

# R6RS: Scheme

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The The Revised<sup>6</sup> Report on the Algorithmic Language Scheme defines a dialect of Scheme. We use *R<sup>6</sup>RS* to refer to both the standard and the language defined by the standard.

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

See §23 “Dialects of Racket and Scheme” for general information about different dialects of Scheme within Racket.

# Contents

<b>1</b>	<b>Using R<sup>6</sup>RS with DrRacket</b>	<b>4</b>
<b>2</b>	<b>Running Top-Level Programs</b>	<b>5</b>
<b>3</b>	<b>Installing Libraries</b>	<b>6</b>
<b>4</b>	<b>R<sup>6</sup>RS Module Language</b>	<b>8</b>
4.1	Using R <sup>6</sup> RS . . . . .	8
4.2	The Implementation of R <sup>6</sup> RS . . . . .	8
<b>5</b>	<b>Libraries and Collections</b>	<b>9</b>
<b>6</b>	<b>Language Interoperability</b>	<b>10</b>
<b>7</b>	<b>R<sup>6</sup>RS Conformance</b>	<b>11</b>
<b>8</b>	<b>R<sup>6</sup>RS Libraries</b>	<b>13</b>
8.1	<code>(rnrs base (6))</code> : Base . . . . .	13
8.2	<code>(rnrs unicode (6))</code> : Unicode . . . . .	13
8.3	<code>(rnrs bytevectors (6))</code> : Bytevectors . . . . .	13
8.4	<code>(rnrs lists (6))</code> : List utilities . . . . .	13
8.5	<code>(rnrs sorting (6))</code> : Sorting . . . . .	13
8.6	<code>(rnrs control (6))</code> : Control Structures . . . . .	13
8.7	<code>(rnrs records syntactic (6))</code> : Records: Syntactic . . . . .	14
8.8	<code>(rnrs records procedural (6))</code> : Records: Procedural . . . . .	14
8.9	<code>(rnrs records inspection (6))</code> : Records: Inspection . . . . .	14
8.10	<code>(rnrs exceptions (6))</code> : Exceptions . . . . .	14

8.11	<code>(rnrs conditions (6))</code> : Conditions . . . . .	14
8.12	<code>(rnrs io ports (6))</code> : I/O: Ports . . . . .	14
8.13	<code>(rnrs io simple (6))</code> : I/O: Simple . . . . .	15
8.14	<code>(rnrs files (6))</code> : File System . . . . .	15
8.15	<code>(rnrs programs (6))</code> : Command-line Access and Exit Values . . . . .	15
8.16	<code>(rnrs arithmetic fixnums (6))</code> : Arithmetic: Fixnums . . . . .	15
8.17	<code>(rnrs arithmetic flonums (6))</code> : Arithmetic: Flonums . . . . .	15
8.18	<code>(rnrs arithmetic bitwise (6))</code> : Arithmetic: Bitwise . . . . .	15
8.19	<code>(rnrs syntax-case (6))</code> : Syntax-Case . . . . .	16
8.20	<code>(rnrs hashtables (6))</code> : Hashtables . . . . .	16
8.21	<code>(rnrs enums (6))</code> : Enumerations . . . . .	16
8.22	<code>(rnrs eval (6))</code> : Eval . . . . .	16
8.23	<code>(rnrs mutable-pairs (6))</code> : Mutable Pairs . . . . .	16
8.24	<code>(rnrs mutable-strings (6))</code> : Mutable Strings . . . . .	16
8.25	<code>(rnrs r5rs (6))</code> : R5RS Compatibility . . . . .	17
	<b>Index</b> . . . . .	<b>18</b>
	<b>Index</b> . . . . .	<b>18</b>

## 1 Using R<sup>6</sup>RS with DrRacket

To run an R<sup>6</sup>RS program with DrRacket choose Use language declared in source from the language dialog box and add the following line to the top of your program. `#!r6rs`.

Here is a small example R<sup>6</sup>RS program that will work in DrRacket.

```
#!r6rs
(import (rnrs lists (6))
        (rnrs base (6))
        (rnrs io simple (6)))
(display (find even? '(3 1 4 1 5 9)))
```

## 2 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.sps" contains

```
(import (rnrs))
(display "hello\n")
```

then

```
plt-r6rs hi.sps
```

prints "hello."

- Prefix the program with `#!r6rs`, which counts as a comment from the R<sup>6</sup>RS perspective, but is a synonym for `#lang r6rs` from the Racket perspective. Such files can be run like any other Racket module, such as using `racket`:

```
racket <program-file>
```

or using DrRacket. The file can also be compiled to bytecode using `raco make`:

```
raco make <program-file>
```

For example, if "hi.sps" contains

```
#!r6rs
(import (rnrs))
(display "hello\n")
```

then

```
racket hi.sps
```

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

### 3 Installing Libraries

To reference an R<sup>6</sup>RS library from a top-level program or another library, it must be installed as a collection-based library in Racket.

