

# Unstable

Version 5.1.1

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`(require unstable)`

This manual documents some of the libraries available in the `unstable` collection.

The name `unstable` is intended as a warning that the **interfaces** in particular are unstable. Developers of planet packages and external projects should avoid using modules in the unstable collection. Contracts may change, names may change or disappear, even entire modules may move or disappear without warning to the outside world.

Developers of unstable libraries must follow the guidelines in §1 “Guidelines for developing `unstable` libraries”.

# 1 Guidelines for developing `unstable` libraries

Any collection developer may add modules to the `unstable` collection.

Every module needs an owner to be responsible for it.

- If you add a module, you are its owner. Add a comment with your name at the top of the module.
- If you add code to someone else's module, tag your additions with your name. The module's owner may ask you to move your code to a separate module if they don't wish to accept responsibility for it.

When changing a library, check all uses of the library in the collections tree and update them if necessary. Notify users of major changes.

Place new modules according to the following rules. (These rules are necessary for maintaining PLT's separate text, gui, and dracket distributions.)

- Non-GUI modules go under `unstable` (or subcollections thereof). Put the documentation in `unstable/scribblings` and include with `include-section` from `unstable/scribblings/unstable.scrbl`.
- GUI modules go under `unstable/gui`. Put the documentation in `unstable/scribblings/gui` and include them with `include-section` from `unstable/scribblings/gui.scrbl`.
- Do not add modules depending on DrRacket to the `unstable` collection.
- Put tests in `tests/unstable`.

Keep documentation and tests up to date.

## 2 Bytes

(require unstable/bytes)

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(bytes-ci=? b1 b2) → boolean?  
  b1 : bytes?  
  b2 : bytes?
```

Compares two bytes case insensitively.

---

```
(read/bytes b) → serializable?  
  b : bytes?
```

`reads` a value from `b` and returns it.

---

```
(write/bytes v) → bytes?  
  v : serializable?
```

`writes` `v` to a bytes and returns it.

### 3 Contracts

`(require unstable/contract)`

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(non-empty-string? x) → boolean?  
  x : any/c  
(non-empty-list? x) → boolean?  
  x : any/c  
(non-empty-bytes? x) → boolean?  
  x : any/c  
(non-empty-vector? x) → boolean?  
  x : any/c
```

Returns `#t` if `x` is of the appropriate data type (string, list, bytes, or vector, respectively) and is not empty; returns `#f` otherwise.

---

```
(singleton-list? x) → boolean?  
  x : any/c
```

Returns `#t` if `x` is a list of one element; returns `#f` otherwise.

---

```
port-number? : contract?
```

Equivalent to `(between/c 1 65535)`.

---

```
tcp-listen-port? : contract?
```

Equivalent to `(between/c 0 65535)`.

---

```
path-element? : contract?
```

Equivalent to `(or/c path-string? (symbols 'up 'same))`.

---

```
(if/c predicate then-contract else-contract) → contract?  
  predicate : (-> any/c any/c)  
  then-contract : contract?  
  else-contract : contract?
```

Produces a contract that, when applied to a value, first tests the value with `predicate`; if

The subsequent bindings were added by Ryan Culpepper.

*predicate* returns true, the *then-contract* is applied; otherwise, the *else-contract* is applied. The resulting contract is a flat contract if both *then-contract* and *else-contract* are flat contracts.

For example, the following contract enforces that if a value is a procedure, it is a thunk; otherwise it can be any (non-procedure) value:

```
(if/c procedure? (-> any) any/c)
```

Note that the following contract is **not** equivalent:

```
(or/c (-> any) any/c) ; wrong!
```

The last contract is the same as *any/c* because *or/c* tries flat contracts before higher-order contracts.

---

```
failure-result/c : contract?
```

A contract that describes the failure result arguments of procedures such as *hash-ref*.

Equivalent to `(if/c procedure? (-> any) any/c)`.

---

```
(rename-contract contract name) → contract?  
  contract : contract?  
  name : any/c
```

Produces a contract that acts like *contract* but with the name *name*.

The resulting contract is a flat contract if *contract* is a flat contract.

The subsequent bindings were added by Carl Eastlund <cce@racket-lang.org>.

### 3.1 Flat Contracts

---

```
nat/c : flat-contract?
```

This contract recognizes natural numbers that satisfy *exact-nonnegative-integer?*.

---

```
pos/c : flat-contract?
```

This contract recognizes positive integers that satisfy *exact-positive-integer?*.

---

`truth/c : flat-contract?`

This contract recognizes Scheme truth values, i.e., any value, but with a more informative name and description. Use it in negative positions for arguments that accept arbitrary truth values that may not be booleans.

## 3.2 Syntax Object Contracts

---

`(syntax-datum/c datum/c) → flat-contract?`  
`datum/c : any/c`

Recognizes syntax objects `stx` such that `(syntax->datum stx)` satisfies `datum/c`.

---

`(syntax-listof/c elem/c) → flat-contract?`  
`elem/c : any/c`

Recognizes syntax objects `stx` such that `(syntax->list stx)` satisfies `(listof elem/c)`.

---

`(syntax-list/c elem/c ...) → flat-contract?`  
`elem/c : any/c`

Recognizes syntax objects `stx` such that `(syntax->list stx)` satisfies `(list/c elem/c ...)`.

## 3.3 Higher-Order Contracts

---

`thunk/c : contract?`  
`unary/c : contract?`  
`binary/c : contract?`

These contracts recognize functions that accept 0, 1, or 2 arguments, respectively, and produce a single result.

---

`predicate/c : contract?`  
`predicate-like/c : contract?`

These contracts recognize predicates: functions of a single argument that produce a boolean result.

The first constrains its output to satisfy `boolean?`. Use `predicate/c` in positive position for predicates that guarantee a result of `#t` or `#f`.

The second constrains its output to satisfy `truth/c`. Use `predicate-like/c` in negative position for predicates passed as arguments that may return arbitrary values as truth values.

---

```
comparison/c : contract?  
comparison-like/c : contract?
```

These contracts recognize comparisons: functions of two arguments that produce a boolean result.

The first constrains its output to satisfy `boolean?`. Use `comparison/c` in positive position for comparisons that guarantee a result of `#t` or `#f`.

The second constrains its output to satisfy `truth/c`. Use `comparison-like/c` in negative position for comparisons passed as arguments that may return arbitrary values as truth values.

---

```
(sequence/c elem/c ...) → contract?  
  elem/c : contract?
```

Wraps a sequence, obligating it to produce as many values as there are `elem/c` contracts, and obligating each value to satisfy the corresponding `elem/c`. The result is not guaranteed to be the same kind of sequence as the original value; for instance, a wrapped list is not guaranteed to satisfy `list?`.

