext) (sfe2 sndfile-ext))
```

**20.2.470 sndfile-ext/reset**

[ *sndfile-ext* ] [ *Methods* ]

**DESCRIPTION:**

Reset the <followers> circular list to the first or any other following sound file.

**ARGUMENTS:**

A sndfile-ext object.

**OPTIONAL ARGUMENTS:**

The position (index) to reset to (will default to 0 i.e. the beginning of the list). NB This position may be higher than the number of followers attached to any given sndfile-ext object as it will wrap around.

**RETURN VALUE:**

T

**SYNOPSIS:**

```
(defmethod reset ((sfe sndfile-ext) &optional where (warn t))
```

**20.2.471 sndfile-ext/set-characteristic**

[ *sndfile-ext* ] [ *Methods* ]

**DESCRIPTION:**

Set the characteristic of a sndfile-ext object to a given value. The value for the slot is first checked to correspond to an accepted range; if not an error (default) or warning (or nothing) will be issued.

**ARGUMENTS:**

- a sndfile-ext object.
- the characteristic, i.e. one of the class slot names, as a symbol.
- the new value, as an accepted integer (see characteristics slot for accepted range).

**OPTIONAL ARGUMENTS:**

- the function to call if the given value is out of range. Default = #'error but could also be #'warn, or NIL (if no error message should be issued).

**RETURN VALUE:**

NIL on fail otherwise <value>

**EXAMPLE:**

```
(let ((sf4 (make-sndfile-ext
              nil :pitch 3 :pitch-curve 4 :bandwidth 10 :energy 2
              :harmonicity-curve 1)))
  ;; out of range but no error/warning
  (print (set-characteristic sf4 'harmonicity-curve 15 nil))
  ;; out of range and warn
  (print (set-characteristic sf4 'harmonicity-curve -1 #'warn))
  ;; in range
  (set-characteristic sf4 'harmonicity-curve 0))

=>
NIL
WARNING:
  sndfile-ext::set-characteristic: No such characteristic: HARMONICITY-CURVE -1
NIL
0
```

**SYNOPSIS:**

```
(defmethod set-characteristic ((sfe sndfile-ext) characteristic value
                               &optional (on-fail #'error))
```

**20.2.472 sndfile/stereo**

[ *sndfile* ] [ *Methods* ]

**DESCRIPTION:**

Test whether the CHANNELS slot of a given sndfile object is set to 2.

**ARGUMENTS:**

- A sndfile object.

**RETURN VALUE:**

Returns T if the CHANNELS slot is set to 2, otherwise returns NIL.

**EXAMPLE:**

```
;; The method make-sndfile creates a sndfile object with the CHANNELS slot set
;; to NIL. Make a sndfile object, test to see whether the value of the CHANNELS
;; slot is 2; set the CHANNELS slot to 2 and test again.
(let ((sf-1 (make-sndfile "/path/to/sndfile-1.aiff")))
  (print (stereo sf-1))
  (setf (channels sf-1) 2)
  (print (stereo sf-1)))

=>
NIL
T
```

**SYNOPSIS:**

```
(defmethod stereo ((sf sndfile))
```

**20.2.473 linked-named-object/tempo**

[ *linked-named-object* ] [ *Classes* ]

**NAME:**

tempo

File: tempo.lsp

Class Hierarchy: named-object -> linked-named-object -> tempo

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the tempo class which holds very simple tempo information, simply the type of beat and the number of beats per minute etc.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 11th 2001

\$\$ Last modified: 17:33:53 Mon Jun 25 2012 BST

SVN ID: \$Id: tempo.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.474 tempo/make-tempo***[ tempo ] [ Functions ]***DESCRIPTION:**

Make a tempo object.

**ARGUMENTS:**

- A number indicating beats per minute.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :beat. Sets the "beat" value of the beats per minute; i.e., 'q (or 4) for "quarter = xx bpm" etc. Default = 4.
- :id. Sets the ID of the tempo object.
- :description. A text description (string) of the tempo, such as "Allegro con brio" etc.

**RETURN VALUE:**

A tempo object.

**EXAMPLE:**

```
;; Default beat is a quarter, thus the following makes a tempo object of
;; quarter=60.
(make-tempo 60)
```

```
=>
```

```
TEMPO: bpm: 60, beat: 4, beat-value: 4.0, qtr-dur: 1.0
      qtr-bpm: 60.0, usecs: 1000000, description: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: 60
```

```
;; Set the beat using the :beat keyword argument. Thus, the following makes a
;; tempo object of dotted-quarter = 96.
(make-tempo 96 :beat 'q.)
```

```
;; Add a text description, which is stored in the tempo object's DESCRIPTION
;; slot.
(let ((tt (make-tempo 76 :beat 2 :description "Allegretto")))
```



```
(description tt))
=> "Allegretto"
```

**SYNOPSIS:**

```
(defun make-tempo (bpm &key (beat 4) id description)
```

**20.2.475 tempo/tempo-equal**

```
[ tempo ] [ Methods ]
```

**DESCRIPTION:**

Test to determine whether the values of two tempo objects are equal.

**ARGUMENTS:**

- A first tempo object.
- A second tempo object.

**RETURN VALUE:**

Returns T if the values of the two tempo objects are equal, otherwise NIL.

**EXAMPLE:**

```
;; Equal
(let ((tt1 (make-tempo 60))
      (tt2 (make-tempo 60)))
  (tempo-equal tt1 tt2))
```

```
=> T
```

```
;; Not equal
(let ((tt1 (make-tempo 60))
      (tt2 (make-tempo 96)))
  (tempo-equal tt1 tt2))
```

```
=> NIL
```

**SYNOPSIS:**

```
(defmethod tempo-equal ((t1 tempo) (t2 tempo))
```

**20.2.476 linked-named-object/time-sig***[ linked-named-object ] [ Classes ]***NAME:**

time-sig

File: time-sig.lsp

Class Hierarchy: named-object -&gt; linked-named-object -&gt; sclist -&gt; time-sig

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of a time-sig class that stores  
information about time signatures, allows comparison of  
time signatures etc.

Author: Michael Edwards: m@michael-edwards.org

Creation date: 12th February 2001

\$\$ Last modified: 11:27:41 Sat Apr 20 2013 BST

SVN ID: \$Id: time-sig.lsp 4223 2013-10-29 10:57:09Z medward2 \$

**20.2.477 time-sig/beat-duration***[ time-sig ] [ Methods ]***DESCRIPTION:**

Get the duration in seconds of one beat of the given time-signature at a  
tempo of quarter=60.

**ARGUMENTS:**

- A time-sig object.

**RETURN VALUE:**

A number.

**EXAMPLE:**

```
;; Beat duration in seconds for time-signature 2/4 at quarter=60
(let ((ts (make-time-sig '(2 4))))
  (beat-duration ts))

=> 1.0
```

```
;; Beat duration in seconds for 6/8 at quarter=60
(let ((ts (make-time-sig '(6 8))))
  (beat-duration ts))

=> 1.5
```

**SYNOPSIS:**

```
(defmethod beat-duration ((ts time-sig))
```

**20.2.478 time-sig/get-beat-as-rhythm**

```
[ time-sig ] [ Methods ]
```

**DESCRIPTION:**

Get the beat unit of a given time-sig object and return it as a rhythm.

**ARGUMENTS:**

- A time-sig object.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to consider the beat of a compound meter to be the denominator of the time signature (such as 8 for 6/8) or the beat duration derived from the traditionally understood beat of that meter (such as Q. for 6/8). NIL = denominator. Default = NIL.

**RETURN VALUE:**

A rhythm object.

**EXAMPLE:**

```
;; Returns a rhythm object
(let ((ts (make-time-sig '(2 4))))
  (get-beat-as-rhythm ts))
```

```
=>
RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
        score-rthm: 4.0f0, undotted-value: 4, num-flags: 0, num-dots: 0,
        is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
        is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
        rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
        letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: 4, tag: NIL,
data: 4
```

```
;; Default for compound meters is to return the denominator of the time
;; signature
(let ((ts (make-time-sig '(6 8))))
  (data (get-beat-as-rhythm ts)))
```

```
=> 8
```

```
;; Setting the optional argument to T returns the compound beat of a compound
;; meter rather than the denominator of the time signature
(let ((ts (make-time-sig '(6 8))))
  (data (get-beat-as-rhythm ts t)))
```

```
=> Q.
```

## SYNOPSIS:

```
(defmethod get-beat-as-rhythm ((ts time-sig) &optional handle-compound)
```

### 20.2.479 time-sig/get-whole-bar-rest

[ *time-sig* ] [ *Methods* ]

## DESCRIPTION:

Create an event object consisting of a rest equal in duration to one full bar of the given time-sig object.

## ARGUMENTS:

- A time-sig object.

## RETURN VALUE:

Returns an event object.

**EXAMPLE:**

```
;; Returns an event object
(let ((ts (make-time-sig '(2 4))))
  (get-whole-bar-rest ts))
```

```
=>
```

```
EVENT: start-time: NIL, end-time: NIL,
       duration-in-tempo: 0.0,
       compound-duration-in-tempo: 0.0,
       amplitude: 0.7
       bar-num: -1, marks-before: NIL,
       tempo-change: NIL
       instrument-change: NIL
       display-tempo: NIL, start-time-qtrs: -1,
       midi-time-sig: NIL, midi-program-changes: NIL,
       8va: 0
       pitch-or-chord: NIL
       written-pitch-or-chord: NIL
RHYTHM: value: 2.000, duration: 2.000, rq: 2, is-rest: T,
       score-rthm: 2.0f0, undotted-value: 2, num-flags: 0, num-dots: 0,
       is-tied-to: NIL, is-tied-from: NIL, compound-duration: 2.000,
       is-grace-note: NIL, needs-new-note: NIL, beam: NIL, bracket: NIL,
       rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
       letter-value: 2, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: 2, tag: NIL,
data: 2
```

```
;; The rhythmic value of the event object returned is equal to the rhythmic
;; duration of a full bar in the given time signature, the PITCH-OR-CHORD slot
;; is set to NIL, and the IS-REST slot is set to T.
```

```
(let* ((ts (make-time-sig '(2 4)))
       (tsnbr (get-whole-bar-rest ts)))
  (print (value tsnbr))
  (print (pitch-or-chord tsnbr))
  (print (is-rest tsnbr)))
```

```
=>
```

```
2.0
NIL
T
```

**SYNOPSIS:**

```
(defmethod get-whole-bar-rest ((ts time-sig))
```

**20.2.480 time-sig/is-compound***[ time-sig ] [ Methods ]***DESCRIPTION:**

Determine whether the value of a given time-sig object is a compound time signature.

**ARGUMENTS:**

- A time-sig object.

**RETURN VALUE:**

T if the value of the given time-sig object is a compound time signature, otherwise NIL.

**EXAMPLE:**

```
;; Testing a time-sig object with a 2/4 time signature returns NIL
(let ((ts (make-time-sig '(2 4))))
  (is-compound ts))

=> NIL
```

```
;; Testing a time-sig object with a 6/8 time signature returns T
(let ((ts (make-time-sig '(6 8))))
  (is-compound ts))

=> T
```

**SYNOPSIS:**

```
(defmethod is-compound ((ts time-sig))
```

**20.2.481 time-sig/make-time-sig***[ time-sig ] [ Functions ]***DESCRIPTION:**

Create a time-sig object. In addition to the numerator and denominator values, the object also stores other automatically calculated information, such as whether the signature is simple or compound, the duration of one bar of the given time signature in seconds, the number of midi-clocks, etc.

**ARGUMENTS:**

- A two-item list of numbers, the first being the numerator (number of beats per measure), the second being the denominator (beat type).

**RETURN VALUE:**

- A time-sig object.

**EXAMPLE:**

```
(make-time-sig '(2 4))
```

```
=>
```

```
TIME-SIG: num: 2, denom: 4, duration: 2.0, compound: NIL, midi-clocks: 24, num-beats: 2
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0204", tag: NIL,
data: (2 4)
```

**SYNOPSIS:**

```
(defun make-time-sig (ts)
```

**20.2.482 time-sig/scale**

```
[ time-sig ] [ Methods ]
```

**DESCRIPTION:**

Scale the value of the given time-sig object by a specified factor.

**ARGUMENTS:**

- A time-sig object.
- A number (scaling factor).

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether or not to preserve the meter by maintaining the same number of beats as the numerator of the time signature. T = preserve the meter. Default = T.

**RETURN VALUE:**

A time-sig object.

#### EXAMPLE:

```
;; Scaling a (2 4) time-sig object by 3 creates a new time-sig object with a
;; value of 6/4
(let ((ts (make-time-sig '(2 4))))
  (scale ts 3))

=>
TIME-SIG: num: 6, denom: 4, duration: 6.0, compound: NIL, midi-clocks: 24, num-beats: 6
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: "0604", tag: NIL,
data: (6 4)
```

```
;; Scaling a (2 4) time-sig object by 2 by default preserves the meter
(let ((ts (make-time-sig '(2 4))))
  (data (scale ts 2)))
```

```
=> (2 2)
```

```
;; Scaling a (2 4) time-sig object by 2 with the optional argument set to NIL
;; changes the meter and results in a 4/4
(let ((ts (make-time-sig '(2 4))))
  (data (scale ts 2 nil)))
```

```
=> (4 4)
```

```
;; Halving the value of a time-sig object is achieved using a factor of .5
(let ((ts (make-time-sig '(2 4))))
  (data (scale ts .5)))
```

```
=> (2 8)
```

#### SYNOPSIS:

```
(defmethod scale ((ts time-sig) scaler
                  &optional (preserve-meter t) ignore1 ignore2)
```

#### 20.2.483 time-sig/time-sig-equal

[ *time-sig* ] [ *Methods* ]

#### DESCRIPTION:



Determine whether the values of two given time-sig objects are the same. If they are identical in signature, return T; if they are different signatures but have the same duration (e.g. 2/4, 4/8, 8/16 etc.) return TIME-SIG-EQUAL-DURATION; otherwise return NIL.

#### ARGUMENTS:

- A first time-sig object.
- A second time-sig object.

#### RETURN VALUE:

Returns T if the time signatures are identical; returns TIME-SIG-EQUAL-DURATION if they are different signatures with the same duration; otherwise NIL.

#### EXAMPLE:

```
;; Two identical signatures return T
(let ((ts1 (make-time-sig '(2 4)))
      (ts2 (make-time-sig '(2 4))))
  (time-sig-equal ts1 ts2))
```

=> T

```
;; Two different signatures of the same duration return TIME-SIG-EQUAL-DURATION
(let ((ts1 (make-time-sig '(2 4)))
      (ts2 (make-time-sig '(4 8))))
  (time-sig-equal ts1 ts2))
```

=> TIME-SIG-EQUAL-DURATION

```
;; Two completely different signatures return NIL
(let ((ts1 (make-time-sig '(2 4)))
      (ts2 (make-time-sig '(3 4))))
  (time-sig-equal ts1 ts2))
```

=> NIL

#### SYNOPSIS:

```
(defmethod time-sig-equal ((ts1 time-sig) (ts2 time-sig))
```

## 21 sc/slippy-chicken

[ Classes ]

**NAME:**

slippery-chicken

File: slippery-chicken.lsp

Class Hierarchy: named-object -> slippery-chicken

Version: 1.0.4

Project: slippery chicken (algorithmic composition)

Purpose: Implementation of the slippery-chicken class.

Author: Michael Edwards: m@michael-edwards.org

Creation date: March 19th 2001

\$\$ Last modified: 09:24:35 Thu Jan 9 2014 GMT

SVN ID: \$Id: slippery-chicken.lsp 4351 2014-01-09 09:35:31Z medward2 \$

**21.1 slippery-chicken/auto-set-written**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Automatically set the WRITTEN-PITCH-OR-CHORD slot for all events where the player plays a transposing instrument (which can change of course).

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :start-bar. NIL or an integer that is the first bar for which the written pitch/chord data is to be set. If NIL, start from bar 1. Default = NIL.
- :end-bar. NIL or an integer that is the last bar for which the written pitch/chord data is to be set. If NIL, do all bars. Default = NIL.
- :players. NIL, the ID or a list of IDs for the player(s) whose part(s) are to be affected. If NIL, all players' parts will be affected. Default = NIL.

**RETURN VALUE:**

T

**EXAMPLE:**

```

;;; Create a slippery-chicken object, set all the written-pitch-or-chord ;
;;; slots to NIL and print the results. Apply the method and print the results ;
;;; again to see the difference.          ;
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((hn (french-horn :midi-channel 1))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
       :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((hn (1 1 1 1 1))))))
      (next-event mini 'hn nil 1)
      (loop for ne = (next-event mini 'hn)
            while ne
            do (setf (written-pitch-or-chord ne) nil))
      (next-event mini 'hn nil 1)
      (print
       (loop for ne = (next-event mini 'hn)
             while ne
             collect (written-pitch-or-chord ne)))
      (auto-set-written mini)
      (next-event mini 'hn nil 1)
      (print
       (loop for ne = (next-event mini 'hn)
             while ne
             collect (data (written-pitch-or-chord ne))))))

=>
(NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL NIL
 NIL NIL NIL NIL NIL NIL NIL)
(C4 D4 E4 FS4 G4 C4 D4 E4 FS4 G4 C4 D4 E4 FS4 G4 C4 D4 E4 FS4 G4 C4 D4 E4
 FS4 G4)

```

**SYNOPSIS:**

```

(defmethod auto-set-written ((sc slippery-chicken) &key start-bar end-bar
                             players)

```

## 21.2 slippery-chicken/change-bar-line-type

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Change single to double or repeat bar lines and vice-versa. NB This is a score function only, i.e., if you add repeat bar lines these will not (yet) be reflected in playback with MIDI or CLM.

### ARGUMENTS:

- the slippery-chicken object
- the bar number at the end of which you want the bar line to change
- bar line type: 0 = normal, 1 = double bar, 2 = final double bar, 3 = begin repeat, 4 = begin and end repeat, 5 = end repeat

### RETURN VALUE:

always T

### EXAMPLE:

