

R⁶RS: Standard Language

Version 4.1.5

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The The Revised⁶ Report on the Algorithmic Language Scheme defines a dialect of Scheme. We use *R⁶RS* to refer to both the standard and the language defined by the standard.

R⁶RS defines both *libraries* and *top-level programs*. Both correspond to PLT Scheme *modules* (see §6 “Modules”). That is, although R⁶RS defines top-level programs as entry points, you can just as easily treat a library as an entry point when using PLT Scheme. The only difference is that an R⁶RS top-level program cannot export any bindings to other modules.

See §21 “Dialects of Scheme” for general information about different dialects of Scheme within PLT Scheme.

Contents

1	Running Top-Level Programs	4
2	Installing Libraries	5
3	R⁶RS Module Language	6
4	Libraries and Collections	7
5	Scheme Interoperability	8
6	R⁶RS Conformance	9
7	R⁶RS Libraries	11
7.1	<code>(rnrs base (6))</code> : Base	11
7.2	<code>(rnrs unicode (6))</code> : Unicode	11
7.3	<code>(rnrs bytevectors (6))</code> : Bytevectors	11
7.4	<code>(rnrs lists (6))</code> : List utilities	11
7.5	<code>(rnrs sorting (6))</code> : Sorting	11
7.6	<code>(rnrs control (6))</code> : Control Structures	11
7.7	<code>(rnrs records syntactic (6))</code> : Records: Syntactic	12
7.8	<code>(rnrs records procedural (6))</code> : Records: Procedural	12
7.9	<code>(rnrs records inspection (6))</code> : Records: Inspection	12
7.10	<code>(rnrs exceptions (6))</code> : Exceptions	12
7.11	<code>(rnrs conditions (6))</code> : Conditions	12
7.12	<code>(rnrs io ports (6))</code> : I/O: Ports	12
7.13	<code>(rnrs io simple (6))</code> : I/O: Simple	13
7.14	<code>(rnrs files (6))</code> : File System	13

7.15	(<code>rnrs programs (6)</code>): Command-line Access and Exit Values	13
7.16	(<code>rnrs arithmetic fixnums (6)</code>): Arithmetic: Fixnums	13
7.17	(<code>rnrs arithmetic flonums (6)</code>): Arithmetic: Flonums	13
7.18	(<code>rnrs arithmetic bitwise (6)</code>): Arithmetic: Bitwise	13
7.19	(<code>rnrs syntax-case (6)</code>): Syntax-Case	14
7.20	(<code>rnrs hashtables (6)</code>): Hashtables	14
7.21	(<code>rnrs enums (6)</code>): Enumerations	14
7.22	(<code>rnrs eval (6)</code>): Eval	14
7.23	(<code>rnrs mutable-pairs (6)</code>): Mutable Pairs	14
7.24	(<code>rnrs mutable-strings (6)</code>): Mutable Strings	14
7.25	(<code>rnrs r5rs (6)</code>): R5RS Compatibility	15

Index		16
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1 Running Top-Level Programs

To run a top-level program, either:

- Use the `plt-r6rs` executable, supplying the file that contains the program on the command line:

```
plt-r6rs <program-file>
```

Additional command-line arguments are propagated as command-line arguments to the program (accessed via [command-line](#)).

To compile the file to bytecode (to speed future runs of the program), use `plt-r6rs` with the `--compile` flag:

```
plt-r6rs --compile <program-file>
```

The bytecode file is written in a "compiled" sub-directory next to *<program-file>*.

For example, if "hi.scm" contains

```
(import (rnrs))
(display "hello\n")
then
  plt-r6rs hi.scm
prints "hello."
```

- Prefix the program with `#!r6rs`, which counts as a comment from the R⁶RS perspective, but is a synonym for `#lang r6rs` from the PLT Scheme perspective. Such files can be run like any other PLT Scheme module, such as using `mzscheme`:

```
mzscheme <program-file>
```

or using DrScheme with the Module language. The file can also be compiled to bytecode using `mzc`:

```
mzc <program-file>
```

For example, if "hi.ss" contains

```
#!r6rs
(import (rnrs))
(display "hello\n")
then
  mzscheme hi.ss
```

prints "hello." Similarly, opening "hi.ss" in DrScheme and clicking Run prints "hello" within the DrScheme interactions window.

2 Installing Libraries

To reference an R⁶RS library from a top-level program or another library, it must be installed as a collection-based library in PLT Scheme.