Examples:

```
> (define/contract predicates  
  (sequence/c (-> any/c boolean?))  
  (list integer? string->symbol))  
> (for ([P predicates])  
  (printf "~s\n" (P "cat")))
```

```
#f
```

```
self-contract violation: expected <boolean?>, given: 'cat  
  contract on predicates from (definition predicates),  
  blaming (definition predicates)  
  contract:  
    (sequence/c (-> any/c boolean?))  
  at: eval:3.0
```

---

```
(dict/c key/c value/c) → contract?  
  key/c : contract?  
  value/c : contract?
```

Wraps a dictionary, obligating its keys to satisfy `key/c` and their corresponding values to

satisfy `value/c`. The result is not guaranteed to be the same kind of dictionary as the original value; for instance, a wrapped hash table is not guaranteed to satisfy `hash?`.

Examples:

```
> (define/contract table
  (dict/c symbol? string?)
  (make-immutable-hash (list (cons 'A "A") (cons 'B 2) (cons 3 "C"))))
> (dict-ref table 'A)
"A"
> (dict-ref table 'B)
self-contract violation: expected <string?>, given: 2
contract on table from (definition table), blaming
(definition table)
contract: (dict/c symbol? string?)
at: eval:4.0
> (dict-ref table 3)
contract violation: expected <symbol?>, given: 3
contract on table from top-level, blaming (definition
table)
contract: (dict/c symbol? string?)
at: eval:4.0
```

*Warning:* Bear in mind that key and value contracts are re-wrapped on every dictionary operation, and dictionaries wrapped in `dict/c` multiple times will perform the checks as many times for each operation. Especially for immutable dictionaries (which may be passed through a constructor that involves `dict/c` on each update), contract-wrapped dictionaries may be much less efficient than the original dictionaries.

## 4 Contracts for macro subexpressions

This library provides a procedure `wrap-expr/c` for applying contracts to macro subexpressions.

```
(require unstable/wrapc)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(wrap-expr/c contract-expr
  expr
  [#:positive pos-blame
   #:negative neg-blame
   #:name expr-name
   #:macro macro-name
   #:context context]) → syntax?
contract-expr : syntax?
expr : syntax?
pos-blame : (or/c syntax? string? module-path-index?
             'from-macro 'use-site 'unknown)
           = 'use-site
neg-blame : (or/c syntax? string? module-path-index?
             'from-macro 'use-site 'unknown)
           = 'from-macro
expr-name : (or/c identifier? symbol? string? #f) = #f
macro-name : (or/c identifier? symbol? string? #f) = #f
context : (or/c syntax? #f) = (current-syntax-context)
```

Returns a syntax object representing an expression that applies the contract represented by `contract-expr` to the value produced by `expr`.

The contract's positive blame represents the obligations of the expression being wrapped. The negative blame represents the obligations of the macro imposing the contract—the ultimate caller of `wrap-expr/c`. By default, the positive blame is taken as the module currently being expanded, and the negative blame is inferred from the definition site of the macro (itself inferred from the `context` argument). But both blame locations can be overridden.

Positive and negative blame locations are determined from `pos-blame` and `neg-blame`, respectively, as follows:

- If the argument is a string, it is used directly as the blame label.
- If the argument is syntax, its source location is used to produce the blame label.
- If the argument is a module path index, its resolved module path is used.

- If the argument is `'from-macro`, the macro is inferred from either the `macro-name` argument (if `macro-name` is an identifier) or the `context` argument, and the module where it is *defined* is used as the negative blame location. If neither an identifier `macro-name` nor a `context` argument is given, the location is `"unknown"`.
- If the argument is `'use-site`, the module being expanded is used.
- If the argument is `'unknown`, the blame label is `"unknown"`.

The `macro-name` argument is used to determine the macro's binding, if it is an identifier. If `expr-name` is given, `macro-name` is also included in the contract error message. If `macro-name` is omitted or `#f`, but `context` is a syntax object, then `macro-name` is determined from `context`.

If `expr-name` is not `#f`, it is used in the contract's error message to describe the expression the contract is applied to.

The `context` argument is used, when necessary, to infer the macro name for the negative blame party and the contract error message. The `context` should be either an identifier or a syntax pair with an identifier in operator position; in either case, that identifier is taken as the macro ultimately requesting the contract wrapping.

Examples:

```
> (define-syntax (myparameterize1 stx)
  (syntax-case stx ()
    [(_ ((p v)) body)
     (with-syntax ([cp (wrap-expr/c
                        #'parameter? #'p
                        #:name "the parameter argument"
                        #:context stx)])
       #'(parameterize ((cp v)) body)))]))
> (myparameterize1 ((current-input-port
                    (open-input-string "(1 2 3)")))
  (read))
'(1 2 3)
> (myparameterize1 (('whoops 'something))
  'whatever)
self-contract violation: expected <parameter?>, given:
'whoops
contract on
  the parameter argument of myparameterize1
from top-level, blaming top-level
contract: parameter?
at: eval:4.0
> (module mod racket
  (require (for-syntax unstable/wrapc)))
```

```

(define-syntax (app stx)
  (syntax-case stx ()
    [(app f arg)
     (with-syntax ([cf (wrap-expr/c
                        #'(-> number? number?)
                        #'f
                        #:name "the function argument"
                        #:context stx)])
       #'(cf arg))]))
  (provide app))
> (require 'mod)
> (app add1 5)
6
> (app add1 'apple)
contract violation: expected <number?>, given: 'apple
contract on the function argument of app from top-level,
blaming (quote mod)
contract: (-> number? number?)
at: eval:8.0
> (app (lambda (x) 'pear) 5)
self-contract violation: expected <number?>, given: 'pear
contract on the function argument of app from top-level,
blaming top-level
contract: (-> number? number?)
at: eval:9.0

```

## 5 Contracts for struct type properties

```
(require unstable/prop-contract)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(struct-type-property/c value-contract) → contract?  
value-contract : contract?
```

Produces a contract for struct type properties. When the contract is applied to a struct type property, it produces a wrapped struct type property. When the wrapped struct type property is used to create a new struct type (via `struct`, `make-struct-type`, etc), it applies `value-contract` to the value associated with the property.

The contract has no effect on the struct type property accessor.

Examples:

```
> (define-values (prop prop? prop-ref)  
  (make-struct-type-property 'prop))  
> (define/contract wrapped  
  (struct-type-property/c (-> any/c (-> number? number?)))  
  prop)  
> (struct s (f)  
  #:property wrapped (lambda (s) (s-f s)))  
> (define (get-f s) ((prop-ref s) s))  
> (define s1 (s add1))  
> ((get-f s1) 5)  
6  
> ((get-f s1) 'apple)  
self-contract violation: expected <number?>, given: 'apple  
contract on wrapped from (definition wrapped), blaming  
(definition wrapped)  
contract:  
  (struct-type-property/c  
    (-> any/c (-> number? number?)))  
at: eval:3.0  
> (define s2 (s (lambda (n) (if (zero? n) 'zero 'nonzero))))  
> ((get-f s2) 5)  
contract violation: expected <number?>, given: 'nonzero  
contract on wrapped from (definition wrapped), blaming  
top-level  
contract:  
  (struct-type-property/c  
    (-> any/c (-> number? number?)))
```

```
at: eval:3.0
> ((get-f s2) 'apple)
self-contract violation: expected <number?>, given: 'apple
contract on wrapped from (definition wrapped), blaming
(definition wrapped)
contract:
  (struct-type-property/c
    (-> any/c (-> number? number?)))
at: eval:3.0
```