```
(let ((min
      (make-slippery-chicken
        '+minimum+
        :instrument-palette +slippery-chicken-standard-instrument-palette+
        :ensemble '(((fl (flute :midi-channel 1))))
        :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
        :set-map '((1 (1)))
        :rthm-seq-palette '((1 (((4 4) - e e e e - - e e e e -))))
        :rthm-seq-map '((1 ((fl (1)))))))
      ;; this piece only has one bar so the bar line will be 2 by default
      (print (bar-line-type (get-bar min 1 'fl)))
      (change-bar-line-type min 1 1)
      (bar-line-type (get-bar min 1 'fl)))
  =>
  ...
  2
  1
```

### SYNOPSIS:

```
(defmethod change-bar-line-type ((sc slippery-chicken) bar-num type)
```

### 21.3 slippery-chicken/check-beams

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:

See the description, with example, for check-beams in rthm-seq-bar.lsp. Players can either be a single symbol, a list of symbols, or nil (whereby all players will be checked).

#### SYNOPSIS:

```
(defmethod check-beams ((sc slippery-chicken) &key start-bar end-bar players
                        auto-beam print (on-fail #'warn))
```

### 21.4 slippery-chicken/check-ties

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:

Check that all ties are started and ended properly. If the optional argument <same-spellings> is set to T, all tied pitches will be forced to have the same enharmonic spellings.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to force all tied pitches to have the same enharmonic spellings.

#### RETURN VALUE:

T if all tie data is ok, otherwise performs the on-fail function and returns NIL.

#### EXAMPLE:

```
;;; Create a slippery-chicken object, manually create a problem with the ties,
;;; and call check-ties with a #'warn as the on-fail function.
(let* ((mini
       (make-slippery-chicken
```

```

'+mini+
:ensemble '(((cl (b-flat-clarinet :midi-channel 1))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1)))
:rthm-seq-palette '((1 (((4 4) { 3 tq tq tq } +q e (s) s))))
:rthm-seq-map '((1 ((cl (1))))))
(e4 (get-event mini 1 4 'cl))
(setf (is-tied-to e4) nil)
(check-ties mini nil #'warn))

```

```
=> WARNING: slippery-chicken::check-ties: bad tie, CL bar 1
```

## SYNOPSIS:

```

(defmethod check-ties ((sc slippery-chicken)
                       &optional same-spellings (on-fail #'error))

```

## 21.5 slippery-chicken/check-time-sigs

[ *slippery-chicken* ] [ *Methods* ]

### DATE:

28-Jan-2011

### DESCRIPTION:

Check every bar in the given slippery-chicken object to see if all players have the same time signature. Drops into the debugger with an error if not.

### ARGUMENTS:

- A slippery-chicken object.

### RETURN VALUE:

T if all players have the same time signature at the same time, otherwise drops into the debugger with an error.

### EXAMPLE:

```

;; A successful test
(let* ((mini
(make-slippery-chicken

```

```

'+mini+
:ensemble '(((vn (violin :midi-channel 1))
(va (viola :midi-channel 2))
(vc (cello :midi-channel 3))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((4 4) { 3 tq tq tq } +q e (s) s))))
:rthm-seq-map '((1 ((vn (1 1 1))
(va (1 1 1))
(vc (1 1 1))))))
(check-time-sigs mini))

=> T

;; A failing test
(let* ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((vn (violin :midi-channel 1))
(va (viola :midi-channel 2))
(vc (cello :midi-channel 3))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((4 4) { 3 tq tq tq } +q e (s) s))))
:rthm-seq-map '((1 ((vn (1 1 1))
(va (1 1 1))
(vc (1 1 1))))))
(setf (time-sig (get-bar mini 1 'vn)) '(3 4))
(check-time-sigs mini))

=>
slippery-chicken::check-time-sigs: time signatures are not the same at bar 1
[Condition of type SIMPLE-ERROR]

```

**SYNOPSIS:**

```
(defmethod check-time-sigs ((sc slippery-chicken))
```

**21.6 slippery-chicken/check-tuplets**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Check the qualities of the tuplets brackets in a given slippery-chicken

object to make sure they are all formatted properly (i.e. each starting tuplet bracket has a closing tuplet bracket etc.). If an error is found, the method will try to fix it, then re-check, and only issue an error then if another is found.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

- The function to use if something is not ok with the tuplets. This defaults to #'error, but could also be #'warn for example

#### RETURN VALUE:

T if all tuplets brackets are ok, otherwise performs the on-fail function and returns NIL.

#### EXAMPLE:

```
;;; Create a slippery-chicken object, manually add an error to the tuplet data
;;; and call check-tuplets with #'warn as the on-fail function.
```

```
(let* ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((cl (b-flat-clarinet :midi-channel 1))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1)))
:rthm-seq-palette '((1 (((4 4) { 3 tq tq tq } +q e (s) s))))
:rthm-seq-map '((1 ((cl (1))))))
(e1 (get-event mini 1 1 'cl)))
(setf (bracket e1) nil)
(check-tuplets mini #'warn))
```

```
=> rthm-seq-bar::check-tuplets: Can't close non-existent bracket.
```

#### SYNOPSIS:

```
(defmethod check-tuplets ((sc slippery-chicken) &optional (on-fail #'error))
```

### 21.7 slippery-chicken/clm-play

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:



Using the sound files (samples) defined for the given reference (group ID) in the sndfile-palette slot of the slippery-chicken object, use CLM to generate a new sound file using the pitch and timing information of one or more players' parts from the slippery-chicken object.

NB: The sound file will begin with the first sounding event in the section at 0.0 seconds. If there are any leading rests in the player's part, these will be omitted in the output file.

By grouping sound files in the sndfile-palette slot, the user can generate a CLM sound file version of the piece in various 'flavours'; perhaps, for example, using exclusively source sound files consisting of string samples, or percussion sounds, or a variety of sounds, as desired. See below for an example of a sndfile-palette.

By default this method does not attempt to match the pitches of the output sound file to those generated for the slippery-chicken object, but rather generates its own sequence of pitches based on pitches from the current set. Instead of using the pitches of the specified players' parts, which might produce extreme sound file transpositions both upwards and downwards, it accesses each note of the current set (assigned by the set-map to each rthm-seq) from the bottom up, one voice after another. If do-src is T, transposition will then be calculated such that the frequency of the sound file, if specified, will be shifted to the pitch of the given pitch of the set. Since this transposition process may still yield extreme transpositions, the note-number keyword can be specified to indicate an index into the current set of pitches to serve as the lowest voice instead. However, if the number of voices plus this index exceeds the number of pitches in the set, the method will wrap around to the lowest pitch of the set.

If instead of the above method the user would like the pitches in the resulting sound file to be transposed to match the pitches of the slippery-chicken object, the keyword argument :pitch-synchronous can be set to T (and do-src should be left set to T as well). This will also work with chords.

See also make-sfp-from-wavelab-marker-file in sndfile-palette.lsp for automatically creating a sndfile-palette from markers in a Steinberg Wavelab marker file.

Event amplitudes are as yet unused by this method.

NB: CLM's nrev instrument must be loaded before calling this method.

## ARGUMENTS:

- A slippery chicken object.
- The ID of the starting section.
- The IDs of the player(s) whose events are to be used to obtain the rhythmic structure (and optionally, pitch content) of the resulting sound file. This can be a single symbol for an individual player, a list of player IDs, or NIL. If NIL, the event from all players' parts will be reflected in the output file. Default = NIL.
- The ID of the sound file group in the sndfile-palette slot of the slippery-chicken object that contains the source sound files from which the new sound file is to be generated.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :num-sections. An integer or NIL to indicate how many sections should be generated, including the starting section. If NIL, sound file data will be generated for all sections of the piece. NB If there are sub-sections this will include them in the total, i.e., if section 1 has 3 subsections and :num-sections is 2, we'll generate data from the first two subsections of section 1, not all subsections of main sections 1 and 2. Default = NIL.
- :from-sequence. An integer that is the number of the first sequence within the specified starting section to be used to generate the output file. This argument can only be used when num-sections = 1. Default = 1.
- :num-sequences. NIL or an integer that indicates how many sequences are to be generated, including that specified by :from-sequence. If NIL, all sequences will be played. This argument can only be used when num-sections = 1 and the section has no subsections. Default = NIL.
- :srate. A number that is the sampling rate of the output file (independent of the input file). This and the following two arguments default to the CLM package globals. See [clm.html](#) for more options. Default = `clm::*clm-srate*`.
- :header-type. A CLM package header-type specification to designate the output sound file format. For example, `clm::mus-riff` will produce .wav files, `clm::mus-aiff` will produce .aiff files. The value of this argument defaults to the CLM package globals. See [clm.html](#) for more options. Default = `clm::*clm-header-type*`.
- :data-format. A CLM package data-format specification to designate the output sound file sample data format. For example, `clm::mus-float` will produce a 32-bit little-endian floating-point format; `clm::mus-l24int` will produce little-endian 24-bit integer; `mus-bshort` will produce 16-bit big-endian files, and `mus-bfloat` will produce 32-bit floating-point big-endian files. NB: AIFF and AIFC files are not compatible with little endian formats. The value of this argument defaults to the CLM package globals. See [clm.html](#) for more options. Default = `clm::*clm-data-format*`.

- :sndfile-extension. NIL or a string that will be the extension of the output sound file (e.g. ".wav", ".aif"). If NIL, the method will determine the extension automatically based on the header-type. NB: The extension does not determine the output sound file format; that is determined by :header-type. Default = NIL.
- :channels. An integer that is the number of channels in the output sound file, limited only by the sound file format specified. Note that both stereo and mono sounds from the palette will be randomly panned between any two adjacent channels. Default = 2.
- :rev-amt. A number that determines the amount of reverberation for the resulting sound file, passed to CLM's nrev.  
NB: 0.1 is a lot. Default = 0.0.
- time-offset. A number that is an offset time in seconds. This produces a lead time of a specified number of seconds of silence prior to the sound output.
- :play. T or NIL to indicate whether CLM should play the output file automatically immediately after it has been written.  
T = play. Default = NIL.
- :inc-start. T or NIL to indicate whether playback of the source sound files is to begin at incrementally increasing positions in those files or at their respective 0.0 positions every time. If T, the method will increment the position in the source sound file from which playback is begun such that it reaches the end of the source sound file the last time it is 'played'. T = increment start times. Default = NIL.
- :ignore-rests. T or NIL to indicate whether silence should be incorporated into the resulting sound file to correspond with rests in the player's parts. If T, the sound files will play over the duration of rests. However, this is only true on a bar-by-bar basis; i.e., notes at the end of one bar will not be continued over into a rest in the next bar. This implies that rests at the start of a bar will not be turned into sounding notes. T = ignore resets. Default = T.
- :sound-file-palette-ref2. The ID of a sound file group in the given slippery-chicken object's sndfile-palette slot. If this reference is given, the method will invoke fibonacci-transitions to transition from the first specified group of source sound files to this one. If NIL, only one group of source sound files will be used. Default = NIL.
- :do-src. T, a number, or a note-name pitch symbol to indicate whether transposition of the source sound files for playback will be calculated such that the perceived fundamental frequencies of those sound files are shifted to match the pitches of the current set. If do-src is a number (frequency in Hertz) or a note-name pitch symbol, the method will use only that pitch instead of the sound files' frequencies when transposing to the events' pitches. NB Whichever is used, after being converted to a sample rate conversion factor, this is always multiplied by the src-scaler (see below). T = match sound files' frequencies to set pitches. Default = T.

- `:pitch-synchronous`: T or NIL to indicate whether the source sound files are to be transposed to match the pitches of the events in the given players' part. This will only be effective if the given source sound file has a perceptible frequency that has been specified using the `sndfile` object's `:frequency` slot in the `sndfile-palette`. `:do-src` must also be T for this to work. T = match pitches. Default = NIL.
- `:reset-snds-each-rs`. T or NIL to indicate whether to begin with the first source sound file of the specified group at the beginning of each `rthm-seq`. T = begin with the first sound file. Default = T.
- `:reset-snds-each-player`. T or NIL to indicate whether to begin with the first source sound file of the specified group for the beginning of each player's part. T = begin with the first sound file. Default = T.
- `:play-chance-env`. A list of break-point pairs that determines the chance that a given even from the source player's part will be reflected in the new sound file. It is determined by random selection but uses a fixed seed that is re-initialized each time `clm-play` is called. The following default ensures every note will play. Default = '(0 100 100 100).
- `:play-chance-env-exp`. A number that will be applied as the exponent to the `play-chance-env`'s y values to create an exponential interpolation between break-point pairs. Default = 0.5.
- `:max-start-time`. A number that is the last time-point in seconds for which events will be processed for the output file. If a maximum start time is specified here (in seconds), events after this will be skipped. The default value of 99999999 seconds (27778 hours) will result in all events being reflected in the sound file.
- `:time-scaler`. A number that will be the factor by which all start times are scaled for the output file (in effect a tempo scaler). If `:ignore-rests` is T, this will also have an indirect effect on durations. This argument should not be confused with `:duration-scaler`. Default = 1.0.
- `:duration-scaler`. A number that is the factor by which the duration of all events in the output sound file will be scaled. This does not alter start times, and will therefore result in overlapping sounds if greater than 1.0. This is not to be confused with `:time-scaler`. Default = 1.0.
- `:normalise`. A decimal number that will be the maximum amplitude of the resulting output file; i.e., to which the samples will be scaled. Can also be NIL, whereupon no normalisation will be performed. Default = 0.99
- `:amp-env`. A list of break-point pairs that will govern the amplitude envelope applied to all source-sound files as it is being written to the new output file. NB: If the user wants to maintain the original attack of the source sound file and is not employing the `:inc-start` option, this should be set to '(0 1 ...). If `:inc-start` is T, the resulting sound file will probably contain clicks from non-zero crossings. Default = '(0 0 5 1 60 1 100 0).
- `:src-width`. An integer that reflects the accuracy of the sample-rate

conversion. The higher the value, the more accurate the transposition, but the slower the processing. Values of 100 might be useful for very low transpositions. Default = 20.

- :src-scaler: A number that is the factor by which all sample-rate conversion values will be scaled (for increasing or decreasing the transposition of the overall resulting sound file). Default = 1.0.
- :note-number. A number that is an index, representing the the nth pitch of the current set or chord (from the bottom) to be used for the lowest player. Default = 0.
- :duration-run-over. T or NIL to indicate whether the method will allow a sound file event to extend past the end of specified segment boundaries of a sound file in the sndfile-palette. T = allow. Default = NIL.
- :short-file-names. T or NIL to indicate whether abbreviated output file names will be automatically created instead of the usually rather long names. T = short. Default = NIL.
- :output-name-uniquifier. A user-specified string that will be incorporated into the file name, either at the end or the beginning depending on whether short-file-names is T or NIL. Default = "".
- :check-overwrite. T or NIL to indicate whether to query the user before overwriting existing sound files. T = query. Default = T.
- :print-secs. T or NIL to indicate whether CLM should print the seconds computed as it works. T = print. Default = NIL.
- :simulate. T or NIL to indicate whether only the sound file sequencing information should be calculated and printed for testing purposes, without generating a sound file. T = simulate. Default = NIL.
- :sndfile-palette. NIL or a file name including path and extension that contains an external definition of a sndfile-palette. This will replace any sndfile-palette defined in the slippery-chicken object. If NIL, the one in the slippery-chicken object will be used. Default = NIL.
- :chords. NIL or a list of lists consisting of note-name symbols to be used as the pitches for the resulting sound file in place of the pitches from the set-map. There must be one chord specified for each sequence. If NIL, the pitches from the set-map will be used. Default = NIL.
- :chord-accessor. Sometimes the chord stored in the palette is not a simple list of data so we need to access the nth of the chord list. Default = NIL.
- :clm-ins. The CLM instrument that should be called to generate sound file output. This must accept required and keyword arguments like samp5 (see src/samp5.lsp or more simply src/sine.lsp) but can of course choose to ignore them. Remember that your CLM instruments will (most probably) be in the CLM package so you'll need the clm:: qualifier. Default = #'clm::samp5.
- :clm-ins-args. This should be a list of keyword arguments and values to pass to each CLM instrument call (e.g. '(:cutoff-freq 2000 :q .6)) or a function which takes two arguments (the current event and the event number) and returns a list of keyword arguments perhaps based on

**RETURN VALUE:**

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (hn (french-horn :midi-channel 2))
                        (vc (cello :midi-channel 3))))
        :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1 1))
                    (2 (1 1 1 1 1 1))
                    (3 (1 1 1 1 1 1)))
      :rthm-seq-palette '(((1 (((4 4) h (q) e (s) s))
                                :pitch-seq-palette ((1 (2) 3))))
                            (2 (((4 4) (q) e (s) s h))
                                :pitch-seq-palette ((1 2 (3)))))
                            (3 (((4 4) e (s) s h (q))
                                :pitch-seq-palette ((2 3 3))))
                            (4 (((4 4) (s) s h (q) e))
                                :pitch-seq-palette ((3 (1) 2)))))
      :rthm-seq-map '(((1 ((cl (2 3 2 4 1 3 1))
                              (hn (2 4 1 2 3 1 3))
                              (vc (1 2 2 3 4 1 3)))))
                        (2 ((cl (4 2 1 3 3 1 2))
                              (hn (2 1 4 3 2 1 3))
                              (vc (2 3 4 3 1 2 1)))))
                        (3 ((cl (3 1 2 4 3 1 2))
                              (hn (3 4 2 1 3 2 1))
                              (vc (3 2 3 1 4 2 1)))))
      :snd-output-dir (get-sc-config 'default-dir)
      :sndfile-palette '(((sndfile-grp-1
                            ((test-sndfile-1.aiff)
                             (test-sndfile-2.aiff)
                             (test-sndfile-3.aiff)))
                            (sndfile-grp-2
                             ((test-sndfile-4.aiff :frequency 834)
                              (test-sndfile-5.aiff)
                              (test-sndfile-6.aiff)))))
      ("/path/to/sndfiles-dir-1"
```

```

                                "/path/to/sndfiles-dir-2")))))
(clm-play mini 2 '(cl vc) 'sndfile-grp-1
  :num-sections 1
  :srate 48000
  :header-type clm::mus-aiff
  :data-format clm::mus-b24int
  :rev-amt 0.05
  :inc-start t
  :ignore-rests nil
  :sound-file-palette-ref2 'sndfile-grp-2
  :pitch-synchronous t
  :reset-snds-each-rs nil
  :reset-snds-each-player nil))

```

**SYNOPSIS:**

```

#+clm
(defmethod clm-play ((sc slippery-chicken) section players
  sound-file-palette-ref
  &key
  sound-file-palette-ref2
  (play-chance-env '(0 100 100 100))
  (max-start-time 99999999)
  (play-chance-env-exp 0.5)
  (time-scaler 1.0)
  (normalise .99)
  (simulate nil)
  (from-sequence 1)
  (num-sequences nil)
  (num-sections nil)
  (ignore-rests t)
  (time-offset 0.0)
  (chords nil)
  (chord-accessor nil)
  (note-number 0)
  (play nil)
  (amp-env '(0 0 5 1 60 1 100 0))
  (inc-start nil)
  (src-width 20)
  (src-scaler 1.0)
  (do-src t)
  (pitch-synchronous nil)
  (rev-amt 0.0)
  (duration-scaler 1.0)
  (short-file-names nil)
  (check-overwrite t)

```

```

(reset-snds-each-rs t)
(reset-snds-each-player t)
(duration-run-over nil)
(channels 2)
(srate clm::*clm-srate*)
(header-type clm::*clm-header-type*)
(data-format clm::*clm-data-format*)
(print-secs nil)
(output-name-uniquifier "")
(sndfile-extension nil)
(sndfile-palette nil)
;; MDE Mon Nov 4 10:10:35 2013 -- the following were
;; added so we could use instruments other than samp5
(clm-ins #'clm::samp5)
;; either a list or a function (see above)
clm-ins-args)

```

## 21.8 slippery-chicken/clone

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Copy (clone) the specified instance and all data associated with the slippery-chicken object.