One way to produce an R⁶RS installed library is to create in a collection a file that starts with `#!r6rs` and that contains a `library` form. For example, the following file might be created in a "hello.ss" file within a "examples" collection directory:

```
#!r6rs
(library (examples hello)
 (export greet)
 (import (rnrs)))

(define (greet)
 (display "hello\n"))
```

Alternately, the `plt-r6rs` executable with the `--install` flag accepts a sequence of `library` declarations and installs them into separate files in a collection directory, based on the declared name of each library:

```
plt-r6rs --install <libraries-file>
```

By default, libraries are installed into the user-specific collection directory (see `find-user-collects-dir`). The `--all-users` flag causes the libraries to be installed into the main installation, instead (see `find-collects-dir`):

```
plt-r6rs --install --all-users <libraries-file>
```

See §4 “Libraries and Collections” for information on how R⁶RS library names are turned into collection-based module paths, which determines where the files are written. Libraries installed by `plt-r6rs --install` are automatically compiled to bytecode form.

One final option is to supply a `++path` flag to `plt-r6rs`. A path added with `++path` extends the set of directories that are searched to find a collection (i.e., it sets `current-library-collection-paths`). If `<dir>` contains "duck" and "cow" sub-directories with "duck/feather.sls" and "cow/bell.sls", and if each file is an R⁶RS library prefixed with `#!r6rs`, then `plt-r6rs ++path <dir>` directs the R⁶RS library references `(duck feather)` and `(cow bell)` to the files. Note that this technique does not support accessing "duck.sls" directly within `<dir>`, since the library reference `(duck)` is treated like `(duck main)` for finding the library, as explained in §4 “Libraries and Collections”. Multiple paths can be provided with multiple uses of `++path`; the paths are searched in order, and before the installation’s collections.

3 R⁶RS Module Language

```
#lang r6rs
```

The `r6rs` language is usually used in the form `#!r6rs`, which is equivalent to `#lang r6rs` and is also valid R⁶RS syntax.

The `r6rs` module language provides only a `#!/module-begin` binding, which is used to process the entire module body (see `module`). It allows the body of a module to use the syntax of either a R⁶RS library or a R⁶RS top-level program.

```
(#!/module-begin
 (library library-name
  (export export-spec ...)
  (import import-spec ...)
  library-body ...))
(#!/module-begin
 (import import-spec ...)
 program-body ...)
```

An `r6rs` module that contains a single `library` form defines an R⁶RS library, while a module body that starts with an `import` form defines an R⁶RS top-level program.

The `library`, `export`, and `import` identifiers are not exported by the `r6rs` library; they are recognized through equivalence to unbound identifiers.

4 Libraries and Collections

An R⁶RS library name is sequence of symbols, optionally followed by a version as a sequence of exact, non-negative integers. Roughly, such a name is converted to a PLT Scheme module pathname (see §6.3 “Module Paths”) by concatenating the symbols with a `/` separator, and then appending the version integers each with a preceding `-`. As a special case, when an R⁶RS path contains a single symbol (optionally followed by a version), a `main` symbol is effectively inserted after the initial symbol. See below for further encoding considerations.

When an R⁶RS library or top-level program refers to another library, it can supply version constraints rather than naming a specific version. Version constraints are always resolved at compile time by searching the set of installed files.

In addition, when an R⁶RS library path is converted, a file extension is selected at compile time based on installed files. The search order for file extensions is `".mzscheme.ss"`, `".mzscheme.sls"`, `".ss"`, and `".sls"`. When resolving version constraints, these extensions are all tried when looking for matches.

To ensure that all R⁶RS library names can be converted to a unique and distinct library module path, the following conversions are applied to each symbol before concatenating them:

- The symbol is encoded using UTF-8, and the resulting bytes are treated as Latin-1 encoded characters. ASCII letters, digits, `+`, `-`, and `_` are left as-is; other characters are replaced by `%` followed by two lowercase hexadecimal digits. Note that UTF-8 encodes ASCII letters, digits, etc. as themselves, so typical library names correspond to readable module paths.
- If the R⁶RS library reference has two symbol elements and the second one is `main` followed by any number of underscores, then an extra underscore is added to that symbol. This conversion avoids a collision between an explicit `main` and the implicit `main` when a library path has a single symbol element.

Examples (assuming a typical PLT Scheme installation):

```
(rnrs io simple (6)) means (lib "rnrs/io/simple-6.ss")
(rnrs)                means (lib "rnrs/main-6.ss")
(rnrs main)          means (lib "rnrs/main_.ss")
(rnrs (6))           means (lib "rnrs/main-6.ss")
(scheme base)        means (lib "scheme/base.ss")
(achtung!)            means (lib "achtung%21/main.ss")
(funco new-λ)        means (lib "funco/new-%ce%bb.ss")
```

5 Scheme Interoperability

Using the conversion rules in §4 “Libraries and Collections”, and R⁶RS library can refer to modules that are implemented in other dialects supported by PLT Scheme, and other PLT Scheme modules can refer to libraries that are implemented in R⁶RS.

