Guile Library

version 0.2.6.1, updated July 2018

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This manual is for Guile Library (version 0.2.6.1, updated July 2018)

Short Contents

1 (apicheck)

1.1 Overview

`(apicheck)` exports two routines. `apicheck-generate` produces a description of the Scheme API exported by a set of modules as an S-expression. `apicheck-validate` verifies that the API exported by a set of modules is compatible with an API description generated by `apicheck-generate`.

It would be nice to have Makefile.am fragments here, but for now, see the Guile-Library source distribution for information on how to integrate apicheck with your module's unit test suite.

1.2 Usage

`apicheck-generate` *module-names* [Function]
: Generate a description of the API exported by the set of modules *module-names*.

`apicheck-validate` *api module-names* [Function]
: Validate that the API exported by the set of modules *module-names* is compatible with the recorded API description *api*. Raises an exception if the interface is incompatible.

2 (config load)

2.1 Overview

This module needs to be documented.

2.2 Usage

<configuration> [Class]

load-config! [Generic]

load-config! (*cfg* <configuration>) (*commands* <list>) [Method]
(*file-name* <string>)

&config-error [Variable]

config-error-arguments *c* [Function]

3 (container async-queue)

3.1 Overview

A asynchronous queue can be used to safely send messages from one thread to another.

3.2 Usage

`make-async-queue` [Function]
: Create a new asynchronous queue.

`async-enqueue!` *q elt* [Function]
: Enqueue *elt* into *q*.

`async-dequeue!` *q* [Function]
: Dequeue a single element from *q*. If the queue is empty, the calling thread is blocked until an element is enqueued by another thread.

4 (container nodal-tree)

4.1 Overview

A nodal tree is a tree composed of nodes, each of which may have children. Nodes are represented as alists. The only alist entry that is specified is `children`, which must hold a list of child nodes. Other entries are intentionally left unspecified, so as to allow for extensibility.

4.2 Usage

`nodal-tree?` *x* [Function]

Predicate to determine if *x* is a nodal tree. Not particularly efficient: intended for debugging purposes.

`make-node` . *attributes* [Function]

`node-ref` *node name* [Function]

`node-set!` *node name val* [Function]

`node-children` *node* [Function]

5 (container delay-tree)

5.1 Overview

A delay tree is a superset of a nodal tree (see (container nodal-tree)). It extends nodal trees to allow any entry of the node to be a promise created with the `delay` operator.

5.2 Usage

`force-ref` *node field* [Function]

Access a field in a node of a delay tree. If the value of the field is a promise, the promise will be forced, and the value will be replaced with the forced value.

6 (debugging assert)

6.1 Overview

Defines an `assert` macro, and the `cout` and `cerr` utility functions.

6.2 Usage

`assert` *doit* (*expr ...*) (*r-exp ...*) [Special Form]
`assert` *collect* (*expr ...*) [Special Form]
`assert` *collect* (*expr ...*) *report: r-exp ...* [Special Form]
`assert` *collect* (*expr ...*) *expr1 stuff ...* [Special Form]
`assert` *stuff ...* [Special Form]

Assert the truth of an expression (or of a sequence of expressions).

syntax: `assert` *?expr ?expr* `...` `[report:` *?r-exp ?r-exp* `...]`

If `(and` *?expr ?expr* `...)` evaluates to anything but `#f`, the result is the value of that expression. Otherwise, an error is reported.

The error message will show the failed expressions, as well as the values of selected variables (or expressions, in general). The user may explicitly specify the expressions whose values are to be printed upon assertion failure – as *?r-exp* that follow the identifier `report:`.

Typically, *?r-exp* is either a variable or a string constant. If the user specified no *?r-exp*, the values of variables that are referenced in *?expr* will be printed upon the assertion failure.

`cout` . *args* [Function]

Similar to `cout << arguments << args`, where *argument* can be any Scheme object. If it's a procedure (e.g. `newline`), it's called without args rather than printed.

`cerr` . *args* [Function]

Similar to `cerr << arguments << args`, where *argument* can be any Scheme object. If it's a procedure (e.g. `newline`), it's called without args rather than printed.

7 (debugging time)

7.1 Overview

Defines a macro to time execution of a body of expressions. Each element is timed individually.

7.2 Usage

`time` *args* [Special Form]

syntax: `(time expr1 expr2...)`

Times the execution of a list of expressions, in milliseconds. The resolution is limited to guile's `internal-time-units-per-second`. Disregards the expressions' return value(s) (FIXME).

8 (graph topological-sort)

8.1 Overview

```
The algorithm is inspired by Cormen, Leiserson and Rivest (1990)
``Introduction to Algorithms'', chapter 23.
```

8.2 Usage

`topological-sort` *dag* [Function]

Returns a list of the objects in the directed acyclic graph, *dag*, topologically sorted. Objects are compared using `equal?`. The graph has the form:

```
(list (obj1 . (dependents-of-obj1))
      (obj2 . (dependents-of-obj2)) ...)
```

...specifying, for example, that `obj1` must come before all the objects in `(dependents-of-obj1)` in the sort.

`topological-sortq` *dag* [Function]

Returns a list of the objects in the directed acyclic graph, *dag*, topologically sorted. Objects are compared using `eq?`. The graph has the form:

```
(list (obj1 . (dependents-of-obj1))
      (obj2 . (dependents-of-obj2)) ...)
```

...specifying, for example, that `obj1` must come before all the objects in `(dependents-of-obj1)` in the sort.

`topological-sortv` *dag* [Function]

Returns a list of the objects in the directed acyclic graph, *dag*, topologically sorted. Objects are compared using `eqv?`. The graph has the form:

```
(list (obj1 . (dependents-of-obj1))
      (obj2 . (dependents-of-obj2)) ...)
```

...specifying, for example, that `obj1` must come before all the objects in `(dependents-of-obj1)` in the sort.

9 (htmlprag)

9.1 Overview

HtmlPrag provides permissive HTML parsing capability to Scheme programs, which is useful for software agent extraction of information from Web pages, for programmatically transforming HTML files, and for implementing interactive Web browsers. HtmlPrag emits "SHTML," which is an encoding of HTML in [SXML], so that conventional HTML may be processed with XML tools such as [SXPath] and [SXML-Tools]. Like [SSAX-HTML], HtmlPrag provides a permissive tokenizer, but also attempts to recover structure. HtmlPrag also includes procedures for encoding SHTML in HTML syntax.