### ARGUMENTS:

- A slippery-chicken object.

### RETURN VALUE:

A slippery-chicken object.

### EXAMPLE:

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :instrument-palette +slippery-chicken-standard-instrument-palette+
       :ensemble '(((fl (flute :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1)))
       :rthm-seq-palette '((1 (((4 4) - e e e e - - e e e e -))))
       :rthm-seq-map '((1 ((fl (1)))))))
      (clone mini)))

```



**SYNOPSIS:**

```
(defmethod clone ((sc slippery-chicken))
```

**21.9 slippery-chicken/cmn-display**

```
[ slippery-chicken ] [ Methods ]
```

**DESCRIPTION:**

Write the data stored in a given slippery-chicken object to disk as an EPS (Encapsulated Postscript) file using CMN.

Several of the keyword arguments for this method are passed directly to CMN and therefore have identical names to CMN functions.

NB: This might fail if LilyPond files are generated first. If this happens, re-evaluate the slippery-chicken object and call cmn-display again.

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :file. A string that is the directory path with file name and extension for the .eps file to be created. Default = "cmn.eps" in the directory (get-sc-config 'default-dir) (default "/tmp/")
- :players. NIL or a list of player IDs to indicate whether all players' parts should be printed to the score. If NIL, all players' parts will be written to the score. If a single symbol or a list of player IDs, only the parts of those players will be written to the score. Default = NIL.
- :in-c. T or NIL to indicate whether the output should be printed at sounding pitch (in C) or at written pitch. NB: If in C, piccolo and double bass maintain their usual octave transpositions. T = print at sounding pitch. Default = NIL.
- :respell-notes. T, a list of player IDs paired with a sequence of bar and note numbers, or NIL to indicate whether to the cmn-display method should call the respell-notes method to the pitches contained in the slippery-chicken object according to slippery chicken's enharmonics algorithm. If T, the all of the pitches in the object will be considered and slippery chicken will convert a number of the pitches to their enharmonic equivalents to create more sensible linear pitch progression within bars. If a list of player IDs paired with a sequence of bar and

event numbers is passed, in the form

- ```
'((vln (13 2) (14 3)) (cl (14 3 t)))
```
- , only the specified pitches are changed; e.g., (13 2) = bar 13 note 2 (1-based and counting tied notes but not rests). If an additional T is included after the bar number and event number (as in the cl example above), only the spelling of the written pitch for that event will be changed (the default is to change the sounding note spelling only). Chords are not respelled by the default algorithm, so if these need to be respelled, this should be indicated by sub-grouping the note number portion of the given bar/note pair into a 2-item sublist, in which the first number is the position of the chord in among the attacked notes of that bar and the second number is the position of the desired pitch within the chord, counted from the bottom up, e.g. (vln (13 (2 1))). If NIL, no changes will be made. Default = T.
- :auto-clefs. T or NIL to indicate whether the cmn-display method should call the auto-clefs method, which automatically insert clef changes into the parts of those instruments that use more than one clef. T = automatically place clef changes. Default = T.
  - :start-bar. An integer that indicates the first bar of the object to be written to the resulting .eps file. NIL = the first bar. Default = NIL.
  - :end-bar. The last bar to be written to the resulting .eps file. NIL = the last bar of the slippery-chicken object. Default = NIL.
  - :title. T, a string, or NIL to indicate whether to write the title of the given slippery-chicken object to the resulting .eps file. If T, the TITLE slot of the slippery-chicken object will be used. If a string, the specified string will be used instead. If NIL, no title will be included in the output. Default = T.
  - :size. A number to indicate the overall size of the symbols in the CMN output. Default = 15.
  - :page-nums. T or NIL to indicate whether page numbers are to be written. T = write page numbers. Default = T.
  - :empty-staves. T or NIL to indicate whether an empty staff should be displayed under each instrument. This can be useful for making editing notes by hand. T = print empty staff. Default = NIL.
  - :display-sets. T or NIL to indicate whether to print the set of pitches used for each rthm-seq on a separate treble-bass grand staff at the bottom of each system in the score. T = print. Default = NIL.
  - :write-section-info. T or NIL to indicate whether to write the section ID into the score. NB: This might not work without first regenerating the slippery-chicken object. T = write section IDs. Default = NIL.
  - :display-time. T or NIL to indicate whether the elapsed time in (mins:secs) should printed above each measure in the resulting score. T = print time. Default = NIL.
  - :staff-separation. A number that governs the amount of white space to be placed between staves, measured in CMN's units. Default = 3.
  - :line-separation. A number that governs the amount of white space to be placed between systems (i.e. not groups, but a line of music for the

- whole ensemble), measured in CMN's units. Default = 5.
- :group-separation. A number that governs the amount of white space placed between groups in a system, measured in CMN's units. Default = 2.
  - :system-separation. An indication for how CMN determines the amount of white space between systems. If `cmn::page-mark`, only one system will be written per page. Default `cmn::line-mark`.
  - :page-height. A number to indicate the height of the page in centimeters. Default = 29.7.
  - :page-width. A number to indicate the width of the page in centimeters. Default = 21.0.
  - :all-output-in-one-file. T or NIL to indicate whether to write a separate file for each page of the resulting score. T = write all pages to the same multi-page file. Default = T.
  - :one-line-per-page. T or NIL to indicate whether to write just one line (system) to each page. T = one line per page. Default = NIL.
  - :start-bar-numbering. An integer that indicates the number to be given as the first bar number in the resulting EPS file. The bars will be numbered every five bars starting from this number. NB: The value of this argument is passed directly to a CMN function. If a value is given for this argument, slippery chicken's own bar-number writing function will be disabled. NB: It is recommended that a value not be passed for this argument if a value is given for :auto-bar-nums. NIL = bar 1. Default = NIL.
  - :auto-bar-nums. An integer or NIL to indicate a secondary bar numbering interval. This is separate from and in addition to the bar-number written in every part every 5 bars. It corresponds to CMN's `automatic-measure-numbers`. If set to e.g. 1, a bar number will be printed for every measure at the top of each system, or if :by-line, a bar number will be printed at the start of each line. NB: The value of this argument is passed directly to a CMN function. If a value is given for this argument, slippery chicken's own bar-number writing function will be disabled. NB: It is recommended that a value not be passed for this argument if a value is given for :start-bar-numbering. NIL = no secondary bar numbering. Default = NIL.
  - :rehearsal-letters-all-players. T or NIL to indicate whether rehearsal letters should be placed above the staves of all instruments in a score (this can be useful when generating parts). If NIL, rehearsal letters are only placed above the staves of the instruments at the top of each group. T = place rehearsal letters above all instruments. Default = NIL.
  - :tempi-all-players. T or NIL to indicate whether to print the tempo above all players' parts in the score. T = print above all players' parts. Default = NIL.
  - :process-event-fun. A user-defined function that takes one argument, namely an event object. The specified function will then be called for each event in the piece. This could be used, for example, to algorithmically add accents, dynamics, or change the colour of notes,

- etc. If NIL, no function will be applied. Default = NIL.
- :automatic-octave-signs. T or NIL to indicate whether ottava signs should be inserted automatically when notes would otherwise need many ledger lines. T = automatically insert. Default = NIL.
  - :multi-bar-rests. T or NIL to indicate whether multiple bars of rests should be consolidated when writing parts. T = consolidate. NIL = write each consecutive rest bar separately. Default = NIL.
  - :display-marks-in-part. T or NIL to indicate whether to print the marks stored in the MARKS-IN-PART slot of each rhythm object in the score. If NIL, the indications stored in the MARKS-IN-PART slot are added to parts only. T = also print to score. Default = NIL.
  - :add-postscript. NIL or postscript code to be added to the .eps file after it has been generated. See the add-ps-to-file function for details. Default = NIL.
  - :auto-open. Whether to open the .EPS file once written. Currently only available on OSX with SBCL and CCL. Uses the default app for .EPS files, as if opened with 'open' in the terminal. Default = Value of (get-sc-config cmn-display-auto-open).

**RETURN VALUE:**

Always T.

**EXAMPLE:**

;;; The simplest usage

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :title "mini"
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 60)))
       :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1)))
       :rthm-seq-palette '((1 (((2 4) (s) (s) e e e))
                             :pitch-seq-palette ((1 2 3))))
       :rthm-seq-map '((1 ((vn (1)))))))
      (cmn-display mini :file "/tmp/mini.eps"))
```

;;; Used with some of the more frequently implemented keyword arguments

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                     (hn (french-horn :midi-channel 2))
                     (vc (cello :midi-channel 3)))))
```

```

:tempo-map '((1 (q 60)))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5)))
              (2 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5)))
              (3 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1))
          (2 (2 2 2 2 2))
          (3 (3 3 3 3 3)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
                     :pitch-seq-palette ((1 2 3 4 5))))
                  (2 (((4 4) q e s s h))
                     :pitch-seq-palette ((1 2 3 4 5))))
                  (3 (((4 4) e s s h q))
                     :pitch-seq-palette ((1 2 3 4 5))))
:rthm-seq-map '((1 ((cl (1 3 2 1 2))
                     (hn (3 1 1 2 2))
                     (vc (1 1 3 2 2)))))
              (2 ((cl (3 1 1 2 2))
                  (hn (1 3 1 2 2))
                  (vc (3 2 2 1 1)))))
              (3 ((cl (1 1 3 2 2))
                  (hn (2 1 1 2 3))
                  (vc (3 1 1 2 2))))))
(cmn-display mini
 :file "/tmp/cmn.eps"
 :players '(cl vc)
 :in-c nil
 :respell-notes nil
 :auto-clefs nil
 :start-bar 8
 :end-bar 13
 :title "CMN Fragment"
 :size 13
 :page-nums nil
 :empty-staves t
 :display-sets t
 :write-section-info t
 :display-time t
 :staff-separation 2
 :line-separation 3))

```

=> T

## SYNOPSIS:

```

#+cmn
(defmethod cmn-display ((sc slippery-chicken)

```

```

&key
(respell-notes t)
(start-bar nil)
(start-bar-numbering nil)
(end-bar nil)
;; MDE Fri Apr 6 13:27:08 2012
(title t)
(file (format nil "~a~a.eps"
              (get-sc-config 'default-dir)
              (filename-from-title (title sc))))
(all-output-in-one-file t)
(one-line-per-page nil)
(staff-separation 3)
(line-separation 5)
(empty-staves nil)
(write-section-info nil)
(group-separation 2)
(system-separation cmn::line-mark)
(process-event-fun nil)
(display-sets nil)
(rehearsal-letters-all-players nil)
(display-marks-in-part nil)
(tempi-all-players nil)
(players nil)
(page-height 29.7)
(page-width 21.0)
(size 15)
(auto-bar-nums nil)
(page-nums t)
(in-c nil)
(auto-clefs t)
(multi-bar-rests nil)
(automatic-octave-signs nil)
(display-time nil)
(auto-open (get-sc-config 'cmn-display-auto-open))
(add-postscript nil))

```

## 21.10 slippery-chicken/copy-bars

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Copy the rhythmic contents (rthm-seq-bar objects) from the specified bars of one specified player's part to another. NB No check is performed to

ensure that the copied notes are within the new instrument's range.

#### ARGUMENTS:

- A slippery-chicken object.
- A 1-based integer or assoc-list reference (section seq-num bar-num) that is the number of the first bar in the source player's part whose rhythmic contents are to be copied.
- A 1-based integer or assoc-list reference (section seq-num bar-num) that is the number of the first bar in the target player's part to which the rhythmic contents are to be copied.
- The ID of the source player's part.
- The ID of the target player's part.
- NIL or an integer that is the number of bars to copy, including the start-bar. When NIL, all bars in the piece starting from <to-start-bar> will be copied.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to print feedback to the listener about the copying process. T = print. Default = NIL.

#### RETURN VALUE:

T

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((hn (french-horn :midi-channel 1))
                     (vc (cello :midi-channel 2))))
       :set-palette '(((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '(((1 (1 1 1 1 1))
                    (2 (1 1 1 1 1))
                    (3 (1 1 1 1 1)))
       :rthm-seq-palette '(((1 (((4 4) h q e s s))
                                :pitch-seq-palette ((1 2 3 4 5))))
                           (2 (((4 4) h h))
                                :pitch-seq-palette ((1 2))))))
      :rthm-seq-map '(((1 ((hn (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (2 ((hn (2 2 2 2 2))
                              (vc (2 2 2 2 2))))))
```

```

                (3 ((hn (1 1 1 1 1))
                    (vc (1 1 1 1 1))))))
(copy-bars mini 7 2 'vc 'hn 2 t))

=> T

```

**SYNOPSIS:**

```

(defmethod copy-bars ((sc slippery-chicken) from-start-bar to-start-bar
                    from-player to-player num-bars
                    &optional (print-bar-nums nil))

```

**21.11 slippery-chicken/count-notes**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Returns the number of notes between start-bar and end-bar (both inclusive).

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the first bar in which notes will be counted.
- An integer that is the last bar in which notes will be counted.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether to count just the number of attacked notes (not including ties) or the number of note events (including ties).  
T = just attacked notes. Default = NIL.  
NB: A chord counts as one note only.
- NIL or a list of one or more IDs of the players whose notes should be counted. This can be a single symbol or a list of players. If NIL, the notes in all players' parts will be counted. Default = NIL.

**RETURN VALUE:**

An integer that is the number of notes.