## 6 Debugging

```
(require unstable/debug)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This module provides macros and functions for printing out debugging information.

---

```
(debug options ... expr)
```

```
options = #:name name-expr  
          | #:source srcloc-expr
```

Writes debugging information about the evaluation of `expr` to the current error port. The name and source location of the expression may be overridden by keyword options; their defaults are the syntactic form of the expression and its syntactic source location, respectively.

Examples:

```
> (debug 0)  
>> eval:2.0: 0  
    result: 0  
<< eval:2.0: 0  
0  
> (debug #:name "one, two, three" (values 1 2 3))  
>> eval:3.0: "one, two, three"  
    results: (values 1 2 3)  
<< eval:3.0: "one, two, three"  
1  
2  
3  
> (debug #:source (make-srcloc 'here 1 2 3 4)  
        (error 'function "something went wrong"))  
>> here:1.2: (error 'function "something went wrong")  
    raised exception: function: something went wrong  
<< here:1.2: (error 'function "something went wrong")  
function: something went wrong
```

---

```
(dprintf fmt arg ...) → void?  
  fmt : string?  
  arg : any/c
```

Constructs a message in the same manner as `format` and writes it to (`current-error-port`), with indentation reflecting the number of nested debug forms.

Examples:

```
> (dprintf "level: ~a" 0)
level: 0
> (debug (dprintf "level: ~a" 1))
>> eval:3.0: (dprintf "level: ~a" 1)
level: 1
result: #<void>
<< eval:3.0: (dprintf "level: ~a" 1)
> (debug (debug (dprintf "level: ~a" 2)))
>> eval:4.0: (debug (dprintf "level: ~a" 2))
>> eval:4.0: (dprintf "level: ~a" 2)
level: 2
result: #<void>
<< eval:4.0: (dprintf "level: ~a" 2)
result: #<void>
<< eval:4.0: (debug (dprintf "level: ~a" 2))
```

---

(debug *function-expr* *argument* ...)

*argument* = *argument-expr*  
          | *argument-keyword* *argument-expr*

Logs debugging information for (*%app* *function-expr* *argument* ...), including the evaluation and results of the function and each argument.

Example:

```
> (debugf + 1 2 3)
>> eval:2.0: debugf
>> eval:2.0: +
result: #<procedure:+>
<< eval:2.0: +
>> eval:2.0: 1
result: 1
<< eval:2.0: 1
>> eval:2.0: 2
result: 2
<< eval:2.0: 2
>> eval:2.0: 3
result: 3
<< eval:2.0: 3
result: 6
<< eval:2.0: debugf
```

6

---

```
(begin/debug expr ...)  
(define/debug id expr)  
(define/debug (head args) body ...+)  
(define/private/debug id expr)  
(define/private/debug (head args) body ...+)  
(define/public/debug id expr)  
(define/public/debug (head args) body ...+)  
(define/override/debug id expr)  
(define/override/debug (head args) body ...+)  
(define/augment/debug id expr)  
(define/augment/debug (head args) body ...+)  
(let/debug (lhs-id rhs-expr] ...) body ...+)  
(let/debug loop-id (lhs-id rhs-expr] ...) body ...+)  
(let*/debug (lhs-id rhs-expr] ...) body ...+)  
(letrec/debug (lhs-id rhs-expr] ...) body ...+)  
(let-values/debug ([(lhs-id ...) rhs-expr]] ...) body ...+)  
(let*-values/debug ([(lhs-id ...) rhs-expr]] ...) body ...+)  
(letrec-values/debug ([(lhs-id ...) rhs-expr]] ...) body ...+)  
(with-syntax/debug ([pattern stx-expr]] ...) body ...+)  
(with-syntax*/debug ([pattern stx-expr]] ...) body ...+)  
(parameterize/debug ([param-expr value-expr]] ...) body ...+)
```

These macros add logging based on debug to the evaluation of expressions in begin, define, define/private, define/public, define/override, define/augment, let, let\*, letrec, let-values, let\*-values, letrec-values, with-syntax, *with-syntax\**, and parameterize.

## 7 Definitions

```
(require unstable/define)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

Provides macros for creating and manipulating definitions.

### 7.1 Deferred Evaluation in Modules

---

```
(at-end expr)
```

When used at the top level of a module, evaluates *expr* at the end of the module. This can be useful for calling functions before their definitions.

Examples:

```
> (module Failure scheme
  (f 5)
  (define (f x) x))
> (require 'Failure)
reference to an identifier before its definition: f in
module: 'Failure
> (module Success scheme
  (require unstable/define)
  (at-end (f 5))
  (define (f x) x))
> (require 'Success)
```

### 7.2 Conditional Binding

---

```
(define-if-unbound x e)
(define-if-unbound (f . args) body ...)
(define-values-if-unbound [x ...] e)
(define-syntax-if-unbound x e)
(define-syntax-if-unbound (f . args) body ...)
(define-syntaxes-if-unbound [x ...] e)
```

Define each *x* (or *f*) if no such binding exists, or do nothing if the name(s) is(are) already bound. The `define-values-if-unbound` and `define-syntaxes-if-unbound` forms raise a syntax error if some of the given names are bound and some are not.

These are useful for writing programs that are portable across versions of Racket with different bindings, to provide an implementation of a binding for versions that do not have it but use the built-in one in versions that do.

Examples:

```
> (define-if-unbound x 1)
> x
1
(define y 2)
> (define-if-unbound y 3)
> y
3
```

### 7.3 Renaming Definitions

---

```
(define-renamings [new old] ...)
```

Establishes a rename transformer for each *new* identifier, redirecting it to the corresponding *old* identifier.

Examples:

```
> (define-renamings [def define] [lam lambda])
> (def plus (lam (x y) (+ x y)))
> (plus 1 2)
3
```

### 7.4 Forward Declarations

---

```
(declare-names x ...)
```

Provides forward declarations of identifiers to be defined later. It is useful for macros which expand to mutually recursive definitions, including forward references, that may be used at the Racket top level.

### 7.5 Definition Shorthands

---

```
(define-with-parameter name parameter)
```

Defines the form *name* as a shorthand for setting the parameter *parameter*. Specifically, `(name value body ...)` is equivalent to `(parameterize ([parameter value] body ...))`.

Examples:

```
> (define-with-parameter with-input current-input-port)
> (with-input (open-input-string "Tom Dick Harry") (read))
'Tom
```

---

```
(define-single-definition define-one-name define-many-name)
```

Defines a marco *define-one-name* as a single identifier definition form with function shorthand like `define` and `define-syntax`, based on an existing macro *define-many-name* which works like `define-values` or `define-syntaxes`.