The HtmlPrag parsing behavior is permissive in that it accepts erroneous HTML, handling several classes of HTML syntax errors gracefully, without yielding a parse error. This is crucial for parsing arbitrary real-world Web pages, since many pages actually contain syntax errors that would defeat a strict or validating parser. HtmlPrag's handling of errors is intended to generally emulate popular Web browsers' interpretation of the structure of erroneous HTML. We euphemistically term this kind of parse "pragmatic."

HtmlPrag also has some support for [XHTML], although XML namespace qualifiers [XML-Names] are currently accepted but stripped from the resulting SHTML. Note that valid XHTML input is of course better handled by a validating XML parser like [SSAX].

To receive notification of new versions of HtmlPrag, and to be polled for input on changes to HtmlPrag being considered, ask the author to add you to the moderated, announce-only email list, `htmlprag-announce`.

Thanks to Oleg Kiselyov and Kirill Lisovsky for their help with SXML.

9.2 Usage

`shtml-comment-symbol` [Variable]

`shtml-decl-symbol` [Variable]

`shtml-empty-symbol` [Variable]

`shtml-end-symbol` [Variable]

`shtml-entity-symbol` [Variable]

`shtml-named-char-id` [Variable]

`shtml-numeric-char-id` [Variable]

`shtml-pi-symbol` [Variable]

`shtml-start-symbol` [Variable]

`shtml-text-symbol` [Variable]

`shtml-top-symbol` [Variable]

`html->shtml` *input* [Function]

`html->sxml` *input* [Function]

`html->sxml-0nf` *input* [Function]

`html->sxml-1nf` *input* [Function]

`html->sxml-2nf` *input* [Function]

`make-html-tokenizer` *in normalized?* [Function]

`parse-html/tokenizer` *tokenizer normalized?* [Function]

`shtml->html` *shtml* [Function]

`shtml-entity-value` *entity* [Function]

`shtml-token-kind` *token* [Function]

`sxml->html` *shtml* [Function]

`test-htmlprag` [Function]

`tokenize-html` *in normalized?* [Function]

`write-shtml-as-html` *shtml out* [Function]

`write-sxml-html` *shtml out* [Function]

10 (io string)

10.1 Overview

Procedures that do io with strings.

10.2 Usage

`find-string-from-port?` *str* <*input-port*> . *max-no-char* [Function]

Looks for *str* in <*input-port*>, optionally within the first *max-no-char* characters.

11 (logging logger)

11.1 Overview

This is a logging subsystem similar to the one in the python standard library. There are two main concepts to understand when working with the logging modules. These are loggers and log handlers.

Loggers
: Loggers are the front end interfaces for program logging. They can be registered by name so that no part of a program needs to be concerned with passing around loggers. In addition, a default logger can be designated so that, for most applications, the program does not need to be concerned with logger instances at all beyond the initial setup.

  Log messages all flow through a logger. Messages carry with them a level (for example: 'WARNING, 'ERROR, 'CRITICAL), and loggers can filter out messages on a level basis at runtime. This way, the amount of logging can be turned up during development and bug investigation, but turned back down on stable releases.

  Loggers depend on Log Handlers to actually get text to the log's destination (for example, a disk file). A single Logger can send messages through multiple Log Handlers, effectively multicasting logs to multiple destinations.

Log Handlers
: Log Handlers actually route text to a destination. One or more handlers must be attached to a logger for any text to actually appear in a log.

  Handlers apply a configurable transformation to the text so that it is formatted properly for the destination (for instance: syslogs, or a text file). Like the loggers, they can filter out messages based on log levels. By using filters on both the Logger and the Handlers, precise controls can be put on which log messages go where, even within a single logger.

11.2 Example use of logger

Here is an example program that sets up a logger with two handlers. One handler sends the log messages to a text log that rotates its logs. The other handler sends logs to standard error, and has its levels set so that INFO and WARN-level logs don't get through.

```
(use-modules (logging logger)
             (logging rotating-log)
             (logging port-log)
             (scheme documentation)
             (oop goops))

;;;; ------------------------------------------------------------------
;;;; Support functions
;;;; ------------------------------------------------------------------
(define (setup-logging)
  (let ((lgr       (make <logger>))
```

```
        (rotating  (make <rotating-log>
                     #:num-files 3
                     #:size-limit 1024
                     #:file-name "test-log-file"))
        (err       (make <port-log> #:port (current-error-port))))

    ;; don't want to see warnings or info on the screen!!
    (disable-log-level! err 'WARN)
    (disable-log-level! err 'INFO)

    ;; add the handlers to our logger
    (add-handler! lgr rotating)
    (add-handler! lgr err)

    ;; make this the application's default logger
    (set-default-logger! lgr)
    (open-log! lgr)))


(define (shutdown-logging)
  (flush-log)   ;; since no args, it uses the default
  (close-log!)  ;; since no args, it uses the default
  (set-default-logger! #f))

 ---------------------------------------------------------------------
 Main code
 ---------------------------------------------------------------------
(setup-logging)

 Due to log levels, this will get to file,
 but not to stderr
(log-msg 'WARN "This is a warning.")

 This will get to file AND stderr
(log-msg 'CRITICAL "ERROR message!!!")

(shutdown-logging)
```

11.3 Usage

`<log-handler>` [Class]

This is the base class for all of the log handlers, and encompasses the basic functionality that all handlers are expected to have. Keyword arguments recognized by the `<log-handler>` at creation time are:

`#:formatter`
: This optional parameter must be a function that takes three arguments: the log level, the time (as from `current-time`), and the log string itself. The function must return a string representing the formatted log.

  Here is an example invokation of the default formatter, and what it's output looks like:

```
(default-log-formatter 'CRITICAL
                       (current-time)
                       "The servers are melting!")
==> "2003/12/29 14:53:02 (CRITICAL): The servers are melting!"
```

`emit-log` [Generic]

`emit-log handler str`. This method should be implemented for all the handlers. This sends a string to their output media. All level checking and formatting has already been done by `accept-log`.