**EXAMPLE:**

```
;;; Using defaults
```



```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1))
                   (2 (1 1 1 1 1))
                   (3 (1 1 1 1 1))))
      :rthm-seq-palette '(((1 (((4 4) h (q) e (s) s)
                                (q (e) s +s h)
                                ((e) s (s) (q) h))
                              :pitch-seq-palette ((1 2 3 4 5 1 3 2))))))
      :rthm-seq-map '(((1 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (2 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (3 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1)))))))
      (count-notes mini 2 11))

```

=> 62

;;; Counting all notes just for player 'vc

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1))
                   (2 (1 1 1 1 1))
                   (3 (1 1 1 1 1))))
      :rthm-seq-palette '(((1 (((4 4) h (q) e (s) s)
                                (q (e) s +s h)
                                ((e) s (s) (q) h))
                              :pitch-seq-palette ((1 2 3 4 5 1 3 2))))))
      :rthm-seq-map '(((1 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (2 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1))))
                       (3 ((cl (1 1 1 1 1))
                              (vc (1 1 1 1 1)))))))
      (count-notes mini 2 11 nil 'vc))

```

=> 31

```

;;; Counting just the attacked notes for player 'vc
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h (q) e (s) s)
                                (q (e) s +s h)
                                ((e) s (s) (q) h))
                           :pitch-seq-palette ((1 2 3 4 5 1 3 2))))
      :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                            (vc (1 1 1 1 1))))
                     (2 ((cl (1 1 1 1 1))
                            (vc (1 1 1 1 1))))
                     (3 ((cl (1 1 1 1 1))
                            (vc (1 1 1 1 1))))))
      (count-notes mini 2 11 t 'vc))

=> 27

```

**SYNOPSIS:**

```

(defmethod count-notes ((sc slippery-chicken) start-bar end-bar
                        &optional just-attacks players)

```

**21.12 slippery-chicken/find-note**

[ *slippery-chicken* ] [ *Methods* ]

**DATE:**

09-Apr-2011

**DESCRIPTION:**

Print to the Listener the numbers of all bars in a specified player's part of a given slippery-chicken object in which the specified pitch is found.

**ARGUMENTS:**

- A slippery-chicken object.
- A player ID.
- A note-name pitch symbol or a list of note-name pitch symbols for the pitch to be sought. If a list, this will be handled as a chord.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :written. T or NIL to indicate whether to look for the specified pitch as as a written note only. T = as written only. Default = NIL.
- :start-bar. An integer that is the first bar in which to search for the given pitch. This number is inclusive. Default = 1.
- :end-bar. An integer that is the last bar in which to search for the given pitch. This number is inclusive. Default = number of bars in the given slippery-chicken object.

#### RETURN VALUE:

Returns a list of all corresponding event objects found. Prints the bar numbers of the results directly to the Lisp listener.

#### EXAMPLE:

```
;;; Prints the bar number for all occurrences in the entire piece by default
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1((((4 4) h (q) e (s) s)
                                (q (e) s +s h)
                                ((e) s (s) (q) h))
                             :pitch-seq-palette ((1 2 3 4 5 1 3 2))))
       :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                             (vc (1 1 1 1 1))))
                       (2 ((cl (1 1 1 1 1))
                             (vc (1 1 1 1 1))))
                       (3 ((cl (1 1 1 1 1))
                             (vc (1 1 1 1 1))))))
      (find-note mini 'vc 'f4))
```

=&gt;

bar 1  
 bar 3  
 bar 4  
 bar 6  
 bar 7  
 bar 9  
 bar 10  
 bar 12  
 bar 13  
 bar 15  
 bar 16  
 bar 18  
 bar 19  
 bar 21  
 bar 22  
 bar 24  
 bar 25  
 bar 27  
 bar 28  
 bar 30  
 bar 31  
 bar 33  
 bar 34  
 bar 36  
 bar 37  
 bar 39  
 bar 40  
 bar 42  
 bar 43  
 bar 45

;;; Examples of use specifying the optional arguments

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                       (vc (cello :midi-channel 2))))
       :set-palette '(((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '(((1 (1 1 1 1 1))
                    (2 (1 1 1 1 1))
                    (3 (1 1 1 1 1)))
       :rthm-seq-palette '(((1 (((4 4) h (q) e (s) s)
                                   (q (e) s +s h)
                                   ((e) s (s) (q) h))
                               :pitch-seq-palette ((1 2 3 4 5 1 3 2))))))

```

```

:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                      (vc (1 1 1 1 1))))
              (2 ((cl (1 1 1 1 1))
                  (vc (1 1 1 1 1))))
              (3 ((cl (1 1 1 1 1))
                  (vc (1 1 1 1 1))))))
(find-note mini 'cl 'f3)
(find-note mini 'cl 'f3 :written t)
(find-note mini 'vc 'f4 :start-bar 3 :end-bar 17))

```

**SYNOPSIS:**

```

(defmethod find-note ((sc slippery-chicken) player note &key (written nil)
                    start-bar end-bar)

```

**21.13 slippery-chicken/find-rehearsal-letters**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return in list form the numbers of bars in the given slippery-chicken object that have rehearsal letters.

**ARGUMENTS:**

- A slippery-chicken object.

**RETURN VALUE:**

A list of numbers.

**EXAMPLE:**

```

(let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((vn (violin :midi-channel 1))))
:tempo-map '((1 (q 60)))
:rehearsal-letters '(2 5 7)
:set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1 1 1 1 1)))
:rthm-seq-palette '((1 (((2 4) (s) (s) e e e))
:pitch-seq-palette ((1 2 3))))
:rthm-seq-map '((1 ((vn (1 1 1 1 1 1 1))))))

```

```
(find-rehearsal-letters mini))
```

```
=> (2 5 7)
```

**SYNOPSIS:**

```
(defmethod find-rehearsal-letters ((sc slippery-chicken))
```

**21.14 slippery-chicken/get-all-events**

```
[ slippery-chicken ] [ Methods ]
```

**DATE:**

August 22nd 2013 (Edinburgh)

**DESCRIPTION:**

Return a flat list containing all the events of a slippery-chicken object fo the given player.

**ARGUMENTS:**

- The slippery-chicken object
- The player (symbol)

**RETURN VALUE:**

A list of event objects

**SYNOPSIS:**

```
(defmethod get-all-events ((sc slippery-chicken) player)
```

**21.15 slippery-chicken/get-all-section-refs**

```
[ slippery-chicken ] [ Methods ]
```

**DESCRIPTION:**

Return all section IDs as a list of lists. Subsection IDs will be contained in the same sublists as their enclosing sections.

**ARGUMENTS:**

- A slippery-chicken object.

## RETURN VALUE:

A list of lists.

## EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '(1 (1 1 1))
                  (2 (1 1 1))
                  (3 ((a (1 1 1))
                       (b ((x (1 1 1))
                           (y (1 1 1))))))
                  (4 ((a (1 1 1))
                       (b (1 1 1))
                       (c (1 1 1 1))))
                  (5 (1 1 1))
                  (6 (1 1 1))
                  (7 (1 1 1)))
      :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
      :rthm-seq-map '(1 ((sax (1 1 1)))
                       (2 ((sax (1 1 1)))
                           (3 ((a ((sax (1 1 1)))
                                   (b ((x ((sax (1 1 1)))
   (y ((sax (1 1 1)))))))
                               (4 ((a ((sax (1 1 1)))
                                   (b ((sax (1 1 1)))
                                   (c ((sax (1 1 1 1))))
                               (5 ((sax (1 1 1)))
                               (6 ((sax (1 1 1)))
                               (7 ((sax (1 1 1)))))))
                       (get-all-section-refs mini)))

=> ((1) (2) (3 A) (3 B X) (3 B Y) (4 A) (4 B) (4 C) (5) (6) (7))
```

## SYNOPSIS:

```
(defmethod get-all-section-refs ((sc slippery-chicken))
```

## 21.16 slippery-chicken/get-bar

[ slippery-chicken ] [ Methods ]

**DESCRIPTION:**

Get the `rthm-seq-bar` object located at a specified bar number within a given player's part.

**ARGUMENTS:**

- A slippery-chicken object.
  - An integer that is the number of the bar within the overall piece for which the rthm-seq-bar object is sought.
  - The ID of the player from whose part the rthm-seq-bar object is sought. If this is passed as NIL, the method will return the rthm-seq-bar objects for all players in the ensemble at the specified bar number.
- NB: Although listed as an optional argument, the player ID is actually required. It is listed as optional due to method inheritance.

### OPTIONAL ARGUMENTS:

- (see the comment on the <player> argument above.

**RETURN VALUE:**

A `rthm-seq-bar` object (or objects).

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
        :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 1 1 1 1)
                    (2 1 1 1 1)
                    (3 1 1 1 1)))
      :rthm-seq-palette '(((4 4) h q e s s)
                           (q e s s h)
                           (e s s q h))
      :pitch-seq-palette ((1 2 3 4 5
                             1 3 2 4 5
                             3 5 2 4 1))))))
```



```

:rthm-seq-map '((1 ((cl (1 1 1 1 1))
                      (vc (1 1 1 1 1))))
              (2 ((cl (1 1 1 1 1))
                  (vc (1 1 1 1 1))))
              (3 ((cl (1 1 1 1 1))
                  (vc (1 1 1 1 1))))))
(get-bar mini 17 'cl))

=>
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: NIL, bar-num: 17,
old-bar-nums: NIL, write-bar-num: NIL, start-time: 64.000,
start-time-qtrs: 64.0, is-rest-bar: NIL, multi-bar-rest: NIL,
show-rest: T, notes-needed: 5,
tuplets: NIL, nudge-factor: 0.35, beams: NIL,
current-time-sig: 2, write-time-sig: NIL, num-rests: 0,
num-rhythms: 5, num-score-notes: 5, parent-start-end: NIL,
missing-duration: NIL, bar-line-type: 0,
player-section-ref: (2 CL), nth-seq: 0, nth-bar: 1,
rehearsal-letter: NIL, all-time-sigs: (too long to print)
sounding-duration: 4.000,
rhythms: (
[...]
```

**SYNOPSIS:**

```
(defmethod get-bar ((sc slippery-chicken) bar-num &optional player)
```

**21.17 slippery-chicken/get-bar-from-ref**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return a rthm-seq-bar object from the piece by specifying its section, sequence number, bar number, and the player. Sequenz-num and bar-num are 1-based.

**ARGUMENTS:**

- A slippery-chicken object.
- A section ID (number or list).
- A player ID.
- An integer that is the number of the sequence in the section from which the bar is to be returned (1-based).
- An integer that is the number of the bar within the given sequence (1-based).

**RETURN VALUE:**

A `rthm-seq-bar` object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(((1 (1 1 1 1 1))
                    (2 (1 1 1 1 1))
                    (3 (1 1 1 1 1)))
      :rthm-seq-palette '(((1 (((4 4) h q e s s)
                                (q e s s h)
                                (e s s q h))
                              :pitch-seq-palette ((1 2 3 4 5
   1 3 2 4 5
   3 5 2 4 1))))))
      :rthm-seq-map '(((1 ((cl (1 1 1 1 1))
                               (vc (1 1 1 1 1))))
                        (2 ((cl (1 1 1 1 1))
                               (vc (1 1 1 1 1))))
                        (3 ((cl (1 1 1 1 1))
                               (vc (1 1 1 1 1)))))))
      (get-bar-from-ref mini 2 'vc 3 2))

=>
RTHM-SEQ-BAR: time-sig: 2 (4 4), time-sig-given: NIL, bar-num: 23,
old-bar-nums: NIL, write-bar-num: NIL, start-time: 88.000,
start-time-qtrs: 88.0, is-rest-bar: NIL, multi-bar-rest: NIL,
show-rest: T, notes-needed: 5,
tuplets: NIL, nudge-factor: 0.35, beams: NIL,
current-time-sig: 2, write-time-sig: NIL, num-rests: 0,
num-rhythms: 5, num-score-notes: 5, parent-start-end: NIL,
missing-duration: NIL, bar-line-type: 0,
player-section-ref: (2 VC), nth-seq: 2, nth-bar: 1,
rehearsal-letter: NIL, all-time-sigs: (too long to print)
sounding-duration: 4.000,
rhythms: (
[...]
```

**SYNOPSIS:**

```
(defmethod get-bar-from-ref ((sc slippery-chicken) section player
                             sequenz-num bar-num)
```

## 21.18 slippery-chicken/get-bar-num-from-ref

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Get the bar number of a given rthm-seq-bar object by specifying the section, sequenz, and number of the bar within that sequenz.

### ARGUMENTS:

- A slippery-chicken object.
- The ID of the section in which the given rthm-seq-bar object is located.
- An integer that is the number of the sequence within that section in which the rthm-seq-bar object is located.
- The number of the bar within the given rthm-seq-bar object for which the overall bar number (within the entire piece) is sought.

### RETURN VALUE:

An integer.

### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1))
                  (2 (1 1 1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s)
                                (q e s s h)
                                (e s s q h))
                             :pitch-seq-palette ((1 2 3 4 5
   1 3 2 4 5
   3 5 2 4 1))))))
      :rthm-seq-map '((1 ((cl (1 1 1 1 1))
                            (vc (1 1 1 1 1))))
                     (2 ((cl (1 1 1 1 1))
```

```

                (vc (1 1 1 1 1))))
            (3 ((cl (1 1 1 1 1))
                (vc (1 1 1 1 1))))))
    (get-bar-num-from-ref mini 2 4 3))
=> 27

```

**SYNOPSIS:**

```

(defmethod get-bar-num-from-ref ((sc slippery-chicken) section
                                sequenz-num bar-num)

```

**21.19 slippery-chicken/get-clef**

[ *slippery-chicken* ] [ *Methods* ]

**DATE:**

11-Apr-2011

**DESCRIPTION:**

Get the clef symbol attached to a specified event.

NB: The very first clef symbol in the very first measure of a given player's part is determined by the corresponding instrument object and attached to differently; as such, it cannot be retrieved using this method.

NB: All clef symbols after the starting clef are added using the `auto-clefs` method, either directly or by default in the `cmn-display` or `write-lp-data-for-all` methods.

**ARGUMENTS:**

- A `slippery-chicken` object.
- (NB: The optional arguments are actually required.)

**OPTIONAL ARGUMENTS:**

NB: The optional arguments are actually required.

- An integer that is the number of the bar from which to return the clef symbol.
- An integer that is the number of the event object within that bar from which to retrieve the clef symbol.
- The ID of the player from whose part the clef symbol is to be returned.

**RETURN VALUE:**

A clef symbol.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vc (cello :midi-channel 1))))
       :tempo-map '((1 (q 96)))
       :set-palette '((1 ((g2 f4 e5))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((5 4) e e e e e e e e e e))
                                :pitch-seq-palette ((1 1 2 2 2 2 3 3 3 1)))))
      :rthm-seq-map '((1 ((vc (1 1 1)))))))
  (auto-clefs mini)
  (get-clef mini 1 3 'vc))
```

=> TENOR

**SYNOPSIS:**

```
(defmethod get-clef ((sc slippery-chicken) &optional bar-num event-num player)
```

**21.20 slippery-chicken/get-current-instrument-for-player**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Get the currently active instrument for a given player in a specified sequence of a slippery-chicken object, as defined in the instrument-change-map.

**ARGUMENTS:**

- The ID of the section from which to retrieve the current instrument for the specified player. This can also be a reference, e.g. in the form '(2 1).
- The ID of the player for whom the current instrument is sought.
- The number of the sequence from which to retrieve the current instrument. This is a 1-based number. A slippery-chicken object.

**RETURN VALUE:**



**21.21 slippery-chicken/get-event***[ slippery-chicken ] [ Methods ]***DESCRIPTION:**

Retrieve a specified event object from a slippery-chicken object, giving bar number, event number, and player.

NB: This counts returns event objects, regardless of whether they are notes or rests.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar from which the event object is to be returned.
- An integer that is the number of the event object to be returned from that bar. This number is 1-based and counts all events, including notes, rests, and tied notes.
- A symbol name for the player.

**OPTIONAL ARGUMENTS:**

- T or NIL to indicate whether an error should be signalled if the event doesn't exist.

**RETURN VALUE:**

An event object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                       (vc (cello :midi-channel 2))))
       :tempo-map '((1 (q 60)))
       :set-palette '(((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '(((1 (((2 4) (e) e+e. 32 (32)))
                                :pitch-seq-palette (((1) 2))))
       :rthm-seq-map '(((1 ((vn (1 1 1))
                                (vc (1 1 1))))))))))
```

```

(get-event mini 2 4 'vn))

=>
EVENT: start-time: 3.750, end-time: 3.875,
      duration-in-tempo: 0.125,
      compound-duration-in-tempo: 0.125,
      amplitude: 0.700
      bar-num: 2, marks-before: NIL,
      tempo-change: NIL
      instrument-change: NIL
      display-tempo: NIL, start-time-qtrs: 3.750,
      midi-time-sig: NIL, midi-program-changes: NIL,
      8va: 0
      pitch-or-chord:
PITCH: frequency: 293.665, midi-note: 62, midi-channel: 1
      pitch-bend: 0.0
      degree: 124, data-consistent: T, white-note: D4
      nearest-chromatic: D4
      src: 1.122462, src-ref-pitch: C4, score-note: D4
      qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
      micro-tone: NIL,
      sharp: NIL, flat: NIL, natural: T,
      octave: 4, c5ths: 0, no-8ve: D, no-8ve-no-acc: D
      show-accidental: T, white-degree: 29,
      accidental: N,
      accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: D4, tag: NIL,
data: D4
*****

      written-pitch-or-chord: NIL
RHYTHM: value: 32.000, duration: 0.125, rq: 1/8, is-rest: NIL,
      score-rthm: 32.0, undotted-value: 32, num-flags: 3, num-dots: 0,
      is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.125,
      is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
      rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
      letter-value: 32, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: 32, tag: NIL,
data: 32

```

**SYNOPSIS:**

```

(defmethod get-event ((sc slippery-chicken) bar-num event-num player
                      &optional (error t))

```



**21.22 slippery-chicken/get-events-from-to***[ slippery-chicken ] [ Methods ]***DATE:**

22-Jul-2011 (Pula)

**DESCRIPTION:**

Return a list of event objects for a given player, specifying the region by bar and event number.

**ARGUMENTS:**

- A slippery-chicken object.
- A player ID.
- An integer (1-based) that is the first bar from which to return events.
- An integer (1-based) that is the first event object in the start-bar to return.
- An integer (1-based) that is the last bar from which to return events.

**OPTIONAL ARGUMENTS:**

- An integer (1-based) that is the last event within the end-bar to return.

**RETURN VALUE:**

A flat list of event objects.