Examples:

```
> (define-single-definition define-like define-values)
> (define-like x 0)
> x
0
> (define-like (f a b c) (printf "~s, ~s\n" a b) c)
> (f 1 2 3)
1, 2
3
```

## 7.6 Macro Definitions

---

```
(define-syntax-block (macro-decl ...) body ...)
```

```
macro-decl = macro-id
             | [macro-id expander-id]
```

Defines a syntax transformer for each *macro-id* based on the local definition of each *expander-id* (defaulting to *macro-id/proc*) in *body* .... Especially useful for mutually recursive expander functions and phase 1 macro definitions. Subsumes the behavior of `define-syntax-set`.

Examples:

```
> (define-syntax-block
    ([implies expand-implies]
     nand)
```

```

(define-syntax-rule (==> pattern template)
  (syntax-rules () [pattern template]))

(define expand-implies (==> (_ a b) (or (not a) b)))
(define nand/proc (==> (_ a ...) (not (and a ...))))
> (implies #t (printf "True!\n"))
True!
> (implies #f (printf "False!\n"))
#t
> (nand #t #t (printf "All True!\n"))
All True!
#f
> (nand #t #f (printf "Some False!\n"))
#t
> (define-syntax-block (undefined-macro)
  (define irrelevant "Whoops!"))
eval:8:0: undefined-macro/proc: transformer must be defined
within define-syntax-block in: undefined-macro/proc

```

## 7.7 Effectful Transformation

---

```
(in-phase1 e)
```

Executes *e* during phase 1 (the syntax transformation phase) relative to its context, during pass 1 if it occurs in a head expansion position.

---

```
(in-phase1/pass2 e)
```

Executes *e* during phase 1 (the syntax transformation phase) relative to its context, during pass 2 (after head expansion).

## 8 Dictionaries

```
(require unstable/dict)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This module provides tools for manipulating dictionary values.

---

```
(dict-empty? d) → boolean?  
d : dict?
```

Reports whether *d* is empty (has no keys).

Examples:

```
> (dict-empty? '())  
#t  
> (dict-empty? '([1 . one] [2 . two]))  
#f
```

---

```
(dict-union d0  
  d ...  
  [#:combine combine  
   #:combine/key combine/key])  
→ (and/c dict? dict-can-functional-set?)  
d0 : (and/c dict? dict-can-functional-set?)  
d : dict?  
combine : (-> any/c any/c any/c)  
          = (lambda _ (error 'dict-union ...))  
combine/key : (-> any/c any/c any/c any/c)  
              = (lambda (k a b) (combine a b))
```

Computes the union of *d0* with each dictionary *d* by functional update, adding each element of each *d* to *d0* in turn. For each key *k* and value *v*, if a mapping from *k* to some value *v0* already exists, it is replaced with a mapping from *k* to *(combine/key k v0 v)*.

Examples:

```
> (dict-union '([1 . one]) '([2 . two]) '([3 . three]))  
'((1 . one) (2 . two) (3 . three))  
> (dict-union '([1 one uno] [2 two dos])  
  '([1 ein une] [2 zwei deux])  
  #:combine/key (lambda (k v1 v2) (append v1 v2)))  
'((1 one uno ein une) (2 two dos zwei deux))
```

---

```

(dict-union! d0
  d ...
  [#:combine combine
   #:combine/key combine/key]) → void?
d0 : (and/c dict? dict-mutable?)
d : dict?
combine : (-> any/c any/c any/c)
          = (lambda _ (error 'dict-union! ...))
combine/key : (-> any/c any/c any/c any/c)
              = (lambda (k a b) (combine a b))

```

Computes the union of *d0* with each dictionary *d* by mutable update, adding each element of each *d* to *d0* in turn. For each key *k* and value *v*, if a mapping from *k* to some value *v0* already exists, it is replaced with a mapping from *k* to (*combine/key* *k* *v0* *v*).

Examples:

```

(define d (make-hash))
> d
'#hash()
> (dict-union! d '([1 one uno] [2 two dos]))
> d
'#hash((1 . (one uno)) (2 . (two dos)))
> (dict-union! d
      '([1 ein une] [2 zwei deux])
      #:combine/key (lambda (k v1 v2) (append v1 v2)))
> d
'#hash((1 . (one uno ein une)) (2 . (two dos zwei deux)))

```

## 9 Directories

```
(require unstable/dirs)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This library defines utilities dealing with the directory paths used by the Racket distribution.

---

```
(path->directory-relative-string path
                                [#:default default
                               #:dirs dirs])
→ (or/c string? (one-of/c default))
path : path-string?
default : any/c = (if (path? path) (path->string path) path)
dirs : (listof (cons/c (-> path?) any/c))
      = library-relative-directories
```

Produces a string rendering of *path*, replacing distribution-specific paths (normally: collections, user-installed collections, or PLanet cache) with short abbreviations.

The set of paths and their abbreviations may be overridden by the `#:dirs` option, which accepts an association list. Its keys must be thunks which produce a path. Its values may be either `#f` for no abbreviation (the directory prefix is simply omitted) or any other value to be `displayed` in the output. For instance, `"document.txt"` relative to a path abbreviated `"path"` would be rendered as `"<path>/document.txt"`.

If the path is not relative to one of the given directories, the default return value is a string rendering of the unmodified path. This default may be overridden by providing `default`.

Examples:

```
> (path->directory-relative-string
   (build-path "source" "project.rkt"))
"source/project.rkt"
> (path->directory-relative-string
   (build-path (current-directory) "source" "project.rkt"))
"<collects>/unstable/source/project.rkt"
> (path->directory-relative-string
   (build-path "/" "source" "project.rkt"))
"/source/project.rkt"
> (path->directory-relative-string
   (build-path "/" "source" "project.rkt")
   #:default #f)
#f
> (path->directory-relative-string
```

```
(build-path "/" "source" "project.rkt")
#:dirs (list
        (cons (lambda () (build-path "/" "source"))
              'src)))
"<src>/project.rkt"
```

---

`library-relative-directories` : (listof (cons (-> path?) any/c))

Represents the default directory substitutions for `path->directory-relative-string`. By default, the collections directory is replaced by `collects`, the user-installed collections directory is replaced by `user`, and the PLaneT cache is replaced by `planet`.

---

`setup-relative-directories` : (listof (cons (-> path?) any/c))

Represents the directory substitutions used by `setup-plt`. The collections directory is omitted, the user-installed collections directory is replaced by `user`, and the PLaneT cache is replaced by `planet`.