`accept-log` [Generic]

`accept-log handler lvl time str`. If *lvl* is enabled for *handler*, then *str* will be formatted and sent to the log via the `emit-log` method. Formatting is done via the formatting function given at *handler*'s creation time, or by the default if none was given.

This method should not normally need to be overridden by subclasses. This method should not normally be called by users of the logging system. It is only exported so that writers of log handlers can override this behavior.

`accept-log (`*`self`* `<log-handler>) (`*`level`* `<top>) (`*`time`* `<top>) (`*`str`* `<top>)` [Method]

`<logger>` [Class]

This is the class that aggregates and manages log handlers. It also maintains the global information about which levels of log messages are enabled, and which have been suppressed. Keyword arguments accepted on creation are:

`#:handlers`
: This optional parameter must be a list of objects derived from `<log-handler>`. Handlers can always be added later via `add-handler!` calls.

`add-handler!` [Generic]

`add-handler! lgr handler`. Adds *handler* to *lgr*'s list of handlers. All subsequent logs will be sent through the new handler, as well as any previously registered handlers.

`add-handler! (`*`lgr`* `<logger>) (`*`handler`* `<log-handler>)` [Method]

`log-msg` [Generic]

`log-msg [lgr] lvl arg1 arg2 ...`. Send a log message made up of the `display`'ed representation of the given arguments. The log is generated at level *lvl*, which should be a symbol. If the *lvl* is disabled, the log message is not generated. Generated log messages are sent through each of *lgr*'s handlers.

If the *lgr* parameter is omitted, then the default logger is used, if one is set.

As the args are `display`'ed, a large string is built up. Then, the string is split at newlines and sent through the log handlers as independent log messages. The reason for this behavior is to make output nicer for log handlers that prepend information like pid and timestamps to log statements.

```
;; logging to default logger, level of WARN
(log-msg 'WARN "Warning! " x " is bigger than " y "!!!")

;; looking up a logger and logging to it
(let ((l (lookup-logger "main")))
    (log-msg l 'CRITICAL "FAILURE TO COMMUNICATE!")
    (log-msg l 'CRITICAL "ABORTING NOW"))
```

`log-msg` (*lgr* `<logger>`) (*lvl* `<top>`) (*objs* `<top>`)... [Method]

`log-msg` (*lvl* `<symbol>`) (*objs* `<top>`)... [Method]

`set-default-logger!` *lgr* [Function]

Sets the given logger, *lgr*, as the default for logging methods where a logger is not given. *lgr* can be an instance of `<logger>`, a string that has been registered via `register-logger!`, or `#f` to remove the default logger.

With this mechanism, most applications will never need to worry about logger registration or lookup.

```
;; example 1
(set-default-logger! "main")  ;; look up "main" logger and make it the default

;; example 2
(define lgr (make  <logger>))
(add-handler! lgr
              (make <port-handler>
                    #:port (current-error-port)))
(set-default-logger! lgr)
(log-msg 'CRITICAL "This is a message to the default logger!!!")
(log-msg lgr 'CRITICAL "This is a message to a specific logger!!!")
```

`register-logger!` *str lgr* [Function]

Makes *lgr* accessible from other parts of the program by a name given in *str*. *str* should be a string, and *lgr* should be an instance of class `<logger>`.

```
(define main-log  (make <logger>))
(define corba-log (make <logger>))
(register-logger! "main" main-log)
(register-logger! "corba" corba-log)

;; in a completely different part of the program....
(log-msg (lookup-logger "corba") 'WARNING "This is a corba warning.")
```

`lookup-logger` *str* [Function]

Looks up an instance of class `<logger>` by the name given in *str*. The string should have already been registered via a call to `register-logger!`.

`enable-log-level!` *lgr lvl* [Function]

Enables a specific logging level given by the symbol *lvl*, such that messages at that level will be sent to the log handlers. *lgr* can be of type `<logger>` or `<log-handler>`.

Note that any levels that are neither enabled or disabled are treated as enabled by the logging system. This is so that misspelt level names do not cause a logging blackout.

`disable-log-level!` *lgr lvl* [Function]

Disables a specific logging level, such that messages at that level will not be sent to the log handlers. *lgr* can be of type `<logger>` or `<log-handler>`.

Note that any levels that are neither enabled or disabled are treated as enabled by the logging system. This is so that misspelt level names do not cause a logging blackout.

`flush-log` [Generic]

`flush-log handler`. Tells the `handler` to output any log statements it may have buffered up. Handlers for which a flush operation doesn't make sense can choose not to implement this method. The default implementation just returns `#t`.

`flush-log (`*`lgr`* `<logger>)` [Method]

`flush-log` [Method]

`flush-log (`*`lh`* `<log-handler>)` [Method]

`open-log!` [Generic]

`open-log! handler`. Tells the `handler` to open its log. Handlers for which an open operation doesn't make sense can choose not to implement this method. The default implementation just returns `#t`.

`open-log!` [Method]

`open-log! (`*`lgr`* `<logger>)` [Method]

`open-log! (`*`lh`* `<log-handler>)` [Method]

`close-log!` [Generic]

`open-log! handler`. Tells the `handler` to close its log. Handlers for which a close operation doesn't make sense can choose not to implement this method. The default implementation just returns `#t`.

`close-log!` [Method]

`close-log! (`*`lgr`* `<logger>)` [Method]

`close-log! (`*`lh`* `<log-handler>)` [Method]

12 (logging port-log)

12.1 Overview

This module defines a log handler that writes to an arbitrary port of the user's choice. Uses of this handler could include:

- Sending logs across a socket to a network log collector.
- Sending logs to the screen
- Sending logs to a file
- Collecting logs in memory in a string port for later use

12.2 Usage

`<port-log>` [Class]

This is a log handler which writes logs to a user-provided port.

Keywords recognized by `<port-log>` on creation are:

`#:port` This is the port to which the log handler will write.

`#:formatter`
Allows the user to provide a function to use as the log formatter for this handler. See [logging logger <log-handler>], page 13, for details.