**EXAMPLE:**

```
(let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
(db (double-bass :midi-channel 2))))
:instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax))))
(2 ((sax ((2 alto-sax) (5 tenor-sax))))))
:set-palette '(1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
:set-map '((1 (1 1 1 1 1))
(2 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
:pitch-seq-palette ((1 2 3 4 5))))))
```

```

:rthm-seq-map '((1 ((sax (1 1 1 1 1))
(db (1 1 1 1 1))))
(2 ((sax (1 1 1 1 1))
(db (1 1 1 1 1))))))
(get-events-from-to mini 'sax 3 2 5 3))

=>
(
EVENT: start-time: 10.000, end-time: 11.000,
duration-in-tempo: 1.000,
compound-duration-in-tempo: 1.000,
amplitude: 0.700
bar-num: 3, marks-before: NIL,
tempo-change: NIL
instrument-change: NIL
display-tempo: NIL, start-time-qtrs: 10.000,
midi-time-sig: NIL, midi-program-changes: NIL,
8va: 0
pitch-or-chord:
PITCH: frequency: 164.814, midi-note: 52, midi-channel: 1
pitch-bend: 0.0
degree: 104, data-consistent: T, white-note: E3
nearest-chromatic: E3
src: 0.62996054, src-ref-pitch: C4, score-note: E3
qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
micro-tone: NIL,
sharp: NIL, flat: NIL, natural: T,
octave: 3, c5ths: 0, no-8ve: E, no-8ve-no-acc: E
show-accidental: T, white-degree: 23,
accidental: N,
accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: E3, tag: NIL,
data: E3
*****

written-pitch-or-chord:
PITCH: frequency: 369.994, midi-note: 66, midi-channel: 1
pitch-bend: 0.0
degree: 132, data-consistent: T, white-note: F4
nearest-chromatic: FS4
src: 1.4142135, src-ref-pitch: C4, score-note: FS4
qtr-sharp: NIL, qtr-flat: NIL, qtr-tone: NIL,
micro-tone: NIL,
sharp: T, flat: NIL, natural: NIL,
octave: 4, c5ths: 1, no-8ve: FS, no-8ve-no-acc: F

```

```

show-accidental: T, white-degree: 31,
accidental: S,
accidental-in-parentheses: NIL, marks: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: FS4, tag: NIL,
data: FS4
*****

RHYTHM: value: 4.000, duration: 1.000, rq: 1, is-rest: NIL,
score-rthm: 4.0, undotted-value: 4, num-flags: 0, num-dots: 0,
is-tied-to: NIL, is-tied-from: NIL, compound-duration: 1.000,
is-grace-note: NIL, needs-new-note: T, beam: NIL, bracket: NIL,
rq-note: NIL, rq-info: NIL, marks: NIL, marks-in-part: NIL,
letter-value: 4, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: Q, tag: NIL,
data: Q
*****

```

```

EVENT: start-time: 11.000, end-time: 11.500,
[...]

```

## SYNOPSIS:

```

(defmethod get-events-from-to ((sc slippery-chicken) player start-bar
                               start-event end-bar &optional end-event)

```

## 21.23 slippery-chicken/get-instrument-for-player-at-bar

[ *slippery-chicken* ] [ *Methods* ]

### DATE:

09-Feb-2011

### DESCRIPTION:

Get the current instrument for a specified player at a specified bar number in a slippery-chicken object, as defined in the instrument-change-map.

### ARGUMENTS:

- The ID of a player in the slippery-chicken object.
- An integer that is the number of the bar from which to get the current

instrument.  
- A slippery-chicken object.

**RETURN VALUE:**

An instrument object.

**EXAMPLE:**

```
(let* ((mini
  (make-slippery-chicken
    '+mini+
    :ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
      (db (double-bass :midi-channel 2))))
    :instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax))))
      (2 ((sax ((2 alto-sax) (5 tenor-sax))))))
    :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5)))
    :set-map '((1 (1 1 1 1 1))
      (2 (1 1 1 1 1)))
    :rthm-seq-palette '((1 (((4 4) h q e s s))
      :pitch-seq-palette ((1 2 3 4 5))))
    :rthm-seq-map '((1 ((sax (1 1 1 1 1))
      (db (1 1 1 1 1))))
      (2 ((sax (1 1 1 1 1))
      (db (1 1 1 1 1))))))
  (get-instrument-for-player-at-bar 'sax 3 mini))
```

=>

```
INSTRUMENT: lowest-written: BF3, highest-written: FS6
lowest-sounding: AF2, highest-sounding: E5
starting-clef: TREBLE, clefs: (TREBLE), clefs-in-c: (BASS TREBLE)
prefers-notes: NIL, midi-program: 67
transposition: BF, transposition-semitones: -14
score-write-in-c: NIL, score-write-bar-line: NIL
chords: NIL, chord-function: NIL,
total-bars: 5 total-notes: 25, total-duration: 20.000
total-degrees: 2710, microtones: T
missing-notes: (FQS3 FQS4), subset-id: NIL
staff-name: tenor sax, staff-short-name: ten sax,

largest-fast-leap: 999, tessitura: FS3
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: TENOR-SAX, tag: NIL,
data: NIL
```

**SYNOPSIS:**

```
(defmethod get-instrument-for-player-at-bar (player bar (sc slippery-chicken))
```

## 21.24 slippery-chicken/get-nearest-event

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Find the nearest event to <reference-event> in the <search-player>

### ARGUMENTS:

- the slippery-chicken object
- the reference event object that we want to find the nearest event to in another player
- the player we want to find the nearest event in (symbol).

### OPTIONAL ARGUMENTS:

- if T only return sounding events (pitches/chords) otherwise return the nearest rest or sounding event.
- if T only return struck events i.e. ignore those that are tied to

### RETURN VALUE:

An event object.

### EXAMPLE: SYNOPSIS:

```
(defmethod get-nearest-event ((sc slippery-chicken) reference-event
                             search-player &optional
                             (ignore-rests t)
                             (ignore-tied t))
```

## 21.25 slippery-chicken/get-note

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Get a numbered event from a specified bar of a given player's part within a slippery-chicken object.

NB: Slippery-chicken doesn't have 'note' and 'rest' classes, rather both of

these are events. The nomenclature 'note' and 'rest' are thus used here and elsewhere merely for convenience, to distinguish between sounding and non-sounding events.

See also `rthm-seq-bar` methods for accessing notes by other means.

#### ARGUMENTS:

- A `slippery-chicken` object.
- An integer that is the number of the bar from which to get the note (counting from 1).
- An integer that is the number of the note to get within that bar, counting tied notes (counting from 1). This can also be a list of numbers if accessing pitches in a chord (see below).
- The ID of the player from whose part the note is to be retrieved.

#### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether, when accessing a pitch in a chord, to return the written or sounding pitch. T = written. Default = NIL.

#### RETURN VALUE:

An event object.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '(1 (q 60)))
      :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(1 (1)))
      :rthm-seq-palette '((1 (((2 4) (e) e+e. 32 (32)))
                               :pitch-seq-palette (((1) 2))))
      :rthm-seq-map '((1 ((vn (1)))))))
  (print (data (get-rest mini 1 2 'vn)))
  (print (data (get-note mini 1 2 'vn)))
  (print (data (get-note mini 1 '(2 1) 'vn)))
  (print (data (get-note mini 1 '(2 2) 'vn)))
  (print (is-tied-from (get-note mini 1 1 'vn))))
```

=>

32

"E."  
C4  
A4  
T

## SYNOPSIS:

```
(defmethod get-note ((sc slippery-chicken) bar-num note-num player
                    &optional written)
```

## 21.26 slippery-chicken/get-num-sections

[ *slippery-chicken* ] [ *Methods* ]

## DESCRIPTION:

Return the number of sections in the given slippery-chicken object, as defined in e.g. in the set-map.

## ARGUMENTS:

- A slippery-chicken object.

## RETURN VALUE:

An integer that is the number of section.

## EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1 1))
                  (2 (1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1 1))))
                       (2 ((sax (1 1 1))))
                       (3 ((sax (1 1 1 1 1)))))))
      (get-num-sections mini))

=> 3
```

**SYNOPSIS:**

```
(defmethod get-num-sections ((sc slippery-chicken))
```

**21.27 slippery-chicken/get-phrases**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

This returns lists of events that make up phrases. Its notion of phrases is very simplistic but hopefully useful all the same: it's any sequence of sounding notes surrounded by rests.

**ARGUMENTS:**

- the slippery-chicken object
- a single symbol or list of symbols representing the players from the ensemble.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :start-bar. An integer bar number where the process should start. If NIL we'll default to 1. Default = NIL.
- :end-bar. An integer bar number where the process should end. If NIL we'll default to the last bar. Default = NIL.

**RETURN VALUE:**

A list of sublists, one for each requested player. Each player sublist contains sublists also, with all the events in each phrase.

**SYNOPSIS:**

```
(defmethod get-phrases ((sc slippery-chicken) players
                        &key start-bar end-bar)
```

**21.28 slippery-chicken/get-player**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return the player object for the specified player.



**ARGUMENTS:**

- A slippery-chicken object.
- A player ID.

**RETURN VALUE:**

A player object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((fl (flute :midi-channel 1))
                       (tp (b-flat-trumpet :midi-channel 2))
                       (vn (violin :midi-channel 3)))))
      :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '((1 (1 1 1 1 1)))
      :rthm-seq-palette '((1 (((4 4) h q e s s))
                               :pitch-seq-palette ((1 2 3 4 5)))))
      :rthm-seq-map '((1 ((fl (1 1 1 1 1))
                           (tp (1 1 1 1 1))
                           (vn (1 1 1 1 1)))))))

  (get-player mini 'vn))

=>
PLAYER: (id instrument-palette): SLIPPERY-CHICKEN-STANDARD-INSTRUMENT-PALETTE
doubles: NIL, cmn-staff-args: NIL, total-notes: 25, total-degrees: 3548,
total-duration: 20.000, total-bars: 5, tessitura: B4
LINKED-NAMED-OBJECT: previous: (TP), this: (VN), next: NIL
NAMED-OBJECT: id: VN, tag: NIL,
data:
INSTRUMENT: lowest-written: G3, highest-written: C7
lowest-sounding: G3, highest-sounding: C7
starting-clef: TREBLE, clefs: (TREBLE), clefs-in-c: (TREBLE)
prefers-notes: NIL, midi-program: 41
transposition: C, transposition-semitones: 0
score-write-in-c: NIL, score-write-bar-line: NIL
chords: T, chord-function: VIOLIN-CHORD-SELECTION-FUN,
total-bars: 5 total-notes: 25, total-duration: 20.000
total-degrees: 3548, microtones: T
missing-notes: NIL, subset-id: NIL
staff-name: violin, staff-short-name: vln,
```

```

      largest-fast-leap: 13, tessitura: B4
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: VIOLIN, tag: NIL,
data: NIL

```

**SYNOPSIS:**

```
(defmethod get-player ((sc slippery-chicken) player)
```

**21.29 slippery-chicken/get-rest**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Retrieve the event object that contains the specified rest in a slippery-chicken object by giving bar number, rest number and player.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar from which to retrieve the rest event object.
- An integer that is the number of the rest (not the number of the event) within that bar, counting from 1.
- The ID of the player from whose part to retrieve the rest object.

**RETURN VALUE:**

An event object.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))
                        (vc (cello :midi-channel 2))))
       :tempo-map '(1 (q 60)))
      :set-palette '(1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '(1 (1 1 1)))
      :rthm-seq-palette '(1 (((2 4) (e) e+e. 32 (32)))
                             :pitch-seq-palette (((1) 2))))
      :rthm-seq-map '(1 ((vn (1 1 1))
                          (vc (1 1 1))))))

```

```
(get-rest mini 2 1 'vc))

=>
EVENT: start-time: 2.000, end-time: 2.500,
      duration-in-tempo: 0.500,
      compound-duration-in-tempo: 0.500,
      amplitude: 0.700
      bar-num: 2, marks-before: NIL,
      tempo-change: NIL
      instrument-change: NIL
      display-tempo: NIL, start-time-qtrs: 2.000,
      midi-time-sig: NIL, midi-program-changes: NIL,
      8va: 0
      pitch-or-chord: NIL
      written-pitch-or-chord: NIL
RHYTHM: value: 8.000, duration: 0.500, rq: 1/2, is-rest: T,
      score-rthm: 8.0, undotted-value: 8, num-flags: 1, num-dots: 0,
      is-tied-to: NIL, is-tied-from: NIL, compound-duration: 0.500,
      is-grace-note: NIL, needs-new-note: NIL, beam: NIL, bracket: NIL,
      rqq-note: NIL, rqq-info: NIL, marks: NIL, marks-in-part: NIL,
      letter-value: 8, tuplet-scaler: 1, grace-note-duration: 0.05
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: E, tag: NIL,
data: E
```

**SYNOPSIS:**

```
(defmethod get-rest ((sc slippery-chicken) bar-num rest-num player)
```

**21.30 slippery-chicken/get-section**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return the section object with the specified reference ID.

**ARGUMENTS:**

- A slippery-chicken object.
- A reference ID.

**RETURN VALUE:**

A section object.

**EXAMPLE:**

```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))
                        (db (double-bass :midi-channel 2))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1))
                   (2 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                              :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1 1 1))
                              (db (1 1 1 1 1))))
                        (2 ((sax (1 1 1 1 1))
                              (db (1 1 1 1 1))))))
      (get-section mini 2))

```

=&gt;

```

SECTION:
RECURSIVE-ASSOC-LIST: recurse-simple-data: NIL
num-data: 2
linked: T
full-ref: (2)
ASSOC-LIST: warn-not-found NIL
CIRCULAR-SCLIST: current 0
SCLIST: sclist-length: 2, bounds-alert: T, copy: T
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
BAR-HOLDER:
start-bar: 6
end-bar: 10
num-bars: 5
start-time: 20.0
end-time: 40.0
start-time-qtrs: 0
end-time-qtrs: 40.0
num-notes (attacked notes, not tied): 50
num-score-notes (tied notes counted separately): 50
num-rests: 0
duration-qtrs: 20.0
duration: 20.0 (20.000)

```

**SYNOPSIS:**

```

(defmethod get-section ((sc slippery-chicken) reference)

```

**21.31 slippery-chicken/get-section-refs***[ slippery-chicken ] [ Methods ]***DATE:**

07-May-2012

**DESCRIPTION:**

Return the reference IDs for all section and subsections of a given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the first top-level section for which to return the reference IDs. As this number refers to the number of top-level sections only, any subsections will be contained in these and only count as 1.
- An integer that is the number of consecutive sections to return section reference IDs.

**RETURN VALUE:**

A list of lists containing the section reference IDs of the specified range in the slippery-chicken object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1))
                  (2 (1 1 1))
                  (3 ((a (1 1 1))
                      (b ((x (1 1 1))
                          (y (1 1 1))))))
                  (4 ((a (1 1 1))
                      (b (1 1 1))
                      (c (1 1 1 1))))
                  (5 (1 1 1))
                  (6 (1 1 1))
                  (7 (1 1 1)))))
```

```

:rthm-seq-palette '(((1 (((4 4) h q e s s))
                        :pitch-seq-palette ((1 2 3 4 5))))))
:rthm-seq-map '(((1 ((sax (1 1 1))))
                 (2 ((sax (1 1 1))))
                 (3 ((a ((sax (1 1 1))))
                     (b ((x ((sax (1 1 1))))
                         (y ((sax (1 1 1))))))))))
                 (4 ((a ((sax (1 1 1))))
                     (b ((sax (1 1 1))))
                     (c ((sax (1 1 1 1)))))))
                 (5 ((sax (1 1 1))))
                 (6 ((sax (1 1 1))))
                 (7 ((sax (1 1 1)))))))
(get-section-refs mini 2 4))
=> ((2) (3 A) (3 B X) (3 B Y) (4 A) (4 B) (4 C) (5))

```

**SYNOPSIS:**

```
(defmethod get-section-refs ((sc slippery-chicken) start-section num-sections)
```

**21.32 slippery-chicken/get-sequenz-from-section**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:** **ARGUMENTS:** **OPTIONAL ARGUMENTS:** **RETURN VALUE:**  
**EXAMPLE:** **SYNOPSIS:**

```
(defmethod get-sequenz-from-section ((sc slippery-chicken)
                                     section-ref player-ref seq-num) ; 1-based
```

**21.33 slippery-chicken/get-starting-ins**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return the instrument object that is the first instrument object used by a specified player in a given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- A player ID.

**RETURN VALUE:**

An instrument object.

**EXAMPLE:**

```
(let ((mini
(make-slippery-chicken
'+mini+
:ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
(db (double-bass :midi-channel 2))))
:instrument-change-map '(((1 ((sax ((1 alto-sax) (3 tenor-sax))))
(2 ((sax ((2 alto-sax) (5 tenor-sax))))))
:set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
:set-map '((1 (1 1 1 1 1))
(2 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
:pitch-seq-palette ((1 2 3 4 5))))
:rthm-seq-map '((1 ((sax (1 1 1 1 1))
(db (1 1 1 1 1))))
(2 ((sax (1 1 1 1 1))
(db (1 1 1 1 1))))))
(get-starting-ins mini 'sax))

=>
INSTRUMENT: lowest-written: BF3, highest-written: FS6
lowest-sounding: CS3, highest-sounding: A5
starting-clef: TREBLE, clefs: (TREBLE), clefs-in-c: (TREBLE)
prefers-notes: NIL, midi-program: 66
transposition: EF, transposition-semitones: -9
score-write-in-c: NIL, score-write-bar-line: NIL
chords: NIL, chord-function: NIL,
total-bars: 5 total-notes: 25, total-duration: 20.000
total-degrees: 2920, microtones: T
missing-notes: (BQF3 BQF4), subset-id: NIL
staff-name: alto saxophone, staff-short-name: alt sax,

largest-fast-leap: 999, tessitura: BQF3
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: ALTO-SAX, tag: NIL,
data: NIL
```

**SYNOPSIS:**

```
(defmethod get-starting-ins ((sc slippery-chicken) player) ; symbol
```

**21.34 slippery-chicken/get-tempo***[ slippery-chicken ] [ Methods ]***DESCRIPTION:**

Return the tempo object in effect for a specified bar of a given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of a bar within that slippery-chicken object.

**RETURN VALUE:**

A tempo object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :tempo-map '(((1 (q 60)) (5 (e 72)) (7 (q. 176 "prestissimo"))))
       :set-palette '(((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))))
      :set-map '(((1 (1 1 1 1 1 1 1 1))))
      :rthm-seq-palette '(((1 (((4 4) h q e s s))
                                :pitch-seq-palette ((1 2 3 4 5))))))
      :rthm-seq-map '(((1 ((sax (1 1 1 1 1 1 1 1)))))))
  (get-tempo mini 6))
```

=>

```
TEMPO: bpm: 72, beat: E, beat-value: 8.0, qtr-dur: 1.6666666
      qtr-bpm: 36.0, usecs: 1666666, description: NIL
LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL
NAMED-OBJECT: id: NIL, tag: NIL,
data: 72
```

**SYNOPSIS:**

```
(defmethod get-tempo ((sc slippery-chicken) bar-num)
```



**21.35 slippery-chicken/get-time-sig***[ slippery-chicken ] [ Methods ]***DESCRIPTION:**

Get the time-sig object associate with a specified bar number in a given slippery-chicken object.