Beware that a *pair* in R⁶RS corresponds to a *mutable pair* in `scheme/base`. Otherwise, R⁶RS libraries and `scheme/base` share the same datatype for numbers, characters, strings, bytevectors (a.k.a. byte strings), vectors, and so on. Hash tables are different. Input and output ports from `scheme/base` can be used directly as binary ports with R⁶RS libraries, and all R⁶RS ports can be used as ports in `scheme/base` programs, but only textual ports created via R⁶RS libraries can be used by other R⁶RS operations that expect textual ports.

6 R⁶RS Conformance

PLT Scheme's R⁶RS support does not conform with the standard in several known ways:

- When `guard` catches an exception that no clause matches, the exception is re-raised without restoring the continuation to the one that raised the exception.

This difference can be made visible using `dynamic-wind`. According to R⁶RS, the following program should print “in” and “out” twice, but each prints once using PLT Scheme:

```
(guard (exn [(equal? exn 5) 'five]))
  (guard (exn [(equal? exn 6) 'six]))
    (dynamic-wind
      (lambda () (display "in") (newline))
      (lambda () (raise 5))
      (lambda () (display "out") (newline))))
```

Along similar lines, continuation capture and invocation within an exception handler is restricted. Unless the exception is raised through `raise-continuable`, a handler can escape only through a continuation that is a tail of the current continuation, and a continuation captured within the handler cannot be invoked after control escapes from the raise.

The initial exception handler does not return for non-`&serious` conditions, but `raise` and `raise-continuable` both install an uncaught-exception handler (via `parameterize` and `uncaught-exception-handler`) to one that returns for non-`&serious` conditions.

- Inexact numbers are printed without a precision indicator, and precision indicators are ignored on input (e.g., `0.5|7` is read the same as `0.5`).
- Word boundaries for `string-downcase`, `string-upcase`, and `string-titlecase` are not determined as specified by Unicode Standard Annex #29.
- When an identifier bound by `letrec` or `letrec*` is referenced before it is bound, an exception is not raised; instead, the reference produces `#<undefined>`.
- A custom textual port must represent positions using integers, and the positions must correspond to bytes in a UTF-8 encoding of the port's data. For custom ports (byte or character) that support both input and output, beware that buffered input can create a mismatch between the position implemented by the custom procedures and the port's current position; the result from a custom position procedure is automatically adjusted to account for buffering, and setting the port's position flushes all buffered bytes, but writing after a read does *not* automatically reset the port's position to counteract the effects of buffering.

- The bindings in a namespace produced by `null-environment` or `scheme-report-environment` correspond to R⁵RS bindings instead of R⁶RS bindings. In particular, `=>`, `else`, `_`, and `...` are not bound.

7 R⁶RS Libraries

7.1 `(rnrs base (6))`: Base

`(require rnrs/base-6)`

Original specification: Base

7.2 `(rnrs unicode (6))`: Unicode

`(require rnrs/unicode-6)`

Original specification: Unicode

7.3 `(rnrs bytevectors (6))`: Bytevectors

`(require rnrs/bytevectors-6)`

Original specification: Bytevectors

7.4 `(rnrs lists (6))`: List utilities

`(require rnrs/lists-6)`

Original specification: List utilities

7.5 `(rnrs sorting (6))`: Sorting

`(require rnrs/sorting-6)`

Original specification: Sorting

7.6 `(rnrs control (6))`: Control Structures

`(require rnrs/control-6)`

Original specification: Control Structures

7.7 (nrns records syntactic (6)): Records: Syntactic

(require nrns/records/syntactic-6)

Original specification: Records: Syntactic

7.8 (nrns records procedural (6)): Records: Procedural

(require nrns/records/procedural-6)

Original specification: Records: Procedural

7.9 (nrns records inspection (6)): Records: Inspection

(require nrns/records/inspection-6)

Original specification: Records: Inspection

7.10 (nrns exceptions (6)): Exceptions

(require nrns/exceptions-6)

Original specification: Exceptions

See also §6 “R⁶RS Conformance”.

7.11 (nrns conditions (6)): Conditions

(require nrns/conditions-6)

Original specification: Conditions

7.12 (nrns io ports (6)): I/O: Ports

(require nrns/io/ports-6)