Example of creating a `<port-log>`:

```
(make <port-log> #:port (current-error-port))
```

13 (logging rotating-log)

13.1 Overview

This module defines a log handler for text logs that rotate when they get to be a user-defined size. This is similar to the behavior of many UNIX standard log files. See Chapter 11 [logging logger], page 12, for more information in general on log handlers.

13.2 Usage

`<rotating-log>` [Class]

This is a log handler which writes text logs that rotate when they reach a configurable size limit.

Keywords recognized by `<rotating-log>` on creation are:

`#:num-files`
: This is the number of log files you want the logger to use. Default is 4.

`#:size-limit`
: This is the size, in bytes, a log file must get before the logs get rotated. Default is 1MB (104876 bytes).

`#:file-name`
: This is the base of the log file name. Default is "logfile". Numbers will be appended to the file name representing the log number. The newest log file is always "*NAME*.1".

`#:formatter`
: Allows the user to provide a function to use as the log formatter for this handler. See [logging logger <log-handler>], page 13, for details.

Example of creating a `<rotating-log>`:

```
(make <rotating-log>
     #:num-files 3
     #:size-limit 1024
     #:file-name "test-log-file"))
```

14 (match-bind)

14.1 Overview

Utility functions and syntax constructs for dealing with regular expressions in a concise manner. Will be submitted to Guile for inclusion.

14.2 Usage

`match-bind` [Special Form]

Match a string against a regular expression, binding lexical variables to the various parts of the match.

vars is a list of names to which to bind the parts of the match. The first variable of the list will be bound to the entire match, so the number of variables needed will be equal to the number of open parentheses (‘(’) in the pattern, plus one for the whole match.

consequent is executed if the given expression *str* matches *regex*. If the string does not match, *alternate* will be executed if present. If *alternate* is not present, the result of `match-bind` is unspecified.

Here is a short example:

```
(define (star-indent line)
  "Returns the number of spaces until the first
   star (‘*’) in the input, or #f if the first
   non-space character is not a star."
  (match-bind "^( *)\*.*$" line (_ spaces)
              (string-length spaces)
              #f))
```

`match-bind` compiles the regular expression *regex* at macro expansion time. For this reason, *regex* must be a string literal, not an arbitrary expression.

`s///` *pat subst* [Function]

Make a procedure that performs perl-like regular expression search-and-replace on an input string.

The regular expression pattern *pat* is in the standard regular expression syntax accepted by `make-regexp`. The substitution string is very similar to perl's `s///` operator. Backreferences are indicated with a dollar sign (‘$’), and characters can be escaped with the backslash.

`s///` returns a procedure of one argument, the input string to be matched. If the string matches the pattern, it will be returned with the first matching segment replaced as per the substitution string. Otherwise the string will be returned unmodified.

Here are some examples:

```
((s/// "foo" "bar") "foo bar baz qux foo")
   ⇒ "bar bar baz qux foo"
```

```
((s/// "zag" "bar") "foo bar baz qux foo")
   ⇒ "foo bar baz qux foo"

((s/// "(f(o+)) (zag)?" "$1 $2 $3")
 "foo bar baz qux foo")
   ⇒ "foo oo bar baz qux foo"
```

`s///g` *pat subst* [Function]

Make a procedure that performs perl-like global search-and-replace on an input string.

The *pat* and *subst* arguments are as in the non-global `s///`. See [s///], page 19, for more information.

`s///g` differs from `s///` in that it does a global search and replace, not stopping at the first match.

15 (math minima)

15.1 Overview

This module contains functions for computing the minimum values of mathematical expressions on an interval.

15.2 Usage

`golden-section-search` *f x0 x1 prec* [Function]

The Golden Section Search algorithm finds minima of functions which are expensive to compute or for which derivatives are not available. Although optimum for the general case, convergence is slow, requiring nearly 100 iterations for the example (x^3-2x-5).

If the derivative is available, Newton-Raphson is probably a better choice. If the function is inexpensive to compute, consider approximating the derivative.

x0 and *x1* are real numbers. The (single argument) procedure *func* is unimodal over the open interval (*x0*, *x1*). That is, there is exactly one point in the interval for which the derivative of *func* is zero.

It returns a pair (*x* . *func*(*x*)) where *func*(*x*) is the minimum. The *prec* parameter is the stop criterion. If *prec* is a positive number, then the iteration continues until *x* is within *prec* from the true value. If *prec* is a negative integer, then the procedure will iterate -*prec* times or until convergence. If *prec* is a procedure of seven arguments, *x0*, *x1*, *a*, *b*, *fa*, *fb*, and *count*, then the iterations will stop when the procedure returns `#t`.

Analytically, the minimum of x^3-2x-5 is 0.816497.

```
(define func (lambda (x) (+ (* x (+ (* x x) -2)) -5)))
(golden-section-search func 0 1 (/ 10000))
     ==> (816.4883855245578e-3 . -6.0886621077391165)
(golden-section-search func 0 1 -5)
     ==> (819.6601125010515e-3 . -6.088637561916407)
(golden-section-search func 0 1
                       (lambda (a b c d e f g ) (= g 500)))
     ==> (816.4965933140557e-3 . -6.088662107903635)
```

16 (math primes)

16.1 Overview

This module defines functions related to prime numbers, and prime factorization.

16.2 Usage

`prime:trials` [Variable]

This is the maximum number of iterations of Solovay-Strassen that will be done to test a number for primality. The chance of error (a composite being labelled prime) is `(expt 2 (- prime:trials))`.

`prime?` *n* [Function]

Returns `#f` if *n* is composite, and `t` if it is prime. There is a slight chance, `(expt 2 (- prime:trials))`, that a composite will return `#t`.

`prime>` *start* [Function]

Return the first prime number greater than *start*. It doesn't matter if *start* is prime or composite.

`primes>` *start count* [Function]

Returns a list of the first *count* prime numbers greater than *start*.

`prime<` *start* [Function]

Return the first prime number less than *start*. It doesn't matter if *start* is prime or composite. If no primes are less than *start*, `#f` will be returned.