**ARGUMENTS:**

- A slippery-chicken object.
- An integer that is the number of the bar for which to the time-sig object is to be returned. NB: Although this argument is listed as optional in the method definition (due to inheritance), it is actually required.

**OPTIONAL ARGUMENTS:**

- (see above).

**RETURN VALUE:**

A time-sig object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s)
                                ((5 8) q e s s e)
                                ((3 16) s e))
                           :pitch-seq-palette ((1 2 3 4 5 1 2 3 4 5 1
  2))))))
      :rthm-seq-map '(((1 ((sax (1 1 1)))))))
  (get-time-sig mini 2))
```

=>

TIME-SIG: num: 5, denom: 8, duration: 2.5, compound: NIL, midi-clocks: 24, num-beats: 5  
 SCLIST: sclist-length: 2, bounds-alert: T, copy: T  
 LINKED-NAMED-OBJECT: previous: NIL, this: NIL, next: NIL  
 NAMED-OBJECT: id: "0508", tag: NIL,  
 data: (5 8)

**SYNOPSIS:**

```
(defmethod get-time-sig ((sc slippery-chicken) &optional bar-num)
```

**21.36 slippery-chicken/get-transposition-at-bar**

[ *slippery-chicken* ] [ *Methods* ]

**DATE:**

24-Mar-2011

**DESCRIPTION:**

Return the number of semitones difference between the sounding pitches and written pitches of a given player's part in a specified bar within a slippery-chicken object; e.g. bass clarinet = -14.

**ARGUMENTS:**

- The ID of the player for whom the transposition value is sought.
- An integer which is the number of the bar for which the transposition value is sought.
- A slippery-chicken object.

**RETURN VALUE:**

An integer.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                                :pitch-seq-palette ((1 2 3 4 5)))))
      :rthm-seq-map '((1 ((sax (1 1 1))))))
  (get-transposition-at-bar 'sax 2 mini))
```

=> -9

**SYNOPSIS:**

```
(defmethod get-transposition-at-bar (player bar (sc slippery-chicken))
```

## 21.37 slippery-chicken/lp-display

[ *slippery-chicken* ] [ *Functions* ]

### DESCRIPTION:

This function has exactly the same arguments as `write-lp-data-for-all` and only differs from that method in that after writing all the Lilypond text files for the score, it calls Lilypond to render the PDF, which is then opened automatically from within Lisp (if the value of `(get-sc-config 'lp-display-auto-open)` is T).

In order to work properly, you'll need to make sure the value of the `'lilypond-command` configuration parameter is set via `(set-sc-config ...)` to the full path of your Lilypond command (not the app: it's usually `/path/to/Lilypond.app/Contents/Resources/bin/lilypond` on OSX).

NB Only available with CCL and SBCL on OSX. With SBCL on OSX the output from Lilypond is only printed once the process has exited, so it may take a while until you see anything.

### ARGUMENTS:

See `write-lp-data-for-all`

### RETURN VALUE:

An integer: the shell's exit code for the PDF open command, usually 0 for success. Second returned value is the patch to the PDF file.

### SYNOPSIS:

```
(defun lp-display (&rest args)
```

## 21.38 slippery-chicken/make-slippery-chicken

[ *slippery-chicken* ] [ *Functions* ]

### DESCRIPTION:

Make a `slippery-chicken` object using the specified data. This is the function that will be used most often to "put it all together", and many of its slots require full objects of other classes rather than just straight data. These objects, such as `rthm-seq-palette`, `rthm-seq-map` etc, are also documented in detail elsewhere in the `robodoc` and the user's manual.

**ARGUMENTS:**

- A symbol that is the name/ID of the object. The value passed to this argument will be made into a global variable, so that the newly created slippery-chicken object and the data it contains remain in memory and can be accessed and modified after the object is generated.

**OPTIONAL ARGUMENTS:**

keyword arguments:

NB: Although these arguments are technically optional, the slippery-chicken object will only be complete and make musical sense if many of the core elements are present.

- :title. A string that will be used as the title of the piece. The value given for this object will be used as both the header for the printable output as well as the base for any file names generated by the write-lp-data-for-all method. Default = "slippery-chicken-piece".
- :instrument-palette. An instrument-palette object. This will be the palette of instrument objects available to the players of in the given slippery-chicken object's ensemble slot.  
Default = +slippery-chicken-standard-instrument-palette+.
- :ensemble. A recursive association list that will be used as the data to create an ensemble object populated with player objects within the slippery-chicken object. The format of this list will be a list of user-defined player IDs each coupled with a list of instrument object IDs from the current instrument-palette and various player object parameters. See the user's manual and robodoc entries on the ensemble and player classes for more detail.
- :set-palette. A recursive association list that will be used as the data to create a set-palette object within the slippery-chicken object. This object is where the collections of possible pitches for any given sequence are defined. The format of this list will be a list of IDs for each set of pitches, each coupled with a list of note-name symbols for the pitches that will be used to make that set. See the user's manual and the robodoc entry on the set-palette class for more detail.
- :set-map. A recursive association list that will be used as the data to create a set-map object within the slippery-chicken object. This is where the order in which the pitch collections defined in the set-palette will be used in the piece. The format of this list will be a list of IDs from the given slippery-chicken object's structure coupled with a list of IDs from those given to the sets in the set-palette. There must be an equal number of sections in this list as there are in the rthm-seq-map, and they must have identical names. There must be an equal number of individual set IDs in each list paired with the section IDs as there are in the corresponding lists of the rthm-seq-map. See the user's manual and the robodoc entries for the set-map and sc-map for more detail.

- `:rthm-seq-palette`. A recursive association list that will be used as the data to create a `rthm-seq-palette` object within the `slippery-chicken` object. This object is where the collections of possible rhythm sequences for any given sequence in the piece are defined. This list will take the format of a list of IDs paired with a list of data for individual `rthm-seq` objects. These in turn will consist of one or more lists of rhythm data for `rthm-seq-bar` objects, as well `pitch-seq-palettes` and marks data for the individual `rthm-seq` objects to be created. See the user's manual as well as the `robodoc` entries for `rthm-seq-palette`, `rthm-seq`, `rthm-seq-bar`, `rhythm`, and `pitch-seq-palette` for more detail.
- `:rthm-seq-map`. A recursive association list that will be used as the data to create a `rthm-seq-map` object within the `slippery-chicken` object. This is where the order in which the rhythm sequences defined in the `rthm-seq-palette` will be used in the piece. It will take the format of a list of section IDs, of which there must be an equal number as are given in the `set-map`, each coupled with a list of player IDs, as defined in the ensemble slot of the given `slippery-chicken` object. The player IDs in turn are coupled with a list of IDs for `rthm-seq` objects, as defined in the `rthm-seq-palette`. Each of these lists must contain the same number of elements as are contained in each of the `set-map` sections. See the user's manual and `robodoc` entries for `rthm-seq-map` and `sc-map` for more details.
- `:snd-output-dir`. A string that will be used as the directory path for any output generated by `clm-play` in conjunction with sound files listed in the `sndfile-palette` (see below). Default = `(get-sc-config 'default-dir)`.
- `:sndfile-palette`. A recursive association list that will be used as the data to create a `sndfile-palette` object within the `slippery-chicken` object. This is where the list is defined that contains all possible source sound files which may be used in conjunction with output generated by `clm-play`. This list will take the format of a list of IDs for sound-file groups, coupled with lists of file names and various other parameters associated with the `sndfile` class. The list of sound-file groups is followed by a list of directory paths where the given sound files are located and an optional list of file extensions. See the user's manual and the `robodoc` entries on `sndfile-palette`, `sndfile`, and `clm-play` for more detail.
- `:tempo-map`. A recursive association list that will be used as the data to create tempo objects within the `slippery-chicken` object. This is one of two options for specifying the sequence of tempo changes for a given piece (also see `tempo-curve` below). The format will be a list of integers that are measure numbers within the piece, each coupled with tempo indications in the form `(beat-unit bpm)`. See the user's manual as well as the `robodoc` entry for `tempo-map` for more detail. NB: This slot cannot be used together with `:tempo-curve`.
- `:tempo-curve`. A list of data that will be used to create tempo objects within the `slippery-chicken` object, based on an interpolated list of break-point pairs. This is one of two options for specifying the

sequence of tempo changes for a given piece (also see tempo-map above.) The first item in the list will be the number of bars between each new tempo object. The second item is the beat basis for the tempo objects made. The third and final argument is the list of break-point pairs, of which the first is a value on an arbitrary x-axis and the second is a number of beats-per-minute. See the user's manual and the robodoc entry for tempo-curve for more detail. NB: This slot cannot be used together with :tempo-map.

- :staff-groupings. A list of integers that indicate the placement of group brackets for the printable output. Each number represents a consecutive number of players, in the order they appear in the ensemble object, that will be included in each consecutive group. The sum of the numbers in this list must be equal to the number of players in the ensemble. See the user's manual for more detail.
- :instrument-change-map. A recursive association list that will be used as the data to create an instrument-change-map object within the slippery-chicken object. This will be used to indicate where those players in the ensemble that play multiple instruments will change instruments. The format will be a list of section IDs coupled with a list of player IDs, each of which in turn is coupled with a list of 2-item lists consisting of a sequence number paired with the ID (name) of one of the instrument objects assigned to that player in the ensemble object. See the user's manual and the robodoc entries for instrument-change-map for more detail.
- :set-limits-high. A recursive association list that will be used to limit the uppermost pitches of either the parts of individual players or of the entire ensemble. The format will be a list of player IDs, as defined in the ensemble object, each paired with a list of break-point pairs that consist of a value on an arbitrary x-axis paired with a note-name pitch symbol. These break-point envelopes are applied to the entire duration of the piece. See the user's manual for more detail.
- :set-limits-low. A recursive association list that will be used to limit the lowermost pitches of either the parts of individual players or of the entire ensemble. The format will be a list of player IDs, as defined in the ensemble object, each paired with a list of break-point pairs that consist of a value on an arbitrary x-axis paired with a note-name pitch symbol. These break-point envelopes are applied to the entire duration of the piece. See the user's manual for more detail.
- :fast-leap-threshold. A number that is the longest duration of a note in seconds that can be followed by a leap of a large interval, as defined in the largest-fast-leaps slot of the instrument objects. Default = 0.125.
- :instruments-hierarchy. A list of player IDs from the given slippery-chicken object's ensemble that will specify the order in which slippery chicken's pitch selection algorithm will choose pitches for the instruments. By default (when NIL) this order follows the order in which the instrument objects appear in the ensemble object. See the user's

manual for more detail. Default = NIL.

- :rehearsal-letters. A list of numbers that are measure numbers at which consecutive rehearsal letters will be placed. Since rehearsal letters are technically actually place on the right-hand bar line of the previous measure, measure 1 cannot be entered here. Slippery chicken automatically proceeds consecutively through the alphabet, so only numbers are required here. See the user's manual for more detail. If NIL, no rehearsal letters will be added to the score. Default = NIL.
- :avoid-melodic-octaves. T or NIL to indicate whether two linearly consecutive pitches in the part of a given player may be of the same pitch class but a different octave. T = avoid melodic octaves. Default = T.
- :instruments-write-bar-nums. A list of player IDs above whose parts in the score bar numbers should be written. If NIL, bar numbers will be written above the top player in each group. NB: This slot affects CMN output only. Default = NIL.
- :pitch-seq-index-scaler-min. A decimal number that affects the likelihood that slippery-chicken's pitch selection algorithm will choose pitches for an instrument that have also already been assigned to other players. In general terms, the higher this number is, the more likely it will be that instruments may be assigned the same pitches, though this will of course also be dependent on other factors, such as the characteristics of those instruments and the pitches in the current set. See the user's manual on pitches and the robodoc entries for pitch-seq for more detail. Default = 0.5.
- :bars-per-system-map. A list of 2-item lists, each of which consists of a measure number coupled with a number of measures to be placed in each system starting at that measure number. NB: This list only affects CMN output. See the user's manual on score layout for more details.
- :composer. A string that will be used for the composer portion of the header on the score's first page in LilyPond output. If NIL, no composer's name will appear in the score. Default = NIL.
- :rthm-seq-map-replacements. A list of lists in the format '(((1 2 va) 3 2) ((2 3 vn) 4 3)) that indicate changes to individual elements of lists within the given rthm-seq-map object. Each such list indicates a change, the first element of the list being the reference into the rthm-seq-map (the vla player of section 1, subsection 2 in the first example here), the second element is the nth of the data list for this key to change, and the third is the new data. If NIL, no changes will be made. See the robodoc entries for rthm-seq-map for more detail. Default = NIL.
- :set-map-replacements. A list of lists in the format '(((1 2 2) (3 3 1)) that indicate changes to individual elements of lists within the given set-map object. Each such list indicates a change, the first element of the list being the reference into the set-map (the section, followed by a subsection if any exist), the second element being

the nth of the data list for to change, and the third being the new data. If NIL, no changes will be made. See the robodoc entries for sc-map for more detail. Default = NIL.

- :key-sig. A two-element list indicating starting key signature for the piece, e.g. '(ef minor). Usual note name symbols apply (e.g. ds = d sharp, bf - b flat). Implies nothing beyond the signature, i.e. no conformity to tonality expected. Default '(c major) i.e. no key signature.
- (- :warn-ties. This slot is now obsolete, but is left here for backwards compatibility with pieces composed with earlier versions of slippery-chicken. Default = T.)

#### RETURN VALUE:

T

#### EXAMPLE:

```
;;; An example using all slots
(let ((mini
      (make-slippery-chicken
       '+mini+
       :title "A Little Piece"
       :composer "Joe Green"
       :ensemble '(((fl ((flute piccolo) :midi-channel 1))
                     (cl (b-flat-clarinet :midi-channel 2))
                     (hn (french-horn :midi-channel 3))
                     (tp (b-flat-trumpet :midi-channel 4))
                     (vn (violin :midi-channel 5))
                     (va (viola :midi-channel 6))
                     (vc (cello :midi-channel 7))))))
      :set-palette '(((1 ((fs2 b2 d4 a4 d5 e5 a5 d6)))
                      (2 ((b2 fs2 d4 e4 a4 d5 e5 a5 d6)))
                      (3 ((cs3 fs3 e4 a4 e5 a5 e6))))))
      :set-map '(((1 (2 1 2 3 1 3 1))
                   (2 (1 1 3 2 2 3 1))
                   (3 (2 3 1 3 1 1 2))))
      :rthm-seq-palette '(((1 (((4 4) h (q) e (s) s))
                                :pitch-seq-palette ((1 2 3))))
                          (2 (((4 4) (q) e (s) s h))
                                :pitch-seq-palette ((2 1 3))))
                          (3 (((4 4) e (s) s h (q))
                                :pitch-seq-palette ((3 2 1))))))
      :rthm-seq-map '(((1 ((fl (2 3 3 1 1 1 2))
                           (cl (3 2 1 1 2 1 3))
                           (hn (1 2 3 1 1 3 2))
```



```

      (tp (2 1 1 3 3 2 1))
      (vn (3 1 3 2 1 1 2))
      (va (2 1 1 1 3 2 3))
      (vc (1 2 3 1 3 2 1))))
(2 ((fl (3 1 3 2 2 1 1))
    (cl (1 1 2 3 1 3 2))
    (hn (1 3 2 1 3 1 2))
    (tp (1 1 1 3 3 2 2))
    (vn (2 1 3 1 3 1 2))
    (va (2 2 3 1 1 3 1))
    (vc (1 3 1 2 2 1 3))))
(3 ((fl (1 1 3 2 1 3 2))
    (cl (2 1 2 3 3 1 1))
    (hn (3 2 1 1 1 3 2))
    (tp (3 3 1 1 2 1 2))
    (vn (3 1 3 2 1 1 2))
    (va (3 2 1 1 3 2 1))
    (vc (1 3 2 1 2 3 1))))
:snd-output-dir "/tmp"
:sndfile-palette '(((sndfile-grp-1
  ((test-sndfile-1.aiff :start 0.021 :end 0.283)
   (test-sndfile-2.aiff)
   (test-sndfile-3.aiff)))
  (sndfile-grp-2
   ((test-sndfile-4.aiff :frequency 834)
    (test-sndfile-5.aiff)
    (test-sndfile-6.aiff))))
  ("/path/to/test-sndfiles-dir-1"
   "/path/to/test-sndfiles-dir-2"))
;; :tempo-map '((1 (q 84)) (9 (q 72))) ;
:tempo-curve '(5 q (0 40 25 60 50 80 75 100 100 120))
:staff-groupings '(2 2 3)
:instrument-change-map '((1 ((fl ((1 flute) (3 piccolo) (5 flute)))))
:set-limits-low '((fl (0 c5 50 g5 100 c5))
  (cl (0 c4 50 f4 100 c4))
  (hn (0 f3 50 c4 100 f3))
  (tp (0 c4 50 f4 100 c4))
  (vn (0 e5 50 a5 100 e5))
  (va (0 c3 50 f3 100 c3))
  (vc (0 c2 50 f3 100 c2)))
:set-limits-high '((fl (0 d6 50 a6 100 d6))
  (cl (0 c5 50 a5 100 c5))
  (hn (0 f4 50 c5 100 f4))
  (tp (0 f5 50 c5 100 f5))
  (vn (0 c6 50 e6 100 c6))
  (va (0 g4 50 d5 100 g4))

```

```

                                (vc (0 c4 50 f4 100 c4)))
:fast-leap-threshold 0.5
:instruments-hierarchy '(fl vn cl tp va hn vc)
:rehearsal-letters '(3 11 19)
:avoid-melodic-octaves nil
:instruments-write-bar-nums '(fl cl hn tp)
:pitch-seq-index-scaler-min 0.1
:bars-per-system-map '((1 1) (2 2) (3 3) (7 4) (11 5))
:rthm-seq-map-replacements '(((1 va) 3 1) ((2 fl) 4 3))
:set-map-replacements '(((1 2 2) (3 3 1))))
(midi-play mini :midi-file "/tmp/mini.mid")
(cmn-display mini)
(write-lp-data-for-all mini))

```

**SYNOPSIS:**

```

(defun make-slippery-chicken (name &key
                              rthm-seq-palette
                              rthm-seq-map
                              set-palette
                              set-map
                              sndfile-palette
                              tempo-map
                              tempo-curve
                              (snd-output-dir (get-sc-config 'default-dir))
                              instrument-change-map
                              instruments-write-bar-nums
                              bars-per-system-map
                              staff-groupings
                              rthm-seq-map-replacements
                              set-map-replacements
                              set-limits-low
                              set-limits-high
                              instrument-palette
                              ensemble
                              rehearsal-letters
                              (fast-leap-threshold 0.125)
                              instruments-hierarchy
                              (title "slippery chicken piece")
                              composer
                              (avoid-melodic-octaves t)
                              (avoid-used-notes t)
                              (pitch-seq-index-scaler-min 0.5)
                              defer
                              ;; MDE Mon Jul 2 16:08:42 2012
                              (key-sig '(c major)))

```

```
(warn-ties t))
```

### 21.39 slippery-chicken/midi-play

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:

Generate a MIDI file from the data of the specified slippery-chicken object.