Original specification: I/O: Ports

7.13 `(rnrs io simple (6))`: **I/O: Simple**

`(require rnrs/io/simple-6)`

Original specification: I/O: Simple

7.14 `(rnrs files (6))`: **File System**

`(require rnrs/files-6)`

Original specification: File System

7.15 `(rnrs programs (6))`: **Command-line Access and Exit Values**

`(require rnrs/programs-6)`

Original specification: Command-line Access and Exit Values

7.16 `(rnrs arithmetic fixnums (6))`: **Arithmetic: Fixnums**

`(require rnrs/arithmetic/fixnums-6)`

Original specification: Arithmetic: Fixnums

7.17 `(rnrs arithmetic flonums (6))`: **Arithmetic: Flonums**

`(require rnrs/arithmetic/flonums-6)`

Original specification: Arithmetic: Flonums

7.18 `(rnrs arithmetic bitwise (6))`: **Arithmetic: Bitwise**

`(require rnrs/arithmetic/bitwise-6)`

Original specification: Arithmetic: Bitwise

7.19 `(rnrs syntax-case (6))`: Syntax-Case

`(require rnrs/syntax-case-6)`

Original specification: Syntax-Case

7.20 `(rnrs hashtables (6))`: Hashtables

`(require rnrs/hashtables-6)`

Original specification: Hashtables

A hashtable is a dictionary in the sense of `scheme/dict`.

7.21 `(rnrs enums (6))`: Enumerations

`(require rnrs/enums-6)`

Original specification: Enumerations

7.22 `(rnrs eval (6))`: Eval

`(require rnrs/eval-6)`

Original specification: Eval

7.23 `(rnrs mutable-pairs (6))`: Mutable Pairs

`(require rnrs/mutable-pairs-6)`

Original specification: Mutable Pairs

7.24 `(rnrs mutable-strings (6))`: Mutable Strings

`(require rnrs/mutable-strings-6)`

Original specification: Mutable Strings

7.25 (rnrs r5rs (6)): R5RS Compatibility

(require rnrs/r5rs-6)

Original specification: R5RS Compatibility

See also §6 “R⁶RS Conformance”.

Index

`#!/module-begin`, 6
`&assertion`, 12
`&condition`, 12
`&error`, 12
`&i/o`, 12
`&i/o-decoding`, 12
`&i/o-encoding`, 12
`&i/o-file-already-exists`, 12
`&i/o-file-does-not-exist`, 12
`&i/o-file-is-read-only`, 12
`&i/o-file-protection`, 12
`&i/o-filename`, 12
`&i/o-invalid-position`, 12
`&i/o-port`, 12
`&i/o-read`, 12
`&i/o-write`, 12
`&implementation-restriction`, 12
`&irritants`, 12
`&lexical`, 12
`&message`, 12
`&no-infinities`, 13
`&no-nans`, 13
`&non-continuable`, 12
`&serious`, 12
`&syntax`, 12
`&undefined`, 12
`&violation`, 12
`&warning`, 12
`&who`, 12
`(rnrs arithmetic bitwise (6))`:
 Arithmetic: Bitwise, 13
`(rnrs arithmetic fixnums (6))`:
 Arithmetic: Fixnums, 13
`(rnrs arithmetic flonums (6))`:
 Arithmetic: Flonums, 13
`(rnrs base (6))`: Base, 11
`(rnrs bytevectors (6))`: Bytevectors,
 11
`(rnrs conditions (6))`: Conditions, 12
`(rnrs control (6))`: Control Structures,
 11
`(rnrs enums (6))`: Enumerations, 14
`(rnrs eval (6))`: Eval, 14
`(rnrs exceptions (6))`: Exceptions, 12
`(rnrs files (6))`: File System, 13
`(rnrs hashtables (6))`: Hashtables, 14
`(rnrs io ports (6))`: I/O: Ports, 12
`(rnrs io simple (6))`: I/O: Simple, 13
`(rnrs lists (6))`: List utilities, 11
`(rnrs mutable-pairs (6))`: Mutable
 Pairs, 14
`(rnrs mutable-strings (6))`: Mutable
 Strings, 14
`(rnrs programs (6))`: Command-line
 Access and Exit Values, 13
`(rnrs r5rs (6))`: R5RS Compatibility,
 15
`(rnrs records inspection (6))`:
 Records: Inspection, 12
`(rnrs records procedural (6))`:
 Records: Procedural, 12
`(rnrs records syntactic (6))`:
 Records: Syntactic, 12
`(rnrs sorting (6))`: Sorting, 11
`(rnrs syntax-case (6))`: Syntax-Case,
 14
`(rnrs unicode (6))`: Unicode, 11
`*`, 11
`+`, 11
`++path`, 5
`-`, 11
`...`, 11
`...`, 14
`/`, 11
`<`, 11
`<=`, 11
`=`, 11
`=>`, 11
`=>`, 12
`>`, 11
`>=`, 11
`_`, 11
`_`, 14
`abs`, 11