`primes<` *start count* [Function]

Returns a list of the first *count* prime numbers less than *start*. If there are fewer than *count* prime numbers less than *start*, then the returned list will have fewer than *start* elements.

`factor` *k* [Function]

Returns a list of the prime factors of *k*. The order of the factors is unspecified. In order to obtain a sorted list do `(sort! (factor k) <)`.

17 (os process)

17.1 Overview

This is a library for execution of other programs from Guile. It also allows communication using pipes (or a pseudo terminal device, but that's not currently implemented). This code originates in the `(goosh)` modules, which itself was part of goonix in one of Guile's past lives.

The following will hold when starting programs:

1. If the name of the program does not contain a `/` then the directories listed in the current `PATH` environment variable are searched to locate the program.
2. Unlike for the corresponding primitive exec procedures, e.g., `execlp`, the name of the program can not be set independently of the path to execute: the zeroth and first members of the argument vector are combined into one.

All symbols exported with the prefix `os:process:` are there in support of macros that use them. They should be ignored by users of this module.

17.2 Usage

`os:process:pipe-fork-child` [Special Form]

`run+` *args* [Special Form]

Evaluate an expression in a new foreground process and wait for its completion. If no connection terms are specified, then all ports except `current-input-port`, `current-output-port` and `current-error-port` will be closed in the new process. The file descriptors underlying these ports will not be changed.

The value returned is the exit status from the new process as returned by the `waitpid` procedure.

The *keywords* and *connections* arguments are optional: see `run-concurrently+`, which is documented below. The `#:foreground` keyword is implied.

```
(run+ (begin (write (+ 2 2)) (newline) (quit 0)))
(run+ (tail-call-program "cat" "/etc/passwd"))
```

`run-concurrently+` *args* [Special Form]

Evaluate an expression in a new background process. If no connection terms are specified, then all ports except `current-input-port`, `current-output-port` and `current-error-port` will be closed in the new process. The file descriptors underlying these ports will not be changed.

The value returned in the parent is the pid of the new process.

When the process terminates its exit status can be collected using the `waitpid` procedure.

Keywords can be specified before the connection list:

`#:slave` causes the new process to be put into a new session. If `current-input-port` (after redirections) is a tty it will be assigned as the controlling terminal. This option is used when controlling a process via a pty.

`#:no-auto-close` prevents the usual closing of ports which occurs by default.

`#:foreground` makes the new process the foreground job of the controlling terminal, if the current process is using job control. (not currently implemented). The default is to place it into the background

The optional connection list can take several forms:

`(port)` usually specifies that a given port not be closed. However if `#:no-auto-close` is present it specifies instead a port which should be closed.

`(port 0)` specifies that a port be moved to a given file descriptor (e.g., 0) in the new process. The order of the two components is not significant, but one must be a number and the other must evaluate to a port. If the file descriptor is one of the standard set `(0, 1, 2)` then the corresponding standard port (e.g., `current-input-port`) will be set to the specified port.

Example:

```
(let ((p (open-input-file "/etc/passwd")))
  (run-concurrently+ (tail-call-program "cat") (p 0)))
```

`tail-call-pipeline` *args* [Special Form]

Replace the current process image with a pipeline of connected processes.

The expressions in the pipeline are run in new background processes. The foreground process waits for them all to terminate. The exit status is derived from the status of the process at the tail of the pipeline: its exit status if it terminates normally, otherwise 128 plus the number of the signal that caused it to terminate.

The signal handlers will be reset and file descriptors set up as for `tail-call-program`. Like `tail-call-program` it does not close open ports or flush buffers.

Example:

```
(tail-call-pipeline ("ls" "/etc") ("grep" "passwd"))
```

`tail-call-pipeline+` *args* [Special Form]

Replace the current process image with a pipeline of connected processes.

Each process is specified by an expression and each pair of processes has a connection list with pairs of file descriptors. E.g., `((1 0) (2 0))` specifies that file descriptors 1 and 2 are to be connected to file descriptor 0. This may also be written as `((1 2 0))`.

The expressions in the pipeline are run in new background processes. The foreground process waits for them all to terminate. The exit status is derived from the status of the process at the tail of the pipeline: its exit status if it terminates normally, otherwise 128 plus the number of the signal that caused it to terminate.

The signal handlers will be reset and file descriptors set up as for `tail-call-program`. Like `tail-call-program` it does not close open ports or flush buffers.

Example:

```
(tail-call-pipeline+ (tail-call-program "ls" "/etc") ((1 0))
                     (tail-call-program "grep" "passwd"))
```

`os:process:new-comm-pipes` *old-pipes out-conns* [Function]

`os:process:pipe-make-commands` *fdes port portvar* [Function]

`os:process:pipe-make-redir-commands` *connections portvar* [Function]

`os:process:setup-redirected-port` *port fdes* [Function]

`run` *prog . args* [Function]

Execute *prog* in a new foreground process and wait for its completion. The value returned is the exit status of the new process as returned by the `waitpid` procedure.

Example:

```
(run "cat" "/etc/passwd")
```

`run-concurrently` *. args* [Function]

Start a program running in a new background process. The value returned is the pid of the new process.

When the process terminates its exit status can be collected using the `waitpid` procedure.

Example:

```
(run-concurrently "cat" "/etc/passwd")
```

`run-with-pipe` *mode prog . args* [Function]

Start *prog* running in a new background process. The value returned is a pair: the CAR is the pid of the new process and the CDR is either a port or a pair of ports (with the CAR containing the input port and the CDR the output port). The port(s) can be used to read from the standard output of the process and/or write to its standard input, depending on the *mode* setting. The value of *mode* should be one of `"r"`, `"w"` or `"r+"`.

When the process terminates its exit status can be collected using the `waitpid` procedure.

Example:

```
(use-modules (ice-9 rdelim)) ; needed by read-line
(define catport (cdr (run-with-pipe "r" "cat" "/etc/passwd")))
(read-line catport)
```

`tail-call-program` *prog . args* [Function]

Replace the current process image by executing *prog* with the supplied list of arguments, *args*.

This procedure will reset the signal handlers and attempt to set up file descriptors as follows:

1. File descriptor 0 is set from (current-input-port).
2. File descriptor 1 is set from (current-output-port).
3. File descriptor 2 is set from (current-error-port).