One way to produce an R<sup>6</sup>RS 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.sls" 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>
```

You may as well specify an arbitrary collections directory by using the `--collections` flag:

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

See §5 “Libraries and Collections” for information on how R<sup>6</sup>RS 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 R<sup>6</sup>RS library prefixed with `#!r6rs`, then `plt-r6rs ++path <dir>` directs the R<sup>6</sup>RS 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 §5 “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.

## 4 R<sup>6</sup>RS Module Language

```
#lang r6rs      package: r6rs-lib
```

The `r6rs` language is usually used in the form `#!r6rs`, which is equivalent to `#lang r6rs` and is also valid R<sup>6</sup>RS syntax.

### 4.1 Using R<sup>6</sup>RS

See §1 “Using R<sup>6</sup>RS with DrRacket”, §2 “Running Top-Level Programs”, and §3 “Installing Libraries” for more information on writing and running R<sup>6</sup>RS programs with Racket.

### 4.2 The Implementation of R<sup>6</sup>RS

The R<sup>6</sup>RS language is itself implemented as a module within Racket. The details of that implementation, as provided in this section, are not normally relevant to programmers using R<sup>6</sup>RS; see the links in §4.1 “Using R<sup>6</sup>RS”, instead. The details may be relevant to programmers who are developing new tools or deriving variants of R<sup>6</sup>RS within Racket.

As a Racket module, the `r6rs` module language provides only a `#!/module-begin` binding, which is used to process the entire body of a Racket module (see `module`). The `#!/module-begin` binding from `r6rs` allows the body of a module to use the syntax of either a R<sup>6</sup>RS library or a R<sup>6</sup>RS 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 R<sup>6</sup>RS library, while a module body that starts with an `import` form defines an R<sup>6</sup>RS top-level program.

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

## 5 Libraries and Collections

An R<sup>6</sup>RS 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 Racket 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 R<sup>6</sup>RS 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 R<sup>6</sup>RS 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 R<sup>6</sup>RS 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"`, `".sls"`, and `".rkt"`. When resolving version constraints, these extensions are all tried when looking for matches.

To ensure that all R<sup>6</sup>RS 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 R<sup>6</sup>RS 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 Racket installation):

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

## 6 Language Interoperability

Using the conversion rules in §5 “Libraries and Collections”, and R<sup>6</sup>RS library can refer to modules that are implemented in other dialects supported by Racket, and other Racket modules can refer to libraries that are implemented in R<sup>6</sup>RS.

Beware that a *pair* in R<sup>6</sup>RS corresponds to a *mutable pair* in `racket/base`. Otherwise, R<sup>6</sup>RS libraries and `racket/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 `racket/base` can be used directly as binary ports with R<sup>6</sup>RS libraries, and all R<sup>6</sup>RS ports can be used as ports in `racket/base` programs, but only textual ports created via R<sup>6</sup>RS libraries can be used by other R<sup>6</sup>RS operations that expect textual ports.

## 7 R<sup>6</sup>RS Conformance

Racket's R<sup>6</sup>RS 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 R<sup>6</sup>RS, the following program should print “in” and “out” twice, but each prints once using Racket:

```
(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.
- 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 R<sup>5</sup>RS bindings instead of R<sup>6</sup>RS bindings. In particular, `=>`, `else`, `_`, and `...` are not bound.

- Bindings for `#!/datum`, `#!/app`, `#!/top`, and `#!/top-interaction` are imported into every library and program, and at every phase level for which the library or program has imports.

Changed in version 6.0.1.4: When an identifier bound by `letrec` or `letrec*` is referenced before it is initialized, an exception is raised, instead of producing `#!<undefined>`.

