

R6RS: Scheme

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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 Racket *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 Racket. The only difference is that an *R⁶RS* 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

1	Using R⁶RS with DrRacket	4
2	Running Top-Level Programs	5
3	Installing Libraries	6
4	R⁶RS Module Language	8
4.1	Using R ⁶ RS	8
4.2	The Implementation of R ⁶ RS	8
5	Libraries and Collections	9
6	Language Interoperability	10
7	R⁶RS Conformance	11
8	R⁶RS Libraries	13
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
	Index	18
	Index	18

1 Using R⁶RS with DrRacket

To run an R⁶RS 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 R⁶RS 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 R⁶RS 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 R⁶RS 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 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.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 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 §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 R⁶RS 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 R⁶RS syntax.

4.1 Using R⁶RS

See §1 “Using R⁶RS with DrRacket”, §2 “Running Top-Level Programs”, and §3 “Installing Libraries” for more information on writing and running R⁶RS programs with Racket.

4.2 The Implementation of R⁶RS

The R⁶RS 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 R⁶RS; see the links in §4.1 “Using R⁶RS”, instead. The details may be relevant to programmers who are developing new tools or deriving variants of R⁶RS 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 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.

5 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 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 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"`, `".sls"`, and `".rkt"`. 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 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 R⁶RS 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 R⁶RS.

Beware that a *pair* in R⁶RS corresponds to a *mutable pair* in `racket/base`. Otherwise, R⁶RS 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 R⁶RS libraries, and all R⁶RS ports can be used as ports in `racket/base` programs, but only textual ports created via R⁶RS libraries can be used by other R⁶RS operations that expect textual ports.

7 R⁶RS Conformance

Racket'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 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 R⁵RS bindings instead of R⁶RS 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 R⁶RS 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 “R⁶RS 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 “R⁶RS 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
- [R⁶RS Conformance](#), 11
- [R⁶RS Libraries](#), 13
- [R⁶RS 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 R⁶RS](#), 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 R⁶RS](#), 8
[Using R⁶RS 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