acos, 11
and, 11
angle, 11
append, 11
apply, 11
asin, 11
assert, 11
assertion-violation, 11
assertion-violation?, 12
assoc, 11
assp, 11
assq, 11
assv, 11
atan, 11
begin, 11
binary-port?, 12
bitwise-and, 13
bitwise-arithmetic-shift, 13
bitwise-arithmetic-shift-left, 13
bitwise-arithmetic-shift-right, 13
bitwise-bit-count, 13
bitwise-bit-field, 13
bitwise-bit-set?, 13
bitwise-copy-bit, 13
bitwise-copy-bit-field, 13
bitwise-first-bit-set, 13
bitwise-if, 13
bitwise-ior, 13
bitwise-length, 13
bitwise-not, 13
bitwise-reverse-bit-field, 13
bitwise-rotate-bit-field, 13
bitwise-xor, 13
boolean=?, 11
boolean?, 11
bound-identifier=?, 14
buffer-mode, 12
buffer-mode?, 12
bytevector->sint-list, 11
bytevector->string, 12
bytevector->u8-list, 11
bytevector->uint-list, 11
bytevector-copy, 11
bytevector-copy!, 11
bytevector-fill!, 11
bytevector-ieee-double-native-ref,
11
bytevector-ieee-double-native-
set!, 11
bytevector-ieee-double-ref, 11
bytevector-ieee-single-native-ref,
11
bytevector-ieee-single-native-
set!, 11
bytevector-ieee-single-ref, 11
bytevector-length, 11
bytevector-s16-native-ref, 11
bytevector-s16-native-set!, 11
bytevector-s16-ref, 11
bytevector-s16-set!, 11
bytevector-s32-native-ref, 11
bytevector-s32-native-set!, 11
bytevector-s32-ref, 11
bytevector-s32-set!, 11
bytevector-s64-native-ref, 11
bytevector-s64-native-set!, 11
bytevector-s64-ref, 11
bytevector-s64-set!, 11
bytevector-s8-ref, 11
bytevector-s8-set!, 11
bytevector-sint-ref, 11
bytevector-sint-set!, 11
bytevector-u16-native-ref, 11
bytevector-u16-native-set!, 11
bytevector-u16-ref, 11
bytevector-u16-set!, 11
bytevector-u32-native-ref, 11
bytevector-u32-native-set!, 11
bytevector-u32-ref, 11
bytevector-u32-set!, 11
bytevector-u64-native-ref, 11
bytevector-u64-native-set!, 11
bytevector-u64-ref, 11
bytevector-u64-set!, 11

bytevector-u8-ref, 11
 bytevector-u8-set!, 11
 bytevector-uint-ref, 11
 bytevector-uint-set!, 11
 bytevector=?, 11
 bytevector?, 11
 caar, 11
 cadr, 11
 call-with-bytevector-output-port,
 12
 call-with-current-continuation, 11
 call-with-input-file, 13
 call-with-output-file, 13
 call-with-port, 12
 call-with-string-output-port, 12
 call-with-values, 11
 call/cc, 11
 car, 11
 case, 11
 case-lambda, 11
 cdddar, 11
 cddddr, 11
 cdr, 11
 ceiling, 11
 char->integer, 11
 char-alphabetic?, 11
 char-ci<=?, 11
 char-ci<?, 11
 char-ci=?, 11
 char-ci>=?, 11
 char-ci>?, 11
 char-downcase, 11
 char-foldcase, 11
 char-general-category, 11
 char-lower-case?, 11
 char-numeric?, 11
 char-title-case?, 11
 char-titlecase, 11
 char-upcase, 11
 char-upper-case?, 11
 char-whitespace?, 11
 char<=?, 11
 char<?, 11
 char=?, 11
 char>=?, 11
 char>?, 11
 char?, 11
 close-input-port, 13
 close-output-port, 13
 close-port, 12
 command-line, 13
 complex?, 11
 cond, 11
 condition, 12
 condition-accessor, 12
 condition-irritants, 12
 condition-message, 12
 condition-predicate, 12
 condition-who, 12
 condition?, 12
 cons, 11
 cons*, 11
 cos, 11
 current-error-port, 12
 current-input-port, 12
 current-output-port, 12
 datum->syntax, 14
 define, 11
 define-condition-type, 12
 define-enumeration, 14
 define-record-type, 12
 define-syntax, 11
 delay, 15
 delete-file, 13
 denominator, 11
 display, 13
 div, 11
 div-and-mod, 11
 div0, 11
 div0-and-mod0, 11
 do, 11
 dynamic-wind, 11
 else, 11
 else, 12