If a port can not be used (e.g., because it's closed or it's a string port) then the file descriptor is opened on the file specified by `*null-device*` instead.

Note that this procedure does not close any ports or flush output buffers. Successfully executing *prog* will prevent the normal flushing of buffers that occurs when Guile terminates. Doing otherwise would be incorrect after forking a child process, since the buffers would be flushed in both parent and child.

Examples:

```
(tail-call-program "cat" "/etc/passwd")
(with-input-from-file "/etc/passwd"
 (lambda ()
   (tail-call-program "cat")))
```

18 (scheme documentation)

18.1 Overview

Defines some macros to help in documenting macros, variables, generic functions, and classes.

18.2 Usage

`define-macro-with-docs` *args* [Special Form]
: Define a macro with documentation.

`define-with-docs` *args* [Special Form]
: Define a variable with documentation.

`define-generic-with-docs` *args* [Special Form]
: Define a generic function with documentation.

`define-class-with-docs` *args* [Special Form]
: Define a class with documentation.

19 (scheme kwargs)

19.1 Overview

Support for defining functions that take python-like keyword arguments. In one of his early talks, Paul Graham wrote about a large system called "Rtml":

> Most of the operators in Rtml were designed to take keyword parameters, and what a help that turned out to be. If I wanted to add another dimension to the behavior of one of the operators, I could just add a new keyword parameter, and everyone's existing templates would continue to work. A few of the Rtml operators didn't take keyword parameters, because I didn't think I'd ever need to change them, and almost every one I ended up kicking myself about later. If I could go back and start over from scratch, one of the things I'd change would be that I'd make every Rtml operator take keyword parameters.

See [lambda/kwargs], page 28, for documentation and examples.

See Section "Optional Arguments" in *Guile Reference Manual*, for more information on Guile's standard support for optional and keyword arguments. Quote taken from `http://lib.store.yahoo.net/lib/paulgraham/bbnexcerpts.txt`.

19.2 Usage

`define/kwargs` *args* [Special Form]

Defines a function that takes kwargs. See [scheme kwargs lambda/kwargs], page 28, for more information.

`lambda/kwargs` *args* [Special Form]

Defines a function that takes keyword arguments.

bindings is a list of bindings, each of which may either be a symbol or a two-element symbol-and-default-value list. Symbols without specified default values will default to `#f`.

For example:

```
(define frobulate (lambda/kwargs (foo (bar 13) (baz 42))
                    (list foo bar baz)))
(frobulate) ⇒ (#f 13 42)
(frobulate #:baz 3) ⇒ (#f 13 3)
(frobulate #:foo 3) ⇒ (3 13 42)
(frobulate 3 4) ⇒ (3 4 42)
(frobulate 1 2 3) ⇒ (1 2 3)
(frobulate #:baz 2 #:bar 1) ⇒ (#f 1 2)
(frobulate 10 20 #:foo 3) ⇒ (3 20 42)
```

This function differs from the standard `lambda*` provided by Guile in that invoking the function will accept positional arguments. As an example, the `lambda/kwargs` behaves more intuitively in the following case:

```
((lambda* (#:optional (bar 42) #:key (baz 73))
   (list bar baz))
```

```
 1 2) ⇒ (1 73)
((lambda/kwargs ((bar 42) (baz 73))
   (list bar baz))
 1 2) ⇒ (1 2)
```

The fact that `lambda*` accepts the extra '2' argument is probably just a bug. In any case, `lambda/kwargs` does the right thing.

20 (search basic)

20.1 Overview

```
This module has the classic search functions in it.
```

20.2 Usage

`depth-first-search` *init done? expander* [Function]

Performs a depth-first search from initial state *init*. It will return the first state it sees for which predicate *done?* returns `#t`. It will use function *expander* to get a list of all states reacheable from a given state.

init can take any form the user wishes. This function treats it as opaque data to pass to *done?* and *expander*.

done? takes one argument, of the same type as *init*, and returns either `#t` or `#f`.

expander takes one argument, of the same type as *init*, and returns a list of states that can be reached from there.

`breadth-first-search` *init done? expander* [Function]

Performs a breadth-first search from initial state *init*. It will return the first state it sees for which predicate *done?* returns `#t`. It will use function *expander* to get a list of all states reacheable from a given state.

init can take any form the user wishes. This function treats it as opaque data to pass to *done?* and *expander*.

done? takes one argument, of the same type as *init*, and returns either `#t` or `#f`.

expander takes one argument, of the same type as *init*, and returns a list of states that can be reached from there.

`binary-search-sorted-vector` *vec target* [*cmp*] [*default*] [Function]

Searches a sorted vector *vec* for item *target*. A binary search is employed which should find an item in O(log n) time if it is present. If *target* is found, the index into *vec* is returned.

As part of the search, the function *cmp* is applied to determine whether a vector item is less than, greater than, or equal to the *target*. If *target* cannot be found in the vector, then *default* is returned.

cmp defaults to `-`, which gives a correct comparison for vectors of numbers. *default* will be `#f` if another value is not given.

```
(binary-search-sorted-vector #(10 20 30) 20) ⇒ 1
```

21 (string completion)

21.1 Overview

This module provides a facility that can be used to implement features such as TAB-completion in programs. A class `<string-completer>` tracks all the potential complete strings. Here is an example usage.

```
(use-modules (string completion)
             (oop goops)
             (srfi srfi-11))      ;; for the (let-values)

(define c (make <string-completer>))
(add-strings! c "you your yourself yourselves")

(let-values (((completions expansion exact? unique?) (complete c "yours")))
            (display completions)(newline)
            (display expansion) (newline)
            (display exact?)(newline)
            (display unique?)(newline))

==> ("yourself" "yourselves")
    "yoursel"
    #f
    #f
```

There are several more options for usage, which are detailed in the class and method documentation.

21.2 Usage

`<string-completer>` [Class]

This is the class that knows what the possible expansions are, and can determine the completions of given partial strings. The following are the recognized keywords on the call to `make`:

`#:strings`

This gives the completer an initial set of strings. It is optional, and the `add-strings!` method can add strings to the completer later, whether these initial strings were given or not. The strings that follow this keyword can take any form that the `add-strings!` method can take (see below).