## 10 Exceptions

(require unstable/exn)

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(network-error s fmt v ...) → void
  s : symbol?
  fmt : string?
  v : any/c
```

Like `error`, but throws a `exn:fail:network`.

---

```
(exn->string exn) → string?
  exn : (or/c exn? any/c)
```

Formats `exn` with (`error-display-handler`) as a string.

---

```
(try expr ...+)
```

Executes the first expression `expr` in the sequence, producing its result value(s) if it returns any. If it raises an exception instead, `try` continues with the next `expr`. Exceptions raised by intermediate expressions are reported to the current logger at the `'debug` level before continuing. Exceptions raised by the final expression are not caught by `try`.

Examples:

```
> (try (+ 1 2) (+ 3 4))
3
> (try (+ 'one 'two) (+ 3 4))
7
> (try (+ 'one 'two) (+ 'three 'four))
+: expects type <number> as 1st argument, given: 'three;
other arguments were: 'four
```

The subsequent bindings were added by Carl Eastlund <cce@racket-lang.org>.

## 11 Filesystem

`(require unstable/file)`

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

`(make-directory*/ignore-exists-exn pth) → void`  
`pth : path-string?`

Like `make-directory*`, except it ignores errors when the path already exists. Useful to deal with race conditions on processes that create directories.

## 12 Find

```
(require unstable/find)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(find pred
      x
      [#:stop-on-found? stop-on-found?
       #:stop stop
       #:get-children get-children]) → list?
pred : (-> any/c any/c)
x : any/c
stop-on-found? : any/c = #f
stop : (or/c #f (-> any/c any/c)) = #f
get-children : (or/c #f (-> any/c (or/c #f list?))) = #f
```

Returns a list of all values satisfying *pred* contained in *x* (possibly including *x* itself).

If *stop-on-found?* is true, the children of values satisfying *pred* are not examined. If *stop* is a procedure, then the children of values for which *stop* returns true are not examined (but the values themselves are; *stop* is applied after *pred*). Only the current branch of the search is stopped, not the whole search.

The search recurs through pairs, vectors, boxes, and the accessible fields of structures. If *get-children* is a procedure, it can override the default notion of a value's children by returning a list (if it returns false, the default notion of children is used).

No cycle detection is done, so *find* on a cyclic graph may diverge. To do cycle checking yourself, use *stop* and a mutable table.

Examples:

```
> (find symbol? '((all work) and (no play)))
'(all work and no play)
> (find list? '#((all work) and (no play)) #:stop-on-found? #t)
'((all work) (no play))
> (find negative? 100
   #:stop-on-found? #t
   #:get-children (lambda (n) (list (- n 12))))
'(-8)
> (find symbol? (shared ([x (cons 'a x)] x)
                        #:stop (let ([table (make-hasheq)]
                                     (lambda (x)
                                       (begin0 (hash-ref table x #f))
                                     )))))
```

```
(hash-set! table x #t))))))  
'(a)
```

---

```
(find-first pred  
  x  
  [#:stop stop  
   #:get-children get-children  
   #:default default]) → any/c  
pred : (-> any/c any/c)  
x : any/c  
stop : (or/c #f (-> any/c any/c)) = #f  
get-children : (or/c #f (-> any/c (or/c #f list?))) = #f  
default : any/c = (lambda () (error ....))
```

Like `find`, but only returns the first match. If no matches are found, `default` is applied as a thunk if it is a procedure or returned otherwise.

Examples:

```
> (find-first symbol? '((all work) and (no play)))  
'all  
> (find-first list? '#((all work) and (no play)))  
'(all work)  
> (find-first negative? 100  
   #:get-children (lambda (n) (list (- n 12))))  
-8  
> (find-first symbol? (shared ([x (cons 'a x)] x))  
'a
```

## 13 Finding Mutated Variables

```
(require unstable/mutated-vars)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(find-mutated-vars stx [dict]) → dict?  
  stx : syntax?  
  dict : dict? = (make-immutable-free-id-table)
```

Traverses *stx*, which should be `module-level-form` in the sense of the grammar for fully-expanded forms, and records all of the variables that are mutated. Each mutated variable is added to *dict*, mapped to `#t`. If *dict* is mutable, as determined by `dict-mutable?`, then the table is updated destructively. Otherwise, the table is updated functionally.

Examples:

```
> (define t (find-mutated-vars #'(begin (set! var 'foo) 'bar)))  
> (dict-ref t #'var #f)  
#t  
> (dict-ref t #'other-var #f)  
#f  
> (define tbl (make-free-id-table))  
> (find-mutated-vars #'(begin (set! var 'foo) 'bar) tbl)  
#<mutable-free-id-table>  
> (dict-ref tbl #'var #f)  
#t  
}
```

## 14 Functions

```
(require unstable/function)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This module provides tools for higher-order programming and creating functions.

### 14.1 Simple Functions

---

```
(identity x) → (one-of/c x)
x : any/c
```

Returns  $x$ .

---

```
(thunk body ...)
```

Creates a function that ignores its inputs and evaluates the given body. Useful for creating event handlers with no (or irrelevant) arguments.

Examples:

```
(define f (thunk (define x 1) (printf "~a\n" x)))
> (f)
1
> (f 'x)
1
> (f #:y 'z)
1
```

### 14.2 Higher Order Predicates

---

```
((negate f) x ...) → boolean?
f : (-> A ... boolean?)
x : A
```

Negates the results of  $f$ ; equivalent to `(not (f x ...))`.

This function is reprovided from `scheme/function`.

Examples:

```
(define f (negate exact-integer?))
> (f 1)
#f
> (f 'one)
#t
```

---

```
((conjoin f ...) x ...) → boolean?
 f : (-> A ... boolean?)
 x : A
```

Combines calls to each function with and. Equivalent to (and (f x ...) ...)

Examples:

```
(define f (conjoin exact? integer?))
> (f 1)
#t
> (f 1.0)
#f
> (f 1/2)
#f
> (f 0.5)
#f
```

---

```
((disjoin f ...) x ...) → boolean?
 f : (-> A ... boolean?)
 x : A
```

Combines calls to each function with or. Equivalent to (or (f x ...) ...)

Examples:

```
(define f (disjoin exact? integer?))
> (f 1)
#t
> (f 1.0)
#t
> (f 1/2)
#t
> (f 0.5)
#f
```

## 14.3 Currying and (Partial) Application

---

```
(call f x ...) → B
  f : (-> A ... B)
  x : A
```

Passes `x ...` to `f`. Keyword arguments are allowed. Equivalent to `(f x ...)`. Useful for application in higher-order contexts.

Examples:

```
> (map call
    (list + - * /)
    (list 1 2 3 4)
    (list 5 6 7 8))
'(6 -4 21 1/2)
(define count 0)
(define (inc)
  (set! count (+ count 1)))
(define (reset)
  (set! count 0))
(define (show)
  (printf "~a\n" count))
> (for-each call (list inc inc show reset show))
2
0
```

---

```
(papply f x ...) → (B ... -> C)
  f : (A ... B ... -> C)
  x : A
(papplyr f x ...) → (A ... -> C)
  f : (A ... B ... -> C)
  x : B
```

The `papply` and `papplyr` functions partially apply `f` to `x ...`, which may include keyword arguments. They obey the following equations:

```
((papply f x ...) y ...) = (f x ... y ...)
((papplyr f x ...) y ...) = (f y ... x ...)
```

Examples:

```
(define reciprocal (papply / 1))
> (reciprocal 3)
1/3
> (reciprocal 4)
1/4
```

```

(define halve (papplyr / 2))
> (halve 3)
3/2
> (halve 4)
2

```

---

```

(curryr n f x ...) → (A1 ... -> ... -> An ... -> B)
  n : exact-nonnegative-integer?
  f : (A0 ... A1 ... ... An ... -> B)
  x : A0
(currynr n f x ...) → (An ... -> ... -> A1 ... -> B)
  n : exact-nonnegative-integer?
  f : (A1 ... ... An ... An+1 ... -> B)
  x : An+1

```

*Note:* The ... above denotes a loosely associating ellipsis.