endianness, 11
enum-set->list, 14
enum-set-complement, 14
enum-set-constructor, 14
enum-set-difference, 14
enum-set-indexer, 14
enum-set-intersection, 14
enum-set-member?, 14
enum-set-projection, 14
enum-set-subset?, 14
enum-set-union, 14
enum-set-universe, 14
enum-set=?, 14
environment, 14
eof-object, 12
eof-object?, 12
eol-style, 12
eq?, 11
equal-hash, 14
equal?, 11
eqv?, 11
error, 11
error-handling-mode, 12
error?, 12
eval, 14
even?, 11
exact, 11
exact->inexact, 15
exact-integer-sqrt, 11
exact?, 11
exists, 11
exit, 13
exp, 11
expt, 11
fields, 12
file-exists?, 13
file-options, 12
filter, 11
find, 11
finite?, 11
fixnum->flonum, 13
fixnum-width, 13
fixnum?, 13
fl*, 13
fl+, 13
fl-, 13
fl/, 13
fl<=?, 13
fl<?, 13
fl=?, 13
fl>=?, 13
fl>?, 13
flabs, 13
flacos, 13
flasin, 13
flatan, 13
flceiling, 13
flcos, 13
fldenominator, 13
fldiv, 13
fldiv-and-mod, 13
fldiv0, 13
fldiv0-and-mod0, 13
fleven?, 13
flexp, 13
flexpt, 13
flfinite?, 13
flfloor, 13
flinfinite?, 13
flinteger?, 13
fllog, 13
flmax, 13
flmin, 13
flmod, 13
flmod0, 13
flnan?, 13
flnegative?, 13
flnumerator, 13
flodd?, 13
flonum?, 13
floor, 11
flpositive?, 13
flround, 13
flsin, 13

flsqrt, 13
 fltan, 13
 fltruncate, 13
 flush-output-port, 12
 flzero?, 13
 fold-left, 11
 fold-right, 11
 for-all, 11
 for-each, 11
 force, 15
 free-identifier=?, 14
 fx*, 13
 fx*/carry, 13
 fx+, 13
 fx+/carry, 13
 fx-, 13
 fx-/carry, 13
 fx<=?, 13
 fx<?, 13
 fx=?, 13
 fx>=?, 13
 fx>?, 13
 fxand, 13
 fxarithmetic-shift, 13
 fxarithmetic-shift-left, 13
 fxarithmetic-shift-right, 13
 fxbit-count, 13
 fxbit-field, 13
 fxbit-set?, 13
 fxcopy-bit, 13
 fxcopy-bit-field, 13
 fxdiv, 13
 fxdiv-and-mod, 13
 fxdiv0, 13
 fxdiv0-and-mod0, 13
 fxeven?, 13
 fxfirst-bit-set, 13
 fxif, 13
 fxior, 13
 fxlength, 13
 fxmax, 13
 fxmin, 13
 fxmod, 13
 fxmod0, 13
 fxnegative?, 13
 fxnot, 13
 fxodd?, 13
 fxpositive?, 13
 fxreverse-bit-field, 13
 fxrotate-bit-field, 13
 fxxor, 13
 fxzero?, 13
 gcd, 11
 generate-temporaries, 14
 get-bytevector-all, 12
 get-bytevector-n, 12
 get-bytevector-n!, 12
 get-bytevector-some, 12
 get-char, 12
 get-datum, 12
 get-line, 12
 get-string-all, 12
 get-string-n, 12
 get-string-n!, 12
 get-u8, 12
 greatest-fixnum, 13
 guard, 12
 hashtable-clear!, 14
 hashtable-contains?, 14
 hashtable-copy, 14
 hashtable-delete!, 14
 hashtable-entries, 14
 hashtable-equivalence-function, 14
 hashtable-hash-function, 14
 hashtable-keys, 14
 hashtable-mutable?, 14
 hashtable-ref, 14
 hashtable-set!, 14
 hashtable-size, 14
 hashtable-update!, 14
 hashtable?, 14
 i/o-decoding-error?, 12
 i/o-encoding-error-char, 12
 i/o-encoding-error?, 12