`#:case-sensitive?`

This is a boolean that directs the completer to do its comparisons in a case sensiteve way or not. The default value is `#t`, for case-sensitive behavior.

`case-sensitive-completion?` [Generic]

`case-sensitive-completion? completer`. Returns `#t` if the completer is case-sensitive, and `#f` otherwise.

`case-sensitive-completion?` [Method]

`add-strings!` [Generic]

`add-strings! completer strings`. Adds the given strings to the set of possible comletions known to *completer*. *strings* can either be a list of strings, or a single string of words separated by spaces. The order of the words given is not important.

`add-strings! (sc <string-completer>) (strings <top>)` [Method]

`all-completions` *completer str* [Function]

Returns a list of all possible completions for the given string *str*. The returned list will be in alphabetical order.

Note that users wanting to customize the completion algorithm can subclass `<string-completer>` and override this method.

`complete` [Generic]

`complete completer str`. Accepts a string, *str*, and returns four values via a `values` call. These are:

completions
: This is the same list that would be returned from a call to `all-completions`.

expansion
: This is the longest string that would have returned identical results. In other words, this is what most programs replace your string with when you press TAB once. This value will be equal to *str* if there were no known completionss.

```
 ("wonders" "wonderment" "wondering")
completed against "won" yields an expansion
of "wonder"
```

exact?
: This will be `#t` if the returned *expansion* is an exact match of one of the possible completions.

unique?
: This will be #t if there is only one possible completion. Note that when *unique?* is `#t`, then *exact?* will also be `#t`.

`complete (sc <string-completer>) (str <top>)` [Method]

22 (string soundex)

22.1 Overview

Soundex algorithm, taken from Knuth, Vol. 3 “Sorting and searching”, pp 391–2

22.2 Usage

`soundex` *name* [Function]

Performs the original soundex algorithm on the input *name*. Returns the encoded string. The idea is for similar sounding sames to end up with the same encoding.

```
(soundex "Aiza")
=> "A200"
(soundex "Aisa")
=> "A200"
(soundex "Aesha")
=> "A200"
```

23 (string transform)

23.1 Overview

Module '`(string transform)`' provides functions for modifying strings beyond that which is provided in the guile core and '`(srfi srfi-13)`'.

23.2 Usage

`escape-special-chars` *str special-chars escape-char* [Function]

Returns a copy of *str* with all given special characters preceded by the given *escape-char*.

special-chars can either be a single character, or a string consisting of all the special characters.

```
;; make a string regexp-safe...
 (escape-special-chars "***(Example String)***"
                       "[]()/*."
                       #\\)
=> "\\*\\*\\*\\(Example String\\)\\*\\*\\*"

;; also can escape a singe char...
 (escape-special-chars "richardt@vzavenue.net"
                       #\@
                       #\@)
=> "richardt@@vzavenue.net"
```

`transform-string` *str match? replace* [*start*] [*end*] [Function]

Uses *match?* against each character in *str*, and performs a replacement on each character for which matches are found.

match? may either be a function, a character, a string, or `#t`. If *match?* is a function, then it takes a single character as input, and should return '`#t`' for matches. *match?* is a character, it is compared to each string character using `char=?`. If *match?* is a string, then any character in that string will be considered a match. `#t` will cause every character to be a match.

If *replace* is a function, it is called with the matched character as an argument, and the returned value is sent to the output string via '`display`'. If *replace* is anything else, it is sent through the output string via '`display`'.

Note that te replacement for the matched characters does not need to be a single character. That is what differentiates this function from '`string-map`', and what makes it useful for applications such as converting '`#\&`' to '`"&"`' in web page text. Some other functions in this module are just wrappers around common uses of '`transform-string`'. Transformations not possible with this function should probably be done with regular expressions.

If *start* and *end* are given, they control which portion of the string undergoes transformation. The entire input string is still output, though. So, if *start* is '`5`', then the first five characters of *str* will still appear in the returned string.

```
; these two are equivalent...
 (transform-string str #\space #\-) ; change all spaces to -'s
 (transform-string str (lambda (c) (char=? #\space c)) #\-)
```

`expand-tabs` *str* [*tab-size*] [Function]

Returns a copy of *str* with all tabs expanded to spaces. *tab-size* defaults to 8.

Assuming tab size of 8, this is equivalent to:

```
(transform-string str #\tab "        ")
```

`center-string` *str* [*width*] [*chr*] [*rchr*] [Function]

Returns a copy of *str* centered in a field of *width* characters. Any needed padding is done by character *chr*, which defaults to '`#\space`'. If *rchr* is provided, then the padding to the right will use it instead. See the examples below. left and *rchr* on the right. The default *width* is 80. The default *lchr* and *rchr* is '`#\space`'. The string is never truncated.

```
 (center-string "Richard Todd" 24)
=> "      Richard Todd      "

 (center-string " Richard Todd " 24 #\=)
=> "===== Richard Todd ====="

 (center-string " Richard Todd " 24 #\< #\>)
=> "<<<<< Richard Todd >>>>>"
```

`left-justify-string` *str* [*width*] [*chr*] [Function]

`left-justify-string str [width chr]`. Returns a copy of *str* padded with *chr* such that it is left justified in a field of *width* characters. The default *width* is 80. Unlike '`string-pad`' from srfi-13, the string is never truncated.

`right-justify-string` *str* [*width*] [*chr*] [Function]

Returns a copy of *str* padded with *chr* such that it is right justified in a field of *width* characters. The default *width* is 80. The default *chr* is '`#\space`'. Unlike '`string-pad`' from srfi-13, the string is never truncated.

`collapse-repeated-chars` *str* [*chr*] [*num*] [Function]

Returns a copy of *str* with all repeated instances of *chr* collapsed down to at most *num* instances. The default value for *chr* is '`#\space`', and the default value for *num* is 1.

```
 (collapse-repeated-chars "H  e  l  l  o")
=> "H e l l o"
 (collapse-repeated-chars "H--e--l--l--o" #\-)
=> "H-e-l-l-o"
 (collapse-repeated-chars "H-e--l---l----o" #\- 2)
=> "H-e--l--l--o"
```

24 (string wrap)

24.1 Overview

Module '`(string wrap)`' provides functions for formatting text strings such that they fill a given width field. A class, `<text-wrapper>`, does the work, but two convenience methods create instances of it for one-shot use, and in the process make for a more "schemey" interface. If many strings will be formatted with the same parameters, it might be better performance-wise to create and use a single `<text-wrapper>`.