The `curryr` and `currynr` functions construct a curried version of `f`, specialized at `x ...`, that produces a result after `n` further applications. Arguments at any stage of application may include keyword arguments, so long as no keyword is duplicated. These curried functions obey the following equations:

```

(curryr 0 f x ...) = (f x ...)
((curryr (+ n 1) f x ...) y ...) = (curryr n f x ... y ...)

(currynr 0 f x ...) = (f x ...)
((currynr (+ n 1) f x ...) y ...) = (currynr n f y ... x ...)

```

The `call`, `papply`, and `papplyr` utilities are related to `curryr` and `currynr` in the following manner:

```

(call f x ...) = (curryr 0 f x ...) = (currynr 0 f x ...)
(papply f x ...) = (curryr 1 f x ...)
(papplyr f x ...) = (currynr 1 f x ...)

```

Examples:

```

(define reciprocal (curryr 1 / 1))
> (reciprocal 3)
1/3
> (reciprocal 4)
1/4
(define subtract-from (curryr 2 -))
(define from-10 (subtract-from 10))
> (from-10 5)
5

```

```

> (from-10 10)
0
(define from-0 (subtract-from 0))
> (from-0 5)
-5
> (from-0 10)
-10
(define halve (currynr 1 / 2))
> (halve 3)
3/2
> (halve 4)
2
(define subtract (currynr 2 -))
(define minus-10 (subtract 10))
> (minus-10 5)
-5
> (minus-10 10)
0
(define minus-0 (subtract 0))
> (minus-0 5)
5
> (minus-0 10)
10

```

## 14.4 Eta Expansion

---

```
(eta f)
```

Produces a function equivalent to *f*, except that *f* is evaluated every time it is called.

This is useful for function expressions that may be run, but not called, before *f* is defined. The eta expression will produce a function without evaluating *f*.

Examples:

```

(define f (eta g))
> f
#<procedure:eta>
(define g (lambda (x) (+ x 1)))
> (f 1)
2

```

---

```
(eta* f x ...)
```

Produces a function equivalent to  $f$ , with argument list  $x \dots$ . In simple cases, this is equivalent to `(lambda (x ...) (f x ...))`. Optional (positional or keyword) arguments are not allowed.

This macro behaves similarly to `eta`, but produces a function with statically known arity which may improve efficiency and error reporting.

Examples:

```
(define f (eta* g x))
> f
#<procedure:f>
> (procedure-arity f)
1
(define g (lambda (x) (+ x 1)))
> (f 1)
2
```

## 14.5 Parameter Arguments

---

`(lambda/parameter (param-arg ...) body ...)`

```
param-arg = param-arg-spec
           | keyword param-spec
```

```
param-arg-spec = id
                | [id default-expr]
                | [id #:param param-expr]
```

Constructs a function much like `lambda`, except that some optional arguments correspond to the value of a parameter. For each clause of the form `[id #:param param-expr]`, `param-expr` must evaluate to a value `param` satisfying `parameter?`. The default value of the argument `id` is `(param)`; `param` is bound to `id` via `parameterize` during the function call.

Examples:

```
(define p (open-output-string))
(define hello-world
  (lambda/parameter ([port #:param current-output-port])
    (display "Hello, World!")
    (newline port)))
> (hello-world p)
> (get-output-string p)
"Hello, World!\n"
```

## 15 Generics

```
(require unstable/generics)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(define-generics (name prop:name name?)  
  [method . kw-formals*]  
  ...)
```

```
kw-formals* = (arg* ...)  
              | (arg* ...+ . rest-id)  
              | rest-id
```

```
arg* = id  
      | [id]  
      | keyword id  
      | keyword [id]
```

```
name : identifier?  
prop:name : identifier?  
name? : identifier?  
method : identifier?
```

Defines *name* as a transformer binding for the static information about a new generic group.

Defines *prop:name* as a structure type property. Structure types implementing this generic group should have this property where the value is a vector with one element per *method* where each value is either *#f* or a procedure with the same arity as specified by *kw-formals\**. (*kw-formals\** is similar to the *kw-formals* used by *lambda*, except no expression is given for optional arguments.) The arity of each method is checked by the guard on the structure type property.

Defines *name?* as a predicate identifying instances of structure types that implement this generic group.

Defines each *method* as a generic procedure that calls the corresponding method on values where *name?* is true. Each method must have a required by-position argument that is *free-identifier=?* to *name*. This argument is used in the generic definition to locate the specialization.

---

```
(generics name
          [method . kw-formals*]
          ...)

name : identifier?
method : identifier?
```

Expands to

```
(define-generics (name prop:name name?)
                 [method . kw-formals*]
                 ...)
```

where *prop:name* and *name?* are created with the lexical context of *name*.

---

```
(define-methods name definition ...)
```

*name* : identifier?

*name* must be a transformer binding for the static information about a new generic group.

Expands to a value usable as the property value for the structure type property of the *name* generic group.

If the *definitions* define the methods of *name*, then they are used in the property value.

If any method of *name* is not defined, then `#f` is used to signify that the structure type does not implement the particular method.

Allows `define/generic` to appear in *definition* ....

---

```
(define/generic local-name method-name)

local-name : identifier?
method-name : identifier?
```

When used inside `define-methods`, binds *local-name* to the generic for *method-name*. This is useful for method specializations to use the generic methods on other values.

Syntactically an error when used outside `define-methods`.

Examples:

```
> (define-generics (printable prop:printable printable?))
```

```

(gen-print printable [port])
(gen-port-print port printable)
(gen-print* printable [port] #:width width #:height [height]))
> (define-struct num (v)
  #:property prop:printable
  (define-methods printable
    (define/generic super-print gen-print)
    (define (gen-print n [port (current-output-port)])
      (fprintf port "Num: ~a" (num-v n)))
    (define (gen-port-print port n)
      (super-print n port))
    (define (gen-print* n [port (current-output-port)]
              #:width w #:height [h 0])
      (fprintf port "Num (~ax~a): ~a" w h (num-v n))))))
> (define-struct bool (v)
  #:property prop:printable
  (define-methods printable
    (define/generic super-print gen-print)
    (define (gen-print b [port (current-output-port)])
      (fprintf port "Bool: ~a"
        (if (bool-v b) "Yes" "No"))))
    (define (gen-port-print port b)
      (super-print b port))
    (define (gen-print* b [port (current-output-port)]
              #:width w #:height [h 0])
      (fprintf port "Bool (~ax~a): ~a" w h
        (if (bool-v b) "Yes" "No")))))
> (define x (make-num 10))
> (gen-print x)
Num: 10
> (gen-port-print (current-output-port) x)
Num: 10
> (gen-print* x #:width 100 #:height 90)
Num (100x90): 10
> (define y (make-bool #t))
> (gen-print y)
Bool: Yes
> (gen-port-print (current-output-port) y)
Bool: Yes
> (gen-print* y #:width 100 #:height 90)
Bool (100x90): Yes