#### ARGUMENTS:

- A slippery-chicken object.

#### OPTIONAL ARGUMENTS:

keyword arguments:

- :midi-file. The name of the MIDI file to produce, including directory path and extension. Default is a filename extracted from the title of the sc piece, placed in the (get-sc-config 'default-dir) directory (default /tmp).
- :voices. NIL or a list of player IDs indicating which of the players' parts are to be included in the resulting MIDI file. If NIL, all players' parts will be included. Default = NIL.
- :start-section. An integer that is the number of the first section for which the MIDI file is to be generated. Default = 1.
- :num-sections. An integer that is the number of sections to produce MIDI data for in the MIDI file. If NIL, all sections will be written. Default = NIL.
- :from-sequence. An integer that is the number of the sequence within the specified section from which to start generating MIDI data. NB: This argument can only be used when the num-sections = 1. Default = 1.
- :num-sequences. An integer that is the number of sequences for which MIDI data is to be generated in the resulting MIDI file, including the sequence specified in from-sequence. If NIL, all sequences will be written. NB: This argument can only be used when the num-sections = 1. Default = NIL.
- :force-velocity. An integer between 0 and 127 (inclusive) that is the MIDI velocity value which will be given to all notes in the resulting MIDI file. Default = NIL.
- :auto-open. Whether to open the MIDI file once written. Currently only available on OSX with SBCL or CCL. Uses the default app for MIDI files, as if opened with 'open' in the terminal. Default = Value of (get-sc-config 'midi-play-auto-open).
- :suffix. Add some text to the filename just before .mid?. Default = ""

**RETURN VALUE:**

Returns the path of the file written, as a string.

**EXAMPLE:**

```
;;; An example with some typical values for the keyword arguments.
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (hn (french-horn :midi-channel 2))
                        (vc (cello :midi-channel 3))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1 1 1))
                  (2 (1 1 1 1 1 1 1))
                  (3 (1 1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h (q) e (s) s))
                              :pitch-seq-palette ((1 2 3)))
                            (2 (((4 4) (q) e (s) s h))
                              :pitch-seq-palette ((1 2 3)))
                            (3 (((4 4) e (s) s h (q))
                              :pitch-seq-palette ((2 3 3)))
                            (4 (((4 4) (s) s h (q) e))
                              :pitch-seq-palette ((3 1 2)))))
       :rthm-seq-map '((1 ((cl (1 2 1 2 1 2 1))
                             (hn (1 2 1 2 1 2 1))
                             (vc (1 2 1 2 1 2 1))))
                       (2 ((cl (3 4 3 4 3 4 3))
                             (hn (3 4 3 4 3 4 3))
                             (vc (3 4 3 4 3 4 3))))
                       (3 ((cl (1 2 1 2 1 2 1))
                             (hn (1 2 1 2 1 2 1))
                             (vc (1 2 1 2 1 2 1))))))
      (midi-play mini
        :midi-file "/tmp/md-test.mid"
        :voices '(cl vc)
        :start-section 2))
```

**SYNOPSIS:**

```
#+cm-2
(defmethod midi-play ((sc slippery-chicken)
                     &key
                     ;; no subsection refs: use from-sequence instead
```

```

(start-section 1)
;; these voices are used to get the actual sequence
;; orders i.e. each voice will be appended to <section>
;; when calling get-data.
;; if nil then all voices.
(voices nil)
;; add something to the filename just before .mid?
(suffix "")
(midi-file
 (format nil "~a~a~a.mid"
          (get-sc-config 'default-dir)
          (filename-from-title (title sc))
          suffix))
(from-sequence 1)
(num-sequences nil)
;; if nil we'll write all the sections
(num-sections nil)
;; MDE Tue Jun  4 19:06:11 2013 --
(auto-open (get-sc-config 'midi-play-auto-open))
;; if this is a 7-bit number we'll use this for all notes
(force-velocity nil))

```

## 21.40 slippery-chicken/next-event

[ *slippery-chicken* ] [ *Methods* ]

### DESCRIPTION:

Get the events from a specified player's part within a given slippery-chicken object one after the other (e.g. in a loop). This method must be called once with a bar number (or any other non-NIL value, whereupon we start at bar 1) first in order to reset the counter; doing this will return NIL. Once the counter has been reset, calling the method without a bar number will return the events in sequence.

### ARGUMENTS:

- A slippery-chicken object.
- A player ID.

### OPTIONAL ARGUMENTS:

- T or NIL to indicate whether to return only events that consist of attacked notes (i.e., no ties or rests). T = return only events with attacked notes. Default = NIL.

- NIL or an integer to indicate the first bar from which events are to be retrieved. If NIL, the counter is reset to the first event of the player's part. This should be NIL after the first resetting call.  
Default = NIL
- NIL or an integer to indicate the last bar from which events are to be retrieved. If NIL, all events will be retrieved from the starting point to the last event in the given slippery-chicken object. Default = NIL.

**RETURN VALUE: EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((cl (b-flat-clarinet :midi-channel 1))
                        (hn (french-horn :midi-channel 2))
                        (vc (cello :midi-channel 3))))
        :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
        :set-map '((1 (1 1 1)))
        :rthm-seq-palette '((1 (((4 4) h (q) e (s) s))
                                :pitch-seq-palette ((1 2 3))))
        :rthm-seq-map '((1 ((cl (1 1 1))
                               (hn (1 1 1))
                               (vc (1 1 1)))))))
      (next-event mini 'vc nil 1)
      (loop for ne = (next-event mini 'vc)
            while ne
            collect (get-pitch-symbol ne)))

=> (E4 NIL F4 NIL G4 E4 NIL F4 NIL G4 E4 NIL F4 NIL G4)
```

**SYNOPSIS:**

```
(defmethod next-event ((sc slippery-chicken) player
                      &optional
                      (attacked-notes-only nil)
                      ;; could be a number too, whereupon it's the bar
                      ;; number to start at
                      (start-over nil)
                      (end-bar nil)) ; inclusive
```

**21.41 slippery-chicken/num-bars**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return the number of bars in the piece.

#### ARGUMENTS:

- A slippery-chicken object.

#### RETURN VALUE:

An integer that is the number of bars.

#### EXAMPLE:

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((fl (flute :midi-channel 1))
                       (tp (b-flat-trumpet :midi-channel 2))
                       (vn (violin :midi-channel 3))))
       :set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s)
                                :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((fl (1 1 1 1 1))
                             (tp (1 1 1 1 1))
                             (vn (1 1 1 1 1)))))))
      (num-bars mini))

=> 5
```

#### SYNOPSIS:

```
(defmethod num-bars ((sc slippery-chicken))
```

### 21.42 slippery-chicken/num-notes

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:

Returns the number of attacked notes in a given slippery-chicken object; i.e., not including ties or rests.

#### ARGUMENTS:

- A slippery-chicken object.

**RETURN VALUE:**

An integer,

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((fl (flute :midi-channel 1))))
       :set-palette '((1 ((c4 d4 e4 f4 g4 a4 b4 c5))))
       :set-map '((1 (1)))
       :rthm-seq-palette '((1 (((4 4) - e e e e - - e e e e -))))
       :rthm-seq-map '((1 ((fl (1)))))))
      (num-notes mini))

=> 8
```

**SYNOPSIS:**

```
(defmethod num-notes ((sc slippery-chicken))
```

**21.43 slippery-chicken/num-seqs**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return the number of sequences (which may contain multiple bars) in a specified section of a slippery-chicken object.

NB This will return the total number of seqs if there are sub-sections.

**ARGUMENTS:**

- A slippery-chicken object.
- The ID of the section for which to return the number of sequences.

**RETURN VALUE:**

An integer.

**EXAMPLE:**



```

(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1 1))
                  (2 (1 1 1))
                  (3 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                              :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1 1))))
                       (2 ((sax (1 1 1))))
                       (3 ((sax (1 1 1 1 1)))))))
      (num-seqs mini 2))

```

=> 3

#### SYNOPSIS:

```
(defmethod num-seqs ((sc slippery-chicken) section-ref)
```

### 21.44 slippery-chicken/player-doubles

[ *slippery-chicken* ] [ *Methods* ]

#### DATE:

02-Apr-2012

#### DESCRIPTION:

Boolean test to check whether a specified player plays more than one instrument.

#### ARGUMENTS:

- A slippery-chicken object.
- A player ID.

#### RETURN VALUE:

T if the player has more than one instrument, otherwise NIL>

#### EXAMPLE:

```

(let ((mini
(make-slippy-chicken
'+mini+
:ensemble '(((sax ((alto-sax tenor-sax) :midi-channel 1))
(db (double-bass :midi-channel 2))))
:instrument-change-map '((1 ((sax ((1 alto-sax) (3 tenor-sax)))))
(2 ((sax ((2 alto-sax) (5 tenor-sax)))))
:set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
:set-map '((1 (1 1 1 1 1))
(2 (1 1 1 1 1)))
:rthm-seq-palette '((1 (((4 4) h q e s s))
:pitch-seq-palette ((1 2 3 4 5))))
:rthm-seq-map '((1 ((sax (1 1 1 1 1))
(db (1 1 1 1 1))))
(2 ((sax (1 1 1 1 1))
(db (1 1 1 1 1)))))
(player-doubles mini 'sax))

=> T

```

**SYNOPSIS:**

```
(defmethod player-doubles ((sc slippy-chicken) player)
```

**21.45 slippy-chicken/players**

[ *slippy-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Return a list of all player IDs from the given slippy-chicken object.

**ARGUMENTS:**

- A slippy-chicken object.

**RETURN VALUE:**

A list of player IDs.

**EXAMPLE:**

```

(let ((mini
      (make-slippy-chicken
       '+mini+

```

```

:ensemble '(((cl (b-flat-clarinet :midi-channel 1))
              (hn (french-horn :midi-channel 2))
              (vc (cello :midi-channel 3))))
:set-palette '((1 ((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
:set-map '((1 (1 1 1)))
:rthm-seq-palette '((1 (((4 4) h (q) e (s) s))
                        :pitch-seq-palette ((1 2 3)))))
:rthm-seq-map '((1 ((cl (1 1 1))
                      (hn (1 1 1))
                      (vc (1 1 1))))))

(players mini))

=> (CL HN VC)

```

**SYNOPSIS:**

```
(defmethod players ((sc slippery-chicken))
```

**21.46 slippery-chicken/rebar**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Go through the vertically simultaneous sequences in all players of the given slippery-chicken object and rebar according to the first one that has the least number of bars (but following the player hierarchy).

If rthm-seqs or sequences are created algorithmically and bundled into the slippery-chicken piece slot artificially, bypassing the usual generation structure, it might be difficult to end up with each instrument having the same metric structure when combined vertically. This method goes through the vertically combined sequences and rebars as described above.

NB: See documentation in piece class method. Don't confuse this method with the re-bar method.

NB: This method is used internally and not recommended for direct use.

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

- A list of player IDs from the given slippery-chicken object, ordered in terms of importance i.e. which instrument's bar structure should take precedence.
- NB: The rebar-fun is not yet used.

**RETURN VALUE:**

Always T.

**SYNOPSIS:**

```
(defmethod rebar ((sc slippery-chicken)
                  &optional instruments-hierarchy rebar-fun)
```

**21.47 slippery-chicken/sc-init**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Explicitly initialize the slippery-chicken object. This is usually called implicitly by initialize-instance (i.e. when you call make-slippery-chicken) but there could be circumstances (e.g. in subclasses of slippery-chicken) where you'd like to defer initialization and call this method explicitly instead. In that case set :defer to t when making the slippery-chicken object.

**ARGUMENTS:**

- the slippery-chicken object

**OPTIONAL ARGUMENTS**

keyword arguments:

- :regenerate-pitch-seq-map: the pitch-seq-map is generated here for each instrument using the pitch-seqs in the rthm-seq-palette. By setting this to T we can force regeneration (e.g. if the rthm-seq-palette has changed and we want to re-init the sc with different data). Default = T.

**RETURN VALUE:**

the now fully initialized slippery-chicken object

**EXAMPLE:**

```
(let ((sc (make-slippery-chicken
      '+mini+
      :ensemble '(((vn (violin :midi-channel 1))))
      :set-palette '((1 ((gs4 af4 bf4))))
      :defer t
      :set-map '((1 (1 1 1)))
      :rthm-seq-palette '((1 (((4 4) e e e e e e e))
                                :pitch-seq-palette ((1 2 1 1 1 1 1 1))))
      :rthm-seq-map '((1 ((vn (1 1 1)))))))
  (sc-init sc))
```

**SYNOPSIS:**

```
(defmethod sc-init ((sc slippery-chicken) &key (regenerate-pitch-seq-map t))
```

**21.48 slippery-chicken/shorten-large-fast-leaps**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Modify the pitches of each part in a slippery-chicken object to avoid large melodic leaps at fast speeds, based on the largest-fast-leap slot of the given instrument object and the fast-leap-threshold slot of the slippery-chicken object.

This method is called automatically at init and as such will most likely seldom need to be directly accessed by the user.

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

keyword arguments:

- :threshold. A number that is the maximum duration in seconds between two consecutive notes in the slippery-chicken object for which linear intervals greater than the number specified in the given instrument object's largest-fast-leap slot will be allowed. This value is taken from the fast-leap-threshold slot of the given slippery-chicken object by default.
- :verbose. T or NIL to indicate whether to print feedback about the method's operations to the Lisp listener. T = print. Default = T.

**RETURN VALUE:**

Always T

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((vn (violin :midi-channel 1))))
       :tempo-map '((1 (q 96)))
       :set-palette '((1 ((g3 a5 b6))))
       :set-map '((1 (1 1 1 1 1 1)))
       :rthm-seq-palette '((1 (((2 4) e s 32 64 64 e s 32 64 64))
                                :pitch-seq-palette ((1 5 1 5 1 5 1 5 1 5))))))
      :rthm-seq-map '((1 ((vn (1 1 1 1 1 1))))))
      (shorten-large-fast-leaps mini :threshold 0.25))
```

=>

```
***** section (1)
Getting notes for VN
Shortening short, fast leaps...
Shortened 23 large fast leaps
seq-num 0, VN, replacing B6 with G3
seq-num 0, VN, replacing B6 with G3
seq-num 0, VN, replacing B6 with G3
seq-num 0, VN, replacing B6 with G3
seq-num 0, VN, replacing G3 with B6
seq-num 0, VN, replacing G3 with B6
seq-num 0, VN, replacing G3 with B6
seq-num 1, VN, replacing G3 with B6
seq-num 1, VN, replacing B6 with G3
seq-num 1, VN, replacing B6 with G3
seq-num 1, VN, replacing B6 with G3
seq-num 1, VN, replacing G3 with B6
seq-num 1, VN, replacing G3 with B6
seq-num 1, VN, replacing G3 with B6
seq-num 2, VN, replacing G3 with B6
seq-num 2, VN, replacing B6 with G3
seq-num 2, VN, replacing B6 with G3
seq-num 2, VN, replacing B6 with G3
seq-num 2, VN, replacing B6 with G3
seq-num 2, VN, replacing G3 with B6
seq-num 2, VN, replacing G3 with B6
seq-num 2, VN, replacing G3 with B6
```

```

seq-num 3, VN, replacing G3 with B6
seq-num 3, VN, replacing B6 with G3
seq-num 3, VN, replacing B6 with G3
seq-num 3, VN, replacing B6 with G3
seq-num 3, VN, replacing B6 with G3
seq-num 3, VN, replacing G3 with B6
seq-num 3, VN, replacing G3 with B6
seq-num 3, VN, replacing G3 with B6
seq-num 4, VN, replacing G3 with B6
seq-num 4, VN, replacing B6 with G3
seq-num 4, VN, replacing B6 with G3
seq-num 4, VN, replacing B6 with G3
seq-num 4, VN, replacing B6 with G3
seq-num 4, VN, replacing G3 with B6
seq-num 4, VN, replacing G3 with B6
seq-num 4, VN, replacing G3 with B6
seq-num 5, VN, replacing G3 with B6
seq-num 5, VN, replacing B6 with G3
seq-num 5, VN, replacing B6 with G3
seq-num 5, VN, replacing B6 with G3
seq-num 5, VN, replacing B6 with G3
seq-num 5, VN, replacing G3 with B6
seq-num 5, VN, replacing G3 with B6
seq-num 5, VN, replacing G3 with B6

```

**SYNOPSIS:**

```

(defmethod shorten-large-fast-leaps ((sc slippery-chicken)
                                     &key threshold (verbose t))

```

**21.49 slippery-chicken/statistics**

```
[ slippery-chicken ] [ Methods ]
```

**DESCRIPTION:**

Print various information about the given slippery-chicken object to the Lisp listener or other specified stream.