24.2 Usage

`<text-wrapper>` [Class]

This class encapsulates the parameters needing to be fed to the text wrapping algorithm. The following are the recognized keywords on the call to `make`:

`#:line-width`
: This is the target length used when deciding where to wrap lines. Default is 80.

`#:expand-tabs?`
: Boolean describing whether tabs in the input should be expanded. Default is #t.

`#:tab-width`
: If tabs are expanded, this will be the number of spaces to which they expand. Default is 8.

`#:collapse-whitespace?`
: Boolean describing whether the whitespace inside the existing text should be removed or not. Default is #t.

  If text is already well-formatted, and is just being wrapped to fit in a different width, then setting this to '`#f`'. This way, many common text conventions (such as two spaces between sentences) can be preserved if in the original text. If the input text spacing cannot be trusted, then leave this setting at the default, and all repeated whitespace will be collapsed down to a single space.

`#:initial-indent`
: Defines a string that will be put in front of the first line of wrapped text. Default is the empty string, "".

`#:subsequent-indent`
: Defines a string that will be put in front of all lines of wrapped text, except the first one. Default is the empty string, "".

`#:break-long-words?`
: If a single word is too big to fit on a line, this setting tells the wrapper what to do. Defaults to #t, which will break up long words. When set to #f, the line will be allowed, even though it is longer than the defined `#:line-width`.

Here's an example of creating a `<text-wrapper>`:

```
(make <text-wrapper> #:line-width 48 #:break-long-words? #f)
```

`fill-string` [Generic]

`fill-string str keywds ...`. Wraps the text given in string *str* according to the parameters provided in *keywds*, or the default setting if they are not given. Returns a single string with the wrapped text. Valid keyword arguments are discussed with the `<text-wrapper>` class.

`fill-string tw str`. fills *str* using the instance of `<text-wrapper>` given as *tw*.

`fill-string (tw <text-wrapper>) (str <top>)` [Method]

`fill-string (str <top>) (keywds <top>)...` [Method]

`string->wrapped-lines` [Generic]

`string->wrapped-lines str keywds ...`. Wraps the text given in string *str* according to the parameters provided in *keywds*, or the default setting if they are not given. Returns a list of strings representing the formatted lines. Valid keyword arguments are discussed with the `<text-wrapper>` class.

`string->wrapped-lines tw str`. Wraps the text given in string *str* according to the given `<text-wrapper>` *tw*. Returns a list of strings representing the formatted lines. Valid keyword arguments are discussed with the `<text-wrapper>` class.

`string->wrapped-lines (tw <text-wrapper>) (str <top>)` [Method]

`string->wrapped-lines (str <top>) (keywds <top>)...` [Method]

25 (term ansi-color)

25.1 Overview

The '`(term ansi-color)`' module generates ANSI escape sequences for colors. Here is an example of the module's use:

```
 method one: safer, since you know the colors
 will get reset
(display (colorize-string "Hello!\n" 'RED 'BOLD 'ON-BLUE))

 method two: insert the colors by hand
(for-each display
          (list (color 'RED 'BOLD 'ON-BLUE)
                "Hello!"
                 (color 'RESET)))
```

25.2 Usage

`color` . *lst* [Function]

Returns a string containing the ANSI escape sequence for producing the requested set of attributes.

The allowed values for the attributes are listed below. Unknown attributes are ignored.

Reset Attributes
: '`CLEAR`' and '`RESET`' are allowed and equivalent.

Non-Color Attributes
: '`BOLD`' makes text bold, and '`DARK`' reverses this. '`UNDERLINE`' and '`UNDERSCORE`' are equivalent. '`BLINK`' makes the text blink. '`REVERSE`' invokes reverse video. '`CONCEALED`' hides output (as for getting passwords, etc.).

Foregrond Color Attributes
: '`BLACK`', '`RED`', '`GREEN`', '`YELLOW`', '`BLUE`', '`MAGENTA`', '`CYAN`', '`WHITE`'

Background Color Attributes
: '`ON-BLACK`', '`ON-RED`', '`ON-GREEN`', '`ON-YELLOW`', '`ON-BLUE`', '`ON-MAGENTA`', '`ON-CYAN`', '`ON-WHITE`'

`colorize-string` *str* . *color-list* [Function]

Returns a copy of *str* colorized using ANSI escape sequences according to the attributes specified in *color-list*. At the end of the returned string, the color attributes will be reset such that subsequent output will not have any colors in effect.

The allowed values for the attributes are listed in the documentation for the `color` function.

26 (unit-test)

26.1 Overview

26.2 Usage

`assert-equal` *expected got* [Function]

`assert-true` *got* [Function]

`assert-false` *got* [Function]

`assert-numeric-=` *expected got precision* [Function]

`<test-result>` [Class]

`tests-run` [Generic]

`tests-run` [Method]

`tests-failed` [Generic]

`tests-failed` [Method]

`tests-log` [Generic]

`tests-log` [Method]

`failure-messages` [Generic]

`failure-messages` [Method]

`test-started` [Generic]

`test-started` (*self* `<test-result>`) (*description* `<string>`) [Method]

`test-failed` [Generic]

`test-failed` (*self* `<test-result>`) (*description* `<string>`) [Method]

`summary` [Generic]

`summary` (*self* `<test-result>`) [Method]

`<test-case>` [Class]

`name` [Generic]

`name` [Method]

`name` [Method]

`set-up-test` [Generic]

`set-up-test` (*self* `<test-case>`) [Method]

`tear-down-test` [Generic]

`tear-down-test` (*self* `<test-case>`) [Method]

`run` [Generic]

`run` (*self* `<test-suite>`) (*result* `<test-result>`) [Method]

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Version 1.2, November 2002

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