## 8 R<sup>6</sup>RS Libraries

### 8.1 `(rnrs base (6))`: Base

`(require rnrs/base-6)`      package: r6rs-lib

Original specification: Base

### 8.2 `(rnrs unicode (6))`: Unicode

`(require rnrs/unicode-6)`      package: r6rs-lib

Original specification: Unicode

### 8.3 `(rnrs bytevectors (6))`: Bytevectors

`(require rnrs/bytevectors-6)`      package: r6rs-lib

Original specification: Bytevectors

### 8.4 `(rnrs lists (6))`: List utilities

`(require rnrs/lists-6)`      package: r6rs-lib

Original specification: List utilities

### 8.5 `(rnrs sorting (6))`: Sorting

`(require rnrs/sorting-6)`      package: r6rs-lib

Original specification: Sorting

### 8.6 `(rnrs control (6))`: Control Structures

`(require rnrs/control-6)`      package: r6rs-lib

Original specification: Control Structures

## 8.7 `(nrns records syntactic (6))`: **Records: Syntactic**

`(require nrns/records/syntactic-6)` package: r6rs-lib

Original specification: Records: Syntactic

## 8.8 `(nrns records procedural (6))`: **Records: Procedural**

`(require nrns/records/procedural-6)` package: r6rs-lib

Original specification: Records: Procedural

## 8.9 `(nrns records inspection (6))`: **Records: Inspection**

`(require nrns/records/inspection-6)` package: r6rs-lib

Original specification: Records: Inspection

## 8.10 `(nrns exceptions (6))`: **Exceptions**

`(require nrns/exceptions-6)` package: r6rs-lib

Original specification: Exceptions

See also §7 “R<sup>6</sup>RS Conformance”.

## 8.11 `(nrns conditions (6))`: **Conditions**

`(require nrns/conditions-6)` package: r6rs-lib

Original specification: Conditions

## 8.12 `(nrns io ports (6))`: **I/O: Ports**

`(require nrns/io/ports-6)` package: r6rs-lib

Original specification: I/O: Ports

### 8.13 `(rnrs io simple (6))`: I/O: Simple

`(require rnrs/io/simple-6)`      package: r6rs-lib

Original specification: I/O: Simple

### 8.14 `(rnrs files (6))`: File System

`(require rnrs/files-6)`      package: r6rs-lib

Original specification: File System

### 8.15 `(rnrs programs (6))`: Command-line Access and Exit Values

`(require rnrs/programs-6)`      package: r6rs-lib

Original specification: Command-line Access and Exit Values

### 8.16 `(rnrs arithmetic fixnums (6))`: Arithmetic: Fixnums

`(require rnrs/arithmetic/fixnums-6)`      package: r6rs-lib

Original specification: Arithmetic: Fixnums

### 8.17 `(rnrs arithmetic flonums (6))`: Arithmetic: Flonums

`(require rnrs/arithmetic/flonums-6)`      package: r6rs-lib

Original specification: Arithmetic: Flonums

### 8.18 `(rnrs arithmetic bitwise (6))`: Arithmetic: Bitwise

`(require rnrs/arithmetic/bitwise-6)`      package: r6rs-lib

Original specification: Arithmetic: Bitwise

### 8.19 `(rnrs syntax-case (6))`: Syntax-Case

`(require rnrs/syntax-case-6)`      package: r6rs-lib

Original specification: Syntax-Case

### 8.20 `(rnrs hashtables (6))`: Hashtables

`(require rnrs/hashtables-6)`      package: r6rs-lib

Original specification: Hashtables

A hashtable is a dictionary in the sense of `racket/dict`, and hash table operations interact with threads in the same way for hash tables created with `make-hash` (e.g., `hashtable-ref` and `hashtable-set!` are thread-safe).

### 8.21 `(rnrs enums (6))`: Enumerations

`(require rnrs/enums-6)`      package: r6rs-lib

Original specification: Enumerations

### 8.22 `(rnrs eval (6))`: Eval

`(require rnrs/eval-6)`      package: r6rs-lib

Original specification: Eval

### 8.23 `(rnrs mutable-pairs (6))`: Mutable Pairs

`(require rnrs/mutable-pairs-6)`      package: r6rs-lib

Original specification: Mutable Pairs

### 8.24 `(rnrs mutable-strings (6))`: Mutable Strings

`(require rnrs/mutable-strings-6)`      package: r6rs-lib

Original specification: Mutable Strings

## 8.25 `(rnrs r5rs (6))`: R5RS Compatibility

`(require rnrs/r5rs-6)`      package: r6rs-lib

Original specification: R5RS Compatibility

See also §7 “R<sup>6</sup>RS Conformance”.