```

## 16 Hash Tables

```
(require unstable/hash)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This module provides tools for manipulating hash tables.

---

```
(hash-union h0
            h ...
            [#:combine combine
            #:combine/key combine/key])
→ (and/c hash? hash-can-functional-set?)
h0 : (and/c hash? hash-can-functional-set?)
h : hash?
combine : (-> any/c any/c any/c)
         = (lambda _ (error 'hash-union ...))
combine/key : (-> any/c any/c any/c any/c)
             = (lambda (k a b) (combine a b))
```

Computes the union of *h0* with each hash table *h* by functional update, adding each element of each *h* to *h0* in turn. For each key *k* and value *v*, if a mapping from *k* to some value *v0* already exists, it is replaced with a mapping from *k* to *(combine/key k v0 v)*.

Examples:

```
> (hash-union (make-immutable-hash '([1 . one])) (make-immutable-
hash '([2 . two])) (make-immutable-hash '([3 . three])))
'#hash((1 . one) (2 . two) (3 . three))
> (hash-union (make-immutable-hash '([1 one uno] [2 two dos]))
              (make-immutable-hash '([1 ein une] [2 zwei deux])))
#:combine/key (lambda (k v1 v2) (append v1 v2)))
'#hash((1 . (one uno ein une)) (2 . (two dos zwei deux)))
```

---

```
(hash-union! h0
            h ...
            [#:combine combine
            #:combine/key combine/key]) → void?
h0 : (and/c hash? hash-mutable?)
h : hash?
combine : (-> any/c any/c any/c)
         = (lambda _ (error 'hash-union ...))
combine/key : (-> any/c any/c any/c any/c)
             = (lambda (k a b) (combine a b))
```

Computes the union of *h0* with each hash table *h* by mutable update, adding each element of each *h* to *h0* in turn. For each key *k* and value *v*, if a mapping from *k* to some value *v0* already exists, it is replaced with a mapping from *k* to (*combine/key* *k* *v0* *v*).

Examples:

```
(define h (make-hash))
> h
'#hash()
> (hash-union! h (make-immutable-hash '([1 one uno] [2 two dos])))
> h
'#hash((1 . (one uno)) (2 . (two dos)))
> (hash-union! h
      (make-immutable-hash '([1 ein une] [2 zwei deux])))
      #:combine/key (lambda (k v1 v2) (append v1 v2)))
> h
'#hash((1 . (one uno ein une)) (2 . (two dos zwei deux)))
```

## 17 Interface-Oriented Programming for Classes

```
(require unstable/class-iop)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(define-interface name-id (super-ifc-id ...) (method-id ...))
```

Defines *name-id* as a static interface extending the interfaces named by the *super-ifc-ids* and containing the methods specified by the *method-ids*.

A static interface name is used by the checked method call variants (`send/i`, `send*/i`, and `send/apply/i`). When used as an expression, a static interface name evaluates to an interface value.

Examples:

```
> (define-interface stack%> () (empty? push pop))
> stack%>
#<|interface:stack%>|>
> (define stack%
  (class* object% (stack%>)
    (define items null)
    (define/public (empty?) (null? items))
    (define/public (push x) (set! items (cons x items)))
    (define/public (pop) (begin (car items) (set! items (cdr items))))
    (super-new)))
```

---

```
(define-interface/dynamic name-id ifc-expr (method-id ...))
```

Defines *name-id* as a static interface with dynamic counterpart *ifc-expr*, which must evaluate to an interface value. The static interface contains the methods named by the *method-ids*. A run-time error is raised if any *method-id* is not a member of the dynamic interface *ifc-expr*.

Use `define-interface/dynamic` to wrap interfaces from other sources.

Examples:

```
> (define-interface/dynamic object%> (class->interface object%) ())
> object%>
#<interface:object%>
```

---

```
(send/i obj-exp static-ifc-id method-id arg-expr ...)
```

Checked variant of `send`.

The argument `static-ifc-id` must be defined as a static interface. The method `method-id` must be a member of the static interface `static-ifc-id`; otherwise a compile-time error is raised.

The value of `obj-expr` must be an instance of the interface `static-ifc-id`; otherwise, a run-time error is raised.

Examples:

```
> (define s (new stack%))
> (send/i s stack<%> push 1)
> (send/i s stack<%> popp)
eval:9:0: send/i: method not in static interface in: popp
> (send/i (new object%) stack<%> push 2)
send/i: interface check failed on: (object)
```

---

```
(send*/i obj-expr static-ifc-id (method-id arg-expr ...) ...)
```

Checked variant of `send*`.

Example:

```
> (send*/i s stack<%>
  (push 2)
  (pop))
```

---

```
(send/apply/i obj-expr static-ifc-id method-id arg-expr ... list-arg-expr)
```

Checked variant of `send/apply`.

Example:

```
> (send/apply/i s stack<%> push (list 5))
```

---

```
(define/i id static-ifc-id expr)
```

Checks that `expr` evaluates to an instance of `static-ifc-id` before binding it to `id`. If `id` is subsequently changed (with `set!`), the check is performed again.

No dynamic object check is performed when calling a method (using `send/i`, etc) on a name defined via `define/i`.

---

```
(init/i (id static-ifc-id maybe-default-expr) ...)
```

```
(init-field/i (id static-ifc-id maybe-default-expr) ...)  
(init-private/i (id static-ifc-id maybe-default-expr) ...)
```

```
maybe-default-expr = (  
    | default-expr
```

Checked versions of `init` and `init-field`. The value attached to each `id` is checked against the given interface.

No dynamic object check is performed when calling a method (using `send/i`, etc) on a name bound via one of these forms. Note that in the case of `init-field/i` this check omission is unsound in the presence of mutation from outside the class. This should be fixed.

## 18 Lists

```
(require unstable/list)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(list-prefix? l r) → boolean?  
  l : list?  
  r : list?
```

True if *l* is a prefix of *r*.

Example:

```
> (list-prefix? '(1 2) '(1 2 3 4 5))  
#t
```

The subsequent bindings were added by Sam Tobin-Hochstadt.

---

```
(filter-multiple l f ...) → list? ...  
  l : list?  
  f : procedure?
```

Produces (values (filter *f* *l*) ...).

Example:

```
> (filter-multiple (list 1 2 3 4 5) even? odd?)  
'(2 4)  
'(1 3 5)
```

---

```
(extend l1 l2 v) → list?  
  l1 : list?  
  l2 : list?  
  v : any/c
```

Extends *l2* to be as long as *l1* by adding (- (length *l1*) (length *l2*)) copies of *v* to the end of *l2*.

Example:

```
> (extend '(1 2 3) '(a) 'b)  
'(a b b)
```

The subsequent bindings were added by Ryan Culpepper.

---

```
(check-duplicate lst  
  [#:key extract-key  
  #:same? same?]) → (or/c any/c #f)
```