[i/o-error-filename](#), 12
[i/o-error-port](#), 12
[i/o-error-position](#), 12
[i/o-error?](#), 12
[i/o-file-already-exists-error?](#), 12
[i/o-file-does-not-exist-error?](#), 12
[i/o-file-is-read-only-error?](#), 12
[i/o-file-protection-error?](#), 12
[i/o-filename-error?](#), 12
[i/o-invalid-position-error?](#), 12
[i/o-port-error?](#), 12
[i/o-read-error?](#), 12
[i/o-write-error?](#), 12
[identifier-syntax](#), 11
[identifier?](#), 14
[if](#), 11
[imag-part](#), 11
[immutable](#), 12
[implementation-restriction-violation?](#), 12
[inexact](#), 11
[inexact->exact](#), 15
[inexact?](#), 11
[infinite?](#), 11
[input-port?](#), 12
[Installing Libraries](#), 5
[integer->char](#), 11
[integer-valued?](#), 11
[integer?](#), 11
[irritants-condition?](#), 12
[lambda](#), 11
[latin-1-codec](#), 12
[lcm](#), 11
[least-fixnum](#), 13
[length](#), 11
[let](#), 11
[let*](#), 11
[let*-values](#), 11
[let-syntax](#), 11
[let-values](#), 11
[letrec](#), 11
[letrec*](#), 11
[letrec-syntax](#), 11
[lexical-violation?](#), 12
[Libraries and Collections](#), 7
[list](#), 11
[list->string](#), 11
[list->vector](#), 11
[list-ref](#), 11
[list-sort](#), 11
[list-tail](#), 11
[list?](#), 11
[log](#), 11
[lookahead-char](#), 12
[lookahead-u8](#), 12
[magnitude](#), 11
[make-assertion-violation](#), 12
[make-bytevector](#), 11
[make-custom-binary-input-port](#), 12
[make-custom-binary-input/output-port](#), 12
[make-custom-binary-output-port](#), 12
[make-custom-textual-input-port](#), 12
[make-custom-textual-input/output-port](#), 12
[make-custom-textual-output-port](#), 12
[make-enumeration](#), 14
[make-eq-hashtable](#), 14
[make-eqv-hashtable](#), 14
[make-error](#), 12
[make-hashtable](#), 14
[make-i/o-decoding-error](#), 12
[make-i/o-encoding-error](#), 12
[make-i/o-error](#), 12
[make-i/o-file-already-exists-error](#), 12
[make-i/o-file-does-not-exist-error](#), 12
[make-i/o-file-is-read-only-error](#), 12
[make-i/o-file-protection-error](#), 12
[make-i/o-filename-error](#), 12
[make-i/o-invalid-position-error](#), 12
[make-i/o-port-error](#), 12

[make-i/o-read-error](#), 12
[make-i/o-write-error](#), 12
[make-implementation-restriction-violation](#), 12
[make-irritants-condition](#), 12
[make-lexical-violation](#), 12
[make-message-condition](#), 12
[make-no-infinities-violation](#), 13
[make-no-nans-violation](#), 13
[make-non-continuable-violation](#), 12
[make-polar](#), 11
[make-record-constructor-descriptor](#), 12
[make-record-type-descriptor](#), 12
[make-rectangular](#), 11
[make-serious-condition](#), 12
[make-string](#), 11
[make-syntax-violation](#), 12
[make-transcoder](#), 12
[make-undefined-violation](#), 12
[make-variable-transformer](#), 14
[make-vector](#), 11
[make-violation](#), 12
[make-warning](#), 12
[make-who-condition](#), 12
[map](#), 11
[max](#), 11
[member](#), 11
[memp](#), 11
[memq](#), 11
[memv](#), 11
[message-condition?](#), 12
[min](#), 11
[mod](#), 11
[mod0](#), 11
[modulo](#), 15
[mutable](#), 12
[nan?](#), 11
[native-endianness](#), 11
[native-eol-style](#), 12
[native-transcoder](#), 12
[negative?](#), 11
[newline](#), 13
[no-infinities-violation?](#), 13
[no-nans-violation?](#), 13
[non-continuable-violation?](#), 12
[nongenerative](#), 12
[not](#), 11
[null-environment](#), 15
[null?](#), 11
[number->string](#), 11
[number?](#), 11
[numerator](#), 11
[odd?](#), 11
[opaque](#), 12
[open-bytevector-input-port](#), 12
[open-bytevector-output-port](#), 12
[open-file-input-port](#), 12
[open-file-input/output-port](#), 12
[open-file-output-port](#), 12
[open-input-file](#), 13
[open-output-file](#), 13
[open-string-input-port](#), 12
[open-string-output-port](#), 12
[or](#), 11
[output-port-buffer-mode](#), 12
[output-port?](#), 12
[pair?](#), 11
[parent](#), 12
[parent-rtd](#), 12
[partition](#), 11
[peek-char](#), 13
[port-eof?](#), 12
[port-has-port-position?](#), 12
[port-has-set-port-position!?](#), 12
[port-position](#), 12
[port-transcoder](#), 12
[port?](#), 12
[positive?](#), 11
[procedure?](#), 11
[protocol](#), 12
[put-bytevector](#), 12
[put-char](#), 12
[put-datum](#), 12