## Index

`#!/module-begin`, 8  
`&assertion`, 14  
`&condition`, 14  
`&error`, 14  
`&i/o`, 14  
`&i/o-decoding`, 14  
`&i/o-encoding`, 14  
`&i/o-file-already-exists`, 14  
`&i/o-file-does-not-exist`, 14  
`&i/o-file-is-read-only`, 14  
`&i/o-file-protection`, 14  
`&i/o-filename`, 14  
`&i/o-invalid-position`, 14  
`&i/o-port`, 14  
`&i/o-read`, 14  
`&i/o-write`, 14  
`&implementation-restriction`, 14  
`&irritants`, 14  
`&lexical`, 14  
`&message`, 14  
`&no-infinities`, 15  
`&no-nans`, 15  
`&non-continuable`, 14  
`&serious`, 14  
`&syntax`, 14  
`&undefined`, 14  
`&violation`, 14  
`&warning`, 14  
`&who`, 14  
`(rnrs arithmetic bitwise (6))`:  
  Arithmetic: Bitwise, 15  
`(rnrs arithmetic fixnums (6))`:  
  Arithmetic: Fixnums, 15  
`(rnrs arithmetic flonums (6))`:  
  Arithmetic: Flonums, 15  
`(rnrs base (6))`: Base, 13  
`(rnrs bytevectors (6))`: Bytevectors,  
  13  
`(rnrs conditions (6))`: Conditions, 14  
`(rnrs control (6))`: Control Structures,  
  13  
`(rnrs enums (6))`: Enumerations, 16  
`(rnrs eval (6))`: Eval, 16  
`(rnrs exceptions (6))`: Exceptions, 14  
`(rnrs files (6))`: File System, 15  
`(rnrs hashtables (6))`: Hashtables, 16  
`(rnrs io ports (6))`: I/O: Ports, 14  
`(rnrs io simple (6))`: I/O: Simple, 15  
`(rnrs lists (6))`: List utilities, 13  
`(rnrs mutable-pairs (6))`: Mutable  
  Pairs, 16  
`(rnrs mutable-strings (6))`: Mutable  
  Strings, 16  
`(rnrs programs (6))`: Command-line  
  Access and Exit Values, 15  
`(rnrs r5rs (6))`: R5RS Compatibility,  
  17  
`(rnrs records inspection (6))`:  
  Records: Inspection, 14  
`(rnrs records procedural (6))`:  
  Records: Procedural, 14  
`(rnrs records syntactic (6))`:  
  Records: Syntactic, 14  
`(rnrs sorting (6))`: Sorting, 13  
`(rnrs syntax-case (6))`: Syntax-Case,  
  16  
`(rnrs unicode (6))`: Unicode, 13  
`*`, 13  
`+`, 13  
`++path`, 6  
`-`, 13  
`...`, 13  
`...`, 16  
`/`, 13  
`<`, 13  
`<=`, 13  
`=`, 13  
`=>`, 13  
`=>`, 14  
`>`, 13  
`>=`, 13  
`_`, 13  
`_`, 16  
`abs`, 13

acos, 13  
and, 13  
angle, 13  
append, 13  
apply, 13  
asin, 13  
assert, 13  
assertion-violation, 13  
assertion-violation?, 14  
assoc, 13  
assp, 13  
assq, 13  
assv, 13  
atan, 13  
begin, 13  
binary-port?, 14  
bitwise-and, 15  
bitwise-arithmetic-shift, 15  
bitwise-arithmetic-shift-left, 15  
bitwise-arithmetic-shift-right, 15  
bitwise-bit-count, 15  
bitwise-bit-field, 15  
bitwise-bit-set?, 15  
bitwise-copy-bit, 15  
bitwise-copy-bit-field, 15  
bitwise-first-bit-set, 15  
bitwise-if, 15  
bitwise-ior, 15  
bitwise-length, 15  
bitwise-not, 15  
bitwise-reverse-bit-field, 15  
bitwise-rotate-bit-field, 15  
bitwise-xor, 15  
boolean=?, 13  
boolean?, 13  
bound-identifier=?, 16  
buffer-mode, 14  
buffer-mode?, 14  
bytevector->sint-list, 13  
bytevector->string, 14  
bytevector->u8-list, 13  
bytevector->uint-list, 13  
bytevector-copy, 13  
bytevector-copy!, 13  
bytevector-fill!, 13  
bytevector-ieee-double-native-ref,  
13  
bytevector-ieee-double-native-  
set!, 13  
bytevector-ieee-double-ref, 13  
bytevector-ieee-single-native-ref,  
13  
bytevector-ieee-single-native-  
set!, 13  
bytevector-ieee-single-ref, 13  
bytevector-length, 13  
bytevector-s16-native-ref, 13  
bytevector-s16-native-set!, 13  
bytevector-s16-ref, 13  
bytevector-s16-set!, 13  
bytevector-s32-native-ref, 13  
bytevector-s32-native-set!, 13  
bytevector-s32-ref, 13  
bytevector-s32-set!, 13  
bytevector-s64-native-ref, 13  
bytevector-s64-native-set!, 13  
bytevector-s64-ref, 13  
bytevector-s64-set!, 13  
bytevector-s8-ref, 13  
bytevector-s8-set!, 13  
bytevector-sint-ref, 13  
bytevector-sint-set!, 13  
bytevector-u16-native-ref, 13  
bytevector-u16-native-set!, 13  
bytevector-u16-ref, 13  
bytevector-u16-set!, 13  
bytevector-u32-native-ref, 13  
bytevector-u32-native-set!, 13  
bytevector-u32-ref, 13  
bytevector-u32-set!, 13  
bytevector-u64-native-ref, 13  
bytevector-u64-native-set!, 13  
bytevector-u64-ref, 13  
bytevector-u64-set!, 13