**ARGUMENTS:**

- A slippery-chicken object.

**OPTIONAL ARGUMENTS:**

- NIL or a stream to which the information should be printed. If NIL, the method will not print the information to any stream. T = print to the Lisp listener. Default = T.

**RETURN VALUE:**

A number of formatted statistics about the given slippery-chicken object.

**EXAMPLE:**

```
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))))
       :set-palette '((1 ((e3 fs3 b3 cs4 fs4 gs4 ds5 f5))))
       :set-map '((1 (1 1 1))
                  (2 (1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                             :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1))))
                       (2 ((sax (1 1 1)))))))
      (statistics mini))

=>
+MINI+
"+MINI+-piece"
      start-bar: 1
      end-bar: 6
      num-bars: 6
      start-time: 0.0
      end-time: 24.0
      start-time-qtrs: 0
      end-time-qtrs: 24.0
      num-notes (attacked notes, not tied): 30
      num-score-notes (tied notes counted separately): 30
      num-rests: 0
      duration-qtrs: 24.0
      duration: 24.0 (24.000)
```

**SYNOPSIS:**

```
(defmethod statistics ((sc slippery-chicken) &optional (stream t))
```

**21.50 slippery-chicken/transpose-events**

[ *slippery-chicken* ] [ *Methods* ]



**DESCRIPTION:**

Transpose the pitches of event objects in a specified region and a specified player's part.

**ARGUMENTS:**

- A slippery-chicken object.
- A player ID.
- An integer that is the first bar in which to transpose events.
- An integer that is the first event in that bar to transpose.
- An integer that is the last bar in which to transpose events.
- An integer that is the last event in that bar to transpose.
- A positive or negative number that is the number of semitones by which the pitches of the events in the specified region should be transposed.

**OPTIONAL ARGUMENTS:**

keyword argument:

- :destructively. T or NIL to indicate whether the pitches of the original event objects should be replaced. T = replace. Default = T.

**RETURN VALUE:**

Returns a list of events.

**EXAMPLE:**

```
;;; Print the pitches before and after applying the method
(let ((mini
      (make-slippery-chicken
       '+mini+
       :ensemble '(((sax (alto-sax :midi-channel 1))
                        (db (double-bass :midi-channel 2))))
       :set-palette '((1 ((c2 d2 g2 a2 e3 fs3 b3 cs4 fs4 gs4 ds5 f5 bf5))))
       :set-map '((1 (1 1 1 1 1)))
       :rthm-seq-palette '((1 (((4 4) h q e s s))
                                :pitch-seq-palette ((1 2 3 4 5))))
       :rthm-seq-map '((1 ((sax (1 1 1 1 1))
                                (db (1 1 1 1 1))))))
      (print
       (loop for e in (get-events-from-to mini 'sax 3 2 5 3)
              collect (get-pitch-symbol e))
       (transpose-events mini 'sax 3 2 5 3 11)
       (print
```

```
(loop for e in (get-events-from-to mini 'sax 3 2 5 3)
  collect (get-pitch-symbol e))))
```

```
=>
```

```
(EF4 AF4 BF4 EF5 CS4 EF4 AF4 BF4 EF5 CS4 EF4 AF4)
(D5 G5 A5 D6 C5 D5 G5 A5 D6 C5 D5 G5)
```

#### SYNOPSIS:

```
(defmethod transpose-events ((sc slippery-chicken) player start-bar
  start-event end-bar end-event semitones
  &key (destructively t))
```

### 21.51 slippery-chicken/update-instrument-slots

[ *slippery-chicken* ] [ *Methods* ]

#### DATE:

23rd August 2013

#### DESCRIPTION:

This will go through the generated slippery-chicken object's bar structure and update each players' instruments' total-bars, total-notes, total-duration, and total-degrees slots, for statistical purposes only. This might be called by the user after performing one of the editing routines that deletes or changes notes, etc.

#### ARGUMENTS:

- The slippery-chicken object.

#### RETURN VALUE:

T

#### SYNOPSIS:

```
(defmethod update-instrument-slots ((sc slippery-chicken))
```

### 21.52 slippery-chicken/update-slots

[ *slippery-chicken* ] [ *Methods* ]

#### DESCRIPTION:

Called by initialize-instance and others. Updates timings of events and statistics. Not generally called by the user but can be useful if post-generation editing has changed something fundamental to the structure.

**ARGUMENTS:**

- A slippery-chicken object

### OPTIONAL ARGUMENTS:

- A tempo-map object (not just as a list). If not given, then the tempo-map from the slippery-chicken object will be used. Default = NIL.
- A number that is the start-time of the first event object in seconds. Default = 0.0.
- A number that is the start-time of the first event, in 'quarters' (for MIDI timing). Default = 0.0.
- A integer that is the number of the starting bar. Default = 1.
- The reference of the current section (for internal recursive use in the bar-holder class). Default = NIL.
- The nth sequence (for internal recursive use in the sequenz class). Default = NIL.
- T or NIL to indicate whether to print a warning to the Lisp listener when ties are being used at the beginning of a sequence. This argument is now obsolete and ignored, but remains for some backward compatibility. Default = T.

**RETURN VALUE:**

The duration in seconds of the object; in this class: the whole generated piece.

**EXAMPLE:**

[illegible]

```

      :rthm-seq-map '((1 ((vn (1 1 1 1 1))))))
    (print (start-time (get-event mini 4 1 'vn)))
    (update-slots mini nil 10.0)
    (print (start-time (get-event mini 4 1 'vn))))

=
6.0
16.0

```

**SYNOPSIS:**

```

(defmethod update-slots ((sc slippery-chicken)
  &optional
  (tempo-map nil)
  (start-time 0.0)
  (start-time-qtrs 0.0)
  (start-bar 1)
  (current-section nil)
  (nth nil)
  (warn-ties t)
  (update-write-bar-nums nil))

```

**21.53 slippery-chicken/write-lp-data-for-all**

[ *slippery-chicken* ] [ *Methods* ]

**DESCRIPTION:**

Generate all of the .ly files required by the LilyPond application for printable output from the musical data stored in the given slippery-chicken object.

This method produces .ly files for the score as well as the parts for all individual players in the ensemble (unless otherwise specified by the user). The files are automatically named based on the value passed to the TITLE slot of the given slippery-chicken object.

NB: This method only produces the .ly files. These must be rendered by the LilyPond application separately for PDF output. See the slippery chicken installation web page and the manual page on Output for more detail. Bear in mind that SBCL and CCL users on OSX can use the lp-display macro to call Lilypond and display the resultant PDF automatically.

NB: Many of the arguments for this method pass their values directly to

LilyPond parameters.

NB: Clefs added to grace-note events will not be rendered in Lilypond.

## ARGUMENTS:

- A slippery-chicken object.

## OPTIONAL ARGUMENTS:

keyword arguments:

- `:base-path`. A string that is the directory path only for the resulting files. The method will automatically generate the file names and extensions. Default = `(get-sc-config 'default-dir)`.
- `:start-bar`. An integer that is the first bar of the given slippery-chicken object for which output is to be generated. If NIL, the start-bar will be set to 1. Default = NIL.
- `:end-bar`. An integer that is the last bar of the given slippery-chicken object for which output is to be generated. If NIL, all bars after the start bar will be generated. Default = NIL.
- `:start-bar-numbering`. For bar counting in the score only: the bar number that the `:start-bar` will be counted as (integer). NIL = `:start-bar`. Default = NIL.
- `:players`. A list of player IDs or NIL to indicate which players' parts are to be generated and included in the resulting score. If NIL, all players' parts will be generated and included in the score. This can be handy, for example, for excluding the computer part of a piece for tape and instruments. Default = NIL.
- `:respell-notes`. NIL, T or a list to indicate whether the method should also call the `respell-notes` method on the given slippery-chicken object before generating the output to undertake enharmonic changes. If a list, then these are the specific enharmonic corrections to be undertaken. If this is T, the method will process all pitches for potential respelling. If NIL, no respelling will be undertaken. See the documentation for the `respell-notes` method for more. Default = NIL.
- `:auto-clefs`. T or NIL to indicate whether the `auto-clefs` method should be called to automatically place mid-measure clefs in the parts of instruments that use more than one clef. T = automatically place clefs. Default = T
- `:in-c`. T or NIL to indicate whether the full score is to contain written pitches or sounding pitches. NB: Some transposing C instruments still transpose at the octave in C scores, such as double-bass and piccolo. NB: Parts will always be transposed. T = sounding pitches. Default = NIL.
- `:page-nums`. T or NIL to indicate whether page numbers should automatically be added to each page (not including the start page) of the output. T = add page numbers. Default = T.

- :rehearsal-letters-font-size. A number that indicates the font size of rehearsal letters in LilyPond output. Default = 18.
- :rehearsal-letters-all-players. T or NIL to indicate whether rehearsal letters are to be placed in all parts generated. T = all parts. Default = T. NB: This must be set to T when the user would like the rehearsal letters in all individual LilyPond parts, but printing with CMN thereafter will result in rehearsal letters in all parts as well.
- :tempi-all-players. T or NIL to indicate whether tempo marks are to be placed in all parts generated. T = all parts. Default = T.
- :all-bar-nums. T or NIL to indicate whether the corresponding bar number should be printed above every measure in the score (not including multi-bar rests). T = add a bar number to every measure. Default = NIL.
- :paper. A string to indicate the paper size for LilyPond output. Only LilyPond's predefined paper sizes are valid here. According to the LilyPond manual, these include: "a4, letter, legal, and 11x17... Many more paper sizes are supported... For details, see scm/paper.scm, and search for the definition of paper-alist." NB: This argument will only adjust paper size, but not margins or line widths, which are adjusted using the arguments below. Default = "a4"
- :staff-size. An integer that indicates the size of the notes and staves in the resulting output. Default = 14.
- :group-barlines. T or NIL to indicate whether bar lines should be drawn through the whole staff group or just one staff. T = through the whole staff group. Default = T.
- :landscape. T or NIL to indicate whether the paper format should be landscape or portrait. T = landscape. NB: This argument will only adjust paper layout, but not margins or line widths, which are adjusted using the arguments below. Default = NIL.
- :barline-thickness. A number that is the relative thickness of the bar lines. Default = 0.5.
- :top-margin. A number that is the margin at the top of the page in millimeters. Default = 10.
- :bottom-margin. A number that is the margin at the bottom of the page in millimeters. Default = 10.
- :left-margin. A number that is the margin at the left of the page in millimeters. Default = 20.
- :line-width. A number that is the width of each line in centimeters. Default = 17.
- :page-turns. T or NIL to indicate if LilyPond should attempt to optimize page breaks for page turns in parts. T = optimize page breaks. Default = NIL.
- :min-page-turn. A two-item list indicating the minimum rest necessary for the method to automatically place a page turn, in a format similar to that of a time signature; i.e., '(2 1) would mean a minimum of 2 whole rests. Default = '(2 1))
- :use-custom-markup. T or NIL. Set to T when using a number of marks that

are specific to LilyPond, such as 'bartok or any of the marks that use eps graphics files (whereupon those graphics files would need to be in the same folder as your lilypond files). Default = T.

- :lp-version. A string that will be added to each .ly file generated in conjunction with the LilyPond \version command. Default = "2.17.95"
- :process-event-fun. NIL or a user-defined function that will be applied to every event object in the given slippery-chicken object. If NIL, no processes will be applied. Default = NIL.
- :extend-hairpins. If you want hairpin (cresc/dim) to extend beyond the previous barline (or beyond the note) set to T. Default = NIL.
- :stemlet-length. NIL or a decimal number < 1.0 that indicates the scaled length of stems over rests in LilyPond output, should this feature be desired. 0.75 is a recommended value for this. NIL = no stems over rests. Default = NIL. NB: LilyPond can be instructed to extend beams over rests (without stemlets) simply by using the '-' in the definition of the rthm-seq-bar object, as is done with any other note; however, starting/ending a beam on a rest and then trying to generate a score with CMN will fail.
- :footer. A string to add to the footer of every score page. Default = NIL.
- :subtitle. The subtitle, as a string, to add below the title (taken from the sc object). Default = NIL.

## RETURN VALUE:

The path of the main score file generated.

## EXAMPLE:

;;; An example with values for the most frequently used arguments

```
(let ((mini
      (make-slippery-chicken
        '+mini+
        :ensemble '(((fl (flute :midi-channel 1))
                       (cl (b-flat-clarinet :midi-channel 2))
                       (vc (cello :midi-channel 3))))
        :staff-groupings '(2 1)
        :tempo-map '((1 (q 84)) (9 (q 72)))
        :set-palette '(((f3 g3 a3 b3 c4 d4 e4 f4 g4 a4 b4 c5))))
      :set-map '((1 (1 1 1 1 1 1 1 1))
                  (2 (1 1 1 1 1 1 1 1))
                  (3 (1 1 1 1 1 1 1 1)))
      :rthm-seq-palette '(1 (((4 4) h (q) e (s) s))
                            :pitch-seq-palette ((1 2 3))
                            :marks (bartok 1)))
      (2 (((4 4) (q) e (s) s h))
          :pitch-seq-palette ((1 2 3))))))
```

```

:rthm-seq-map '((1 ((fl (1 2 1 2 1 2 1 2))
                      (cl (1 2 1 2 1 2 1 2))
                      (vc (1 2 1 2 1 2 1 2)))))
              (2 ((fl (1 2 1 2 1 2 1 2))
                  (cl (1 2 1 2 1 2 1 2))
                  (vc (1 2 1 2 1 2 1 2)))))
              (3 ((fl (1 2 1 2 1 2 1 2))
                  (cl (1 2 1 2 1 2 1 2))
                  (vc (1 2 1 2 1 2 1 2)))))
:rehearsal-letters '(3 11 19)))
(write-lp-data-for-all mini
  :start-bar 7
  :end-bar 23
  :paper "letter"
  :landscape t
  :respell-notes nil
  :auto-clefs nil
  :staff-size 17
  :in-c nil
  :barline-thickness 3.7
  :top-margin 40
  :bottom-margin 60
  :left-margin 40
  :line-width 22
  :page-nums t
  :all-bar-nums t
  :use-custom-markup t
  :rehearsal-letters-font-size 24
  :lp-version "2.12.1"
  :group-barlines nil
  :page-turns t
  :players '(fl cl)
  :tempi-all-players t))

```

=> T

## SYNOPSIS:

```

(defmethod write-lp-data-for-all ((sc slippery-chicken)
  &key
  (base-path (get-sc-config 'default-dir))
  start-bar end-bar (paper "a4") landscape
  ;; MDE Tue May 29 21:34:53 2012
  start-bar-numbering
  ;; if a list, then these are the enharmonic
  ;; corrections

```



```

(respell-notes t)
;; automatically add clefs to instruments who
;; read more than one?
(auto-clefs t)
(staff-size 14)
;; parts will always be transposed but score
;; can be in in C or not
(in-c nil)
(barline-thickness 0.5)
(top-margin 10) ; mm
(bottom-margin 10) ; mm
(left-margin 20) ;mm
(line-width 17) ;cm
(page-nums t)
;; print every bar number unless
;; multi-bar-rest?
(all-bar-nums nil)
;; this has to be T if we're going to get
;; letters in the parts--but CMN printing
;; will have all parts all letters too
;; thereafter
(rehearsal-letters-all-players t)
;; set to t if using bartok pizz and
;; other signs
(use-custom-markup t)
(rehearsal-letters-font-size 18)
;; "2.16.2") "2.14.2") ;"2.12.3")
(lp-version "2.17.95")
;; 24.7.11 (Pula) barlines through whole
;; staff group or just a stave
(group-barlines t)
;; 5.11.11 set to t if you want lilypond to
;; optimize page breaks for page turns in
;; parts
(page-turns nil)
;; MDE Sat Mar 10 16:52:31 2012
(process-event-fun nil)
;; MDE Mon Apr 16 16:08:36 2012 -- added so
;; that we can write a subset of players
;; into the score (e.g. leave out a computer
;; part). If nil all players will be written.
(players nil)
;; MDE Fri Dec 27 16:56:51 2013
(subtitle nil)
(footer nil)
;; minimum rest necessary to do a page turn;

```

```
;; something like a time signature e.g. (2 1)
;; would mean we need a min. of 2 whole rests
(min-page-turn '(2 1))
;; MDE Tue May 29 22:58:25 2012
(stemlet-length nil)
;; MDE Thu Jan 9 09:20:33 2014 -- if you
;; want hairpin (cresc/dim) to extend beyond
;; the note set to T
(extend-hairpins nil)
;; sim to rehearsal letters
(tempi-all-players t))
```