[put-string](#), 12
[put-u8](#), 12
[quasiquote](#), 11
[quasisyntax](#), 14
[quote](#), 11
[quotient](#), 15
[r6rs](#), 6
[R⁶RS Conformance](#), 9
[R⁶RS Libraries](#), 11
[R⁶RS Module Language](#), 6
R6RS: Standard Language, 1
[raise](#), 12
[raise-continuable](#), 12
[rational-valued?](#), 11
[rational?](#), 11
[rationalize](#), 11
[read](#), 13
[read-char](#), 13
[real->flonum](#), 13
[real-part](#), 11
[real-valued?](#), 11
[real?](#), 11
[record-accessor](#), 12
[record-constructor](#), 12
[record-constructor-descriptor](#), 12
[record-field-mutable?](#), 12
[record-mutator](#), 12
[record-predicate](#), 12
[record-rtd](#), 12
[record-type-descriptor](#), 12
[record-type-descriptor?](#), 12
[record-type-field-names](#), 12
[record-type-generative?](#), 12
[record-type-name](#), 12
[record-type-opaque?](#), 12
[record-type-parent](#), 12
[record-type-sealed?](#), 12
[record-type-uid](#), 12
[record?](#), 12
[remainder](#), 15
[remove](#), 11
[remp](#), 11
[remq](#), 11
[remv](#), 11
[reverse](#), 11
[rnrs/arithmetic/bitwise-6](#), 13
[rnrs/arithmetic/fixnums-6](#), 13
[rnrs/arithmetic/flonums-6](#), 13
[rnrs/base-6](#), 11
[rnrs/bytevectors-6](#), 11
[rnrs/conditions-6](#), 12
[rnrs/control-6](#), 11
[rnrs/enums-6](#), 14
[rnrs/eval-6](#), 14
[rnrs/exceptions-6](#), 12
[rnrs/files-6](#), 13
[rnrs/hashtables-6](#), 14
[rnrs/io/ports-6](#), 12
[rnrs/io/simple-6](#), 13
[rnrs/lists-6](#), 11
[rnrs/mutable-pairs-6](#), 14
[rnrs/mutable-strings-6](#), 14
[rnrs/programs-6](#), 13
[rnrs/r5rs-6](#), 15
[rnrs/records/inspection-6](#), 12
[rnrs/records/procedural-6](#), 12
[rnrs/records/syntactic-6](#), 12
[rnrs/sorting-6](#), 11
[rnrs/syntax-case-6](#), 14
[rnrs/unicode-6](#), 11
[round](#), 11
[Running Top-Level Programs](#), 4
[Scheme Interoperability](#), 8
[scheme-report-environment](#), 15
[sealed](#), 12
[serious-condition?](#), 12
[set!](#), 11
[set-car!](#), 14
[set-cdr!](#), 14
[set-port-position!](#), 12
[simple-conditions](#), 12
[sin](#), 11
[sint-list->bytevector](#), 11
[sqrt](#), 11

standard-error-port, 12
 standard-input-port, 12
 standard-output-port, 12
 string, 11
 string->bytevector, 12
 string->list, 11
 string->number, 11
 string->symbol, 11
 string->utf16, 11
 string->utf32, 11
 string->utf8, 11
 string-append, 11
 string-ci-hash, 14
 string-ci<=?, 11
 string-ci<?, 11
 string-ci=?, 11
 string-ci>=?, 11
 string-ci>?, 11
 string-copy, 11
 string-downcase, 11
 string-fill!, 14
 string-foldcase, 11
 string-for-each, 11
 string-hash, 14
 string-length, 11
 string-normalize-nfc, 11
 string-normalize-nfd, 11
 string-normalize-nfkc, 11
 string-normalize-nfkd, 11
 string-ref, 11
 string-set!, 14
 string-titlecase, 11
 string-upcase, 11
 string<=?, 11
 string<?, 11
 string=?, 11
 string>=?, 11
 string>?, 11
 string?, 11
 substring, 11
 symbol->string, 11
 symbol-hash, 14
 symbol=?, 11
 symbol?, 11
 syntax, 14
 syntax->datum, 14
 syntax-case, 14
 syntax-rules, 11
 syntax-violation, 14
 syntax-violation-form, 12
 syntax-violation-subform, 12
 syntax-violation?, 12
 tan, 11
 textual-port?, 12
 transcoded-port, 12
 transcoder-codec, 12
 transcoder-eol-style, 12
 transcoder-error-handling-mode, 12
 truncate, 11
 u8-list->bytevector, 11
 uint-list->bytevector, 11
 undefined-violation?, 12
 unless, 11
 unquote, 11
 unquote-splicing, 11
 unsyntax, 14
 unsyntax-splicing, 14
 utf-16-codec, 12
 utf-8-codec, 12
 utf16->string, 11
 utf32->string, 11
 utf8->string, 11
 values, 11
 vector, 11
 vector->list, 11
 vector-fill!, 11
 vector-for-each, 11
 vector-length, 11
 vector-map, 11
 vector-ref, 11
 vector-set!, 11
 vector-sort, 11
 vector-sort!, 11
 vector?, 11

[violation?](#), 12
[warning?](#), 12
when, 11
[who-condition?](#), 12
[with-exception-handler](#), 12
[with-input-from-file](#), 13
[with-output-to-file](#), 13
with-syntax, 14
write, 13
[write-char](#), 13
[zero?](#), 11