bytevector-u8-ref, 13  
 bytevector-u8-set!, 13  
 bytevector-uint-ref, 13  
 bytevector-uint-set!, 13  
 bytevector=?, 13  
 bytevector?, 13  
 caar, 13  
 cadr, 13  
 call-with-bytevector-output-port,  
   14  
 call-with-current-continuation, 13  
 call-with-input-file, 15  
 call-with-output-file, 15  
 call-with-port, 14  
 call-with-string-output-port, 14  
 call-with-values, 13  
 call/cc, 13  
 car, 13  
 case, 13  
 case-lambda, 13  
 cdddar, 13  
 cddddr, 13  
 cdr, 13  
 ceiling, 13  
 char->integer, 13  
 char-alphabetic?, 13  
 char-ci<=?, 13  
 char-ci<?, 13  
 char-ci=?, 13  
 char-ci>=?, 13  
 char-ci>?, 13  
 char-downcase, 13  
 char-foldcase, 13  
 char-general-category, 13  
 char-lower-case?, 13  
 char-numeric?, 13  
 char-title-case?, 13  
 char-titlecase, 13  
 char-upcase, 13  
 char-upper-case?, 13  
 char-whitespace?, 13  
 char<=?, 13  
 char<?, 13  
 char=?, 13  
 char>=?, 13  
 char>?, 13  
 char?, 13  
 close-input-port, 15  
 close-output-port, 15  
 close-port, 14  
 command-line, 15  
 complex?, 13  
 cond, 13  
 condition, 14  
 condition-accessor, 14  
 condition-irritants, 14  
 condition-message, 14  
 condition-predicate, 14  
 condition-who, 14  
 condition?, 14  
 cons, 13  
 cons\*, 13  
 cos, 13  
 current-error-port, 14  
 current-input-port, 14  
 current-output-port, 14  
 datum->syntax, 16  
 define, 13  
 define-condition-type, 14  
 define-enumeration, 16  
 define-record-type, 14  
 define-syntax, 13  
 delay, 17  
 delete-file, 15  
 denominator, 13  
 display, 15  
 div, 13  
 div-and-mod, 13  
 div0, 13  
 div0-and-mod0, 13  
 do, 13  
 dynamic-wind, 13  
 else, 13  
 else, 14

endianness, 13  
enum-set->list, 16  
enum-set-complement, 16  
enum-set-constructor, 16  
enum-set-difference, 16  
enum-set-indexer, 16  
enum-set-intersection, 16  
enum-set-member?, 16  
enum-set-projection, 16  
enum-set-subset?, 16  
enum-set-union, 16  
enum-set-universe, 16  
enum-set=?, 16  
environment, 16  
eof-object, 14  
eof-object?, 14  
eol-style, 14  
eq?, 13  
equal-hash, 16  
equal?, 13  
eqv?, 13  
error, 13  
error-handling-mode, 14  
error?, 14  
eval, 16  
even?, 13  
exact, 13  
exact->inexact, 17  
exact-integer-sqrt, 13  
exact?, 13  
exists, 13  
exit, 15  
exp, 13  
expt, 13  
fields, 14  
file-exists?, 15  
file-options, 14  
filter, 13  
find, 13  
finite?, 13  
fixnum->flonum, 15  
fixnum-width, 15  
fixnum?, 15  
fl\*, 15  
fl+, 15  
fl-, 15  
fl/, 15  
fl<=?, 15  
fl<?, 15  
fl=?, 15  
fl>=?, 15  
fl>?, 15  
flabs, 15  
flacos, 15  
flasin, 15  
flatan, 15  
flceiling, 15  
flcos, 15  
fldenominator, 15  
fldiv, 15  
fldiv-and-mod, 15  
fldiv0, 15  
fldiv0-and-mod0, 15  
fleven?, 15  
flexp, 15  
flexpt, 15  
flfinite?, 15  
flfloor, 15  
flinfinite?, 15  
flinteger?, 15  
fllog, 15  
flmax, 15  
flmin, 15  
flmod, 15  
flmod0, 15  
flnan?, 15  
flnegative?, 15  
flnumerator, 15  
flodd?, 15  
flonum?, 15  
floor, 13  
flpositive?, 15  
flround, 15  
flsin, 15

flsqrt, 15  
 fltan, 15  
 fltruncate, 15  
 flush-output-port, 14  
 flzero?, 15  
 fold-left, 13  
 fold-right, 13  
 for-all, 13  
 for-each, 13  
 force, 17  
 free-identifier=?, 16  
 fx\*, 15  
 fx\*/carry, 15  
 fx+, 15  
 fx+/carry, 15  
 fx-, 15  
 fx-/carry, 15  
 fx<=?, 15  
 fx<?, 15  
 fx=?, 15  
 fx>=?, 15  
 fx>?, 15  
 fxand, 15  
 fxarithmetic-shift, 15  
 fxarithmetic-shift-left, 15  
 fxarithmetic-shift-right, 15  
 fxbit-count, 15  
 fxbit-field, 15  
 fxbit-set?, 15  
 fxcopy-bit, 15  
 fxcopy-bit-field, 15  
 fxdiv, 15  
 fxdiv-and-mod, 15  
 fxdiv0, 15  
 fxdiv0-and-mod0, 15  
 fxeven?, 15  
 fxfirst-bit-set, 15  
 fxif, 15  
 fxior, 15  
 fxlength, 15  
 fxmax, 15  
 fxmin, 15  
 fxmod, 15  
 fxmod0, 15  
 fxnegative?, 15  
 fxnot, 15  
 fxodd?, 15  
 fxpositive?, 15  
 fxreverse-bit-field, 15  
 fxrotate-bit-field, 15  
 fxxor, 15  
 fxzero?, 15  
 gcd, 13  
 generate-temporaries, 16  
 get-bytevector-all, 14  
 get-bytevector-n, 14  
 get-bytevector-n!, 14  
 get-bytevector-some, 14  
 get-char, 14  
 get-datum, 14  
 get-line, 14  
 get-string-all, 14  
 get-string-n, 14  
 get-string-n!, 14  
 get-u8, 14  
 greatest-fixnum, 15  
 guard, 14  
 hashtable-clear!, 16  
 hashtable-contains?, 16  
 hashtable-copy, 16  
 hashtable-delete!, 16  
 hashtable-entries, 16  
 hashtable-equivalence-function, 16  
 hashtable-hash-function, 16  
 hashtable-keys, 16  
 hashtable-mutable?, 16  
 hashtable-ref, 16  
 hashtable-set!, 16  
 hashtable-size, 16  
 hashtable-update!, 16  
 hashtable?, 16  
 i/o-decoding-error?, 14  
 i/o-encoding-error-char, 14  
 i/o-encoding-error?, 14

- [i/o-error-filename](#), 14
- [i/o-error-port](#), 14
- [i/o-error-position](#), 14
- [i/o-error?](#), 14
- [i/o-file-already-exists-error?](#), 14
- [i/o-file-does-not-exist-error?](#), 14
- [i/o-file-is-read-only-error?](#), 14
- [i/o-file-protection-error?](#), 14
- [i/o-filename-error?](#), 14
- [i/o-invalid-position-error?](#), 14
- [i/o-port-error?](#), 14
- [i/o-read-error?](#), 14
- [i/o-write-error?](#), 14
- [identifier-syntax](#), 13
- [identifier?](#), 16
- [if](#), 13
- [imag-part](#), 13
- [immutable](#), 14
- [implementation-restriction-violation?](#), 14
- [inexact](#), 13
- [inexact->exact](#), 17
- [inexact?](#), 13
- [infinite?](#), 13
- [input-port?](#), 14
- [Installing Libraries](#), 6
- [integer->char](#), 13
- [integer-valued?](#), 13
- [integer?](#), 13
- [irritants-condition?](#), 14
- [lambda](#), 13
- [Language Interoperability](#), 10
- [latin-1-codec](#), 14
- [lcm](#), 13
- [least-fixnum](#), 15
- [length](#), 13
- [let](#), 13
- [let\\*](#), 13
- [let\\*-values](#), 13
- [let-syntax](#), 13
- [let-values](#), 13
- [letrec](#), 13
- [letrec\\*](#), 13
- [letrec-syntax](#), 13
- [lexical-violation?](#), 14
- [Libraries and Collections](#), 9
- [list](#), 13
- [list->string](#), 13
- [list->vector](#), 13
- [list-ref](#), 13
- [list-sort](#), 13
- [list-tail](#), 13
- [list?](#), 13
- [log](#), 13
- [lookahead-char](#), 14
- [lookahead-u8](#), 14
- [magnitude](#), 13
- [make-assertion-violation](#), 14
- [make-bytevector](#), 13
- [make-custom-binary-input-port](#), 14
- [make-custom-binary-input/output-port](#), 14
- [make-custom-binary-output-port](#), 14
- [make-custom-textual-input-port](#), 14
- [make-custom-textual-input/output-port](#), 14
- [make-custom-textual-output-port](#), 14
- [make-enumeration](#), 16
- [make-eq-hashtable](#), 16
- [make-eqv-hashtable](#), 16
- [make-error](#), 14
- [make-hashtable](#), 16
- [make-i/o-decoding-error](#), 14
- [make-i/o-encoding-error](#), 14
- [make-i/o-error](#), 14
- [make-i/o-file-already-exists-error](#), 14
- [make-i/o-file-does-not-exist-error](#), 14
- [make-i/o-file-is-read-only-error](#), 14
- [make-i/o-file-protection-error](#), 14
- [make-i/o-filename-error](#), 14
- [make-i/o-invalid-position-error](#), 14

make-i/o-port-error, 14  
 make-i/o-read-error, 14  
 make-i/o-write-error, 14  
 make-implementation-restriction-violation, 14  
 make-irritants-condition, 14  
 make-lexical-violation, 14  
 make-message-condition, 14  
 make-no-infinities-violation, 15  
 make-no-nans-violation, 15  
 make-non-continuable-violation, 14  
 make-polar, 13  
 make-record-constructor-descriptor, 14  
 make-record-type-descriptor, 14  
 make-rectangular, 13  
 make-serious-condition, 14  
 make-string, 13  
 make-syntax-violation, 14  
 make-transcoder, 14  
 make-undefined-violation, 14  
 make-variable-transformer, 16  
 make-vector, 13  
 make-violation, 14  
 make-warning, 14  
 make-who-condition, 14  
 map, 13  
 max, 13  
 member, 13  
 memp, 13  
 memq, 13  
 memv, 13  
 message-condition?, 14  
 min, 13  
 mod, 13  
 mod0, 13  
 modulo, 17  
 mutable, 14  
 nan?, 13  
 native-endianness, 13  
 native-eol-style, 14  
 native-transcoder, 14  
 negative?, 13  
 newline, 15  
 no-infinities-violation?, 15  
 no-nans-violation?, 15  
 non-continuable-violation?, 14  
 nongenerative, 14  
 not, 13  
 null-environment, 17  
 null?, 13  
 number->string, 13  
 number?, 13  
 numerator, 13  
 odd?, 13  
 opaque, 14  
 open-bytevector-input-port, 14  
 open-bytevector-output-port, 14  
 open-file-input-port, 14  
 open-file-input/output-port, 14  
 open-file-output-port, 14  
 open-input-file, 15  
 open-output-file, 15  
 open-string-input-port, 14  
 open-string-output-port, 14  
 or, 13  
 output-port-buffer-mode, 14  
 output-port?, 14  
 pair?, 13  
 parent, 14  
 parent-rtd, 14  
 partition, 13  
 peek-char, 15  
 port-eof?, 14  
 port-has-port-position?, 14  
 port-has-set-port-position!?, 14  
 port-position, 14  
 port-transcoder, 14  
 port?, 14  
 positive?, 13  
 procedure?, 13  
 protocol, 14  
 put-bytevector, 14  
 put-char, 14

- [put-datum](#), 14
- [put-string](#), 14
- [put-u8](#), 14
- [quasiquote](#), 13
- [quasisyntax](#), 16
- [quote](#), 13
- [quotient](#), 17
- [r6rs](#), 8
- [R<sup>6</sup>RS Conformance](#), 11
- [R<sup>6</sup>RS Libraries](#), 13
- [R<sup>6</sup>RS Module Language](#), 8
- [R6RS: Scheme](#), 1
- [raise](#), 14
- [raise-continuable](#), 14
- [rational-valued?](#), 13
- [rational?](#), 13
- [rationalize](#), 13
- [read](#), 15
- [read-char](#), 15
- [real->flonum](#), 15
- [real-part](#), 13
- [real-valued?](#), 13
- [real?](#), 13
- [record-accessor](#), 14
- [record-constructor](#), 14
- [record-constructor-descriptor](#), 14
- [record-field-mutable?](#), 14
- [record-mutator](#), 14
- [record-predicate](#), 14
- [record-rtd](#), 14
- [record-type-descriptor](#), 14
- [record-type-descriptor?](#), 14
- [record-type-field-names](#), 14
- [record-type-generative?](#), 14
- [record-type-name](#), 14
- [record-type-opaque?](#), 14
- [record-type-parent](#), 14
- [record-type-sealed?](#), 14
- [record-type-uid](#), 14
- [record?](#), 14
- [remainder](#), 17
- [remove](#), 13
- [remp](#), 13
- [remq](#), 13
- [remv](#), 13
- [reverse](#), 13
- [rnrs/arithmetic/bitwise-6](#), 15
- [rnrs/arithmetic/fixnums-6](#), 15
- [rnrs/arithmetic/flonums-6](#), 15
- [rnrs/base-6](#), 13
- [rnrs/bytevectors-6](#), 13
- [rnrs/conditions-6](#), 14
- [rnrs/control-6](#), 13
- [rnrs/enums-6](#), 16
- [rnrs/eval-6](#), 16
- [rnrs/exceptions-6](#), 14
- [rnrs/files-6](#), 15
- [rnrs/hashtables-6](#), 16
- [rnrs/io/ports-6](#), 14
- [rnrs/io/simple-6](#), 15
- [rnrs/lists-6](#), 13
- [rnrs/mutable-pairs-6](#), 16
- [rnrs/mutable-strings-6](#), 16
- [rnrs/programs-6](#), 15
- [rnrs/r5rs-6](#), 17
- [rnrs/records/inspection-6](#), 14
- [rnrs/records/procedural-6](#), 14
- [rnrs/records/syntactic-6](#), 14
- [rnrs/sorting-6](#), 13
- [rnrs/syntax-case-6](#), 16
- [rnrs/unicode-6](#), 13
- [round](#), 13
- [Running Top-Level Programs](#), 5
- [scheme-report-environment](#), 17
- [sealed](#), 14
- [serious-condition?](#), 14
- [set!](#), 13
- [set-car!](#), 16
- [set-cdr!](#), 16
- [set-port-position!](#), 14
- [simple-conditions](#), 14
- [sin](#), 13
- [sint-list->bytevector](#), 13
- [sqrt](#), 13

standard-error-port, 14  
 standard-input-port, 14  
 standard-output-port, 14  
 string, 13  
 string->bytevector, 14  
 string->list, 13  
 string->number, 13  
 string->symbol, 13  
 string->utf16, 13  
 string->utf32, 13  
 string->utf8, 13  
 string-append, 13  
 string-ci-hash, 16  
 string-ci<=?, 13  
 string-ci<?, 13  
 string-ci=?, 13  
 string-ci>=?, 13  
 string-ci>?, 13  
 string-copy, 13  
 string-downcase, 13  
 string-fill!, 16  
 string-foldcase, 13  
 string-for-each, 13  
 string-hash, 16  
 string-length, 13  
 string-normalize-nfc, 13  
 string-normalize-nfd, 13  
 string-normalize-nfkc, 13  
 string-normalize-nfkd, 13  
 string-ref, 13  
 string-set!, 16  
 string-titlecase, 13  
 string-upcase, 13  
 string<=?, 13  
 string<?, 13  
 string=?, 13  
 string>=?, 13  
 string>?, 13  
 string?, 13  
 substring, 13  
 symbol->string, 13  
 symbol-hash, 16  
 symbol=?, 13  
 symbol?, 13  
 syntax, 16  
 syntax->datum, 16  
 syntax-case, 16  
 syntax-rules, 13  
 syntax-violation, 16  
 syntax-violation-form, 14  
 syntax-violation-subform, 14  
 syntax-violation?, 14  
 tan, 13  
 textual-port?, 14  
 The Implementation of R<sup>6</sup>RS, 8  
 transcoded-port, 14  
 transcoder-codec, 14  
 transcoder-eol-style, 14  
 transcoder-error-handling-mode, 14  
 truncate, 13  
 u8-list->bytevector, 13  
 uint-list->bytevector, 13  
 undefined-violation?, 14  
 unless, 13  
 unquote, 13  
 unquote-splicing, 13  
 unsyntax, 16  
 unsyntax-splicing, 16  
 Using R<sup>6</sup>RS, 8  
 Using R<sup>6</sup>RS with DrRacket, 4  
 utf-16-codec, 14  
 utf-8-codec, 14  
 utf16->string, 13  
 utf32->string, 13  
 utf8->string, 13  
 values, 13  
 vector, 13  
 vector->list, 13  
 vector-fill!, 13  
 vector-for-each, 13  
 vector-length, 13  
 vector-map, 13  
 vector-ref, 13  
 vector-set!, 13

[vector-sort](#), 13  
[vector-sort!](#), 13  
[vector?](#), 13  
[violation?](#), 14  
[warning?](#), 14  
when, 13  
[who-condition?](#), 14  
[with-exception-handler](#), 14  
[with-input-from-file](#), 15  
[with-output-to-file](#), 15  
with-syntax, 16  
write, 15  
[write-char](#), 15  
[zero?](#), 13