```

lst : list?
extract-key : (-> any/c any/c) = (lambda (x) x)
same? : (or/c (any/c any/c . -> . any/c) = equal?
         dict?)

```

Returns the first duplicate item in *lst*. More precisely, it returns the first *x* such that there was a previous *y* where `(same? (extract-key x) (extract-key y))`.

The `same?` argument can either be an equivalence predicate such as `equal?` or `eqv?` or a dictionary. In the latter case, the elements of the list are mapped to `#t` in the dictionary until an element is discovered that is already mapped to a true value. The procedures `equal?`, `eqv?`, and `eq?` automatically use a dictionary for speed.

Examples:

```

> (check-duplicate '(1 2 3 4))
#f
> (check-duplicate '(1 2 3 2 1))
2
> (check-duplicate '((a 1) (b 2) (a 3)) #:key car)
'(a 3)
> (define id-t (make-free-id-table))
> (check-duplicate (syntax->list #'(a b c d a b))
                  #:same? id-t)

#<syntax:10:0 a>
> (dict-map id-t list)
'((#<syntax:10:0 d> #t) (#<syntax:10:0 a> #t) (#<syntax:10:0 b> #t)
  (#<syntax:10:0 c> #t))

```

The subsequent bindings were added by Carl Eastlund.

---

```

(map/values n f lst ...) → (listof B_1) ... (listof B_n)
n : natural-number/c
f : (-> A ... (values B_1 ... B_n))
lst : (listof A)

```

Produces lists of the respective values of *f* applied to the elements in *lst* ... sequentially.

Example:

```

> (map/values
   3
   (lambda (x)
     (values (+ x 1) x (- x 1))))
(list 1 2 3))
'(2 3 4)
'(1 2 3)
'(0 1 2)

```

---

```
(map2 f lst ...) → (listof B) (listof C)
  f : (-> A ... (values B C))
  lst : (listof A)
```

Produces a pair of lists of the respective values of *f* applied to the elements in *lst* ... sequentially.

Example:

```
> (map2 (lambda (x) (values (+ x 1) (- x 1))) (list 1 2 3))
'(2 3 4)
'(0 1 2)
```

The subsequent  
bindings were  
added by David Van  
Horn.

---

```
(remf pred lst) → list?
  pred : procedure?
  lst : list?
```

Returns a list that is like *lst*, omitting the first element of *lst* for which *pred* produces a true value.

Example:

```
> (remf negative? '(1 -2 3 4 -5))
'(1 3 4 -5)
```

## 19 Mark Parameters

(require unstable/markparam)

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This library provides a simplified version of parameters that are backed by continuation marks, rather than parameterizations. This means they are slightly slower, are not inherited by child threads, do not have initial values, and cannot be imperatively mutated.

---

(struct mark-parameter ())

The struct for mark parameters. It is guaranteed to be serializable and transparent. If used as a procedure, it calls `mark-parameter-first` on itself.

---

(mark-parameter-first mp [tag]) → any/c  
mp : mark-parameter?  
tag : continuation-prompt-tag?  
= default-continuation-prompt-tag

Returns the first value of *mp* up to *tag*.

---

(mark-parameter-all mp [tag]) → list?  
mp : mark-parameter?  
tag : continuation-prompt-tag?  
= default-continuation-prompt-tag

Returns the values of *mp* up to *tag*.

---

(mark-parameters-all mps none-v [tag]) → (listof vector?)  
mps : (listof mark-parameter?)  
none-v : [any/c #f]  
tag : continuation-prompt-tag?  
= default-continuation-prompt-tag

Returns the values of the *mps* up to *tag*. The length of each vector in the result list is the same as the length of *mps*, and a value in a particular vector position is the value for the corresponding mark parameter in *mps*. Values for multiple mark parameter appear in a single vector only when the mark parameters are for the same continuation frame in the current continuation. The *none-v* argument is used for vector elements to indicate the lack of a value.

---

```
(mark-parameterize ([mp expr] ...) body-expr ...)
```

Parameterizes (begin *body-expr* ...) by associating each *mp* with the evaluation of *expr* in the parameterization of the entire expression.

## 20 Match

```
(require unstable/match)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(== val comparator)  
(== val)
```

A match expander which checks if the matched value is the same as *val* when compared by *comparator*. If *comparator* is not provided, it defaults to `equal?`.

Examples:

```
> (match (list 1 2 3)  
      [(== (list 1 2 3)) 'yes]  
      [_ 'no])  
'yes  
> (match (list 1 2 3)  
      [(== (list 1 2 3) eq?) 'yes]  
      [_ 'no])  
'no  
> (match (list 1 2 3)  
      [(list 1 2 (== 3 =)) 'yes]  
      [_ 'no])  
'yes
```

---

```
(match? val-expr pat ...)
```

Returns `#t` if the result of *val-expr* matches any of *pat*, and returns `#f` otherwise.

Examples:

```
> (match? (list 1 2 3)  
         (list a b c)  
         (vector x y z))  
#t  
> (match? (vector 1 2 3)  
         (list a b c)  
         (vector x y z))  
#t  
> (match? (+ 1 2 3)  
         (list a b c)  
         (vector x y z))
```

The subsequent bindings were added by Carl Eastlund <cce@racket-lang.org>.

#f

---

```
(as ([lhs-id rhs-expr] ...) pat ...)
```

As a match expander, binds each *lhs-id* as a pattern variable with the result value of *rhs-expr*, and continues matching each subsequent *pat*.

Example:

```
> (match (list 1 2 3)
      [(as ([a 0]) (list b c d)) (list a b c d)])
'(0 1 2 3)
```

## 21 Net

```
(require unstable/net)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

### 21.1 URLs

```
(require unstable/net/url)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(url-replace-path proc u) → url?  
  proc : ((listof path/param?) . -> . (listof path/param?))  
  u : url?
```

Replaces the URL path of *u* with *proc* of the former path.

---

```
(url-path->string url-path) → string?  
  url-path : (listof path/param?)
```

Formats *url-path* as a string with "/" as a delimiter and no params.

## 22 Path

(require unstable/path)

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(explode-path* p) → (listof path-element?)  
  p : path-string?
```

Like `normalize-path`, but does not resolve symlinks.

---

```
(path-without-base base p) → (listof path-element?)  
  base : path-string?  
  p : path-string?
```

Returns, as a list, the portion of `p` after `base`, assuming `base` is a prefix of `p`.

---

```
(directory-part p) → path?  
  p : path-string?
```

Returns the directory part of `p`, returning `(current-directory)` if it is relative.

---

```
(build-path-unless-absolute base p) → path?  
  base : path-string?  
  p : path-string?
```

Prepends `base` to `p`, unless `p` is absolute.

---

```
(strip-prefix-ups p) → (listof path-element?)  
  p : (listof path-element?)
```

Removes all the prefix `".."`s from `p`.

## 23 Ports

```
(require unstable/port)
```

This module provides tools for port I/O.

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(read-all [reader port]) → list?  
  reader : (-> any/c) = read  
  port : input-port? = (current-input-port)
```

This function produces a list of all the values produced by calling `(reader)` while `current-input-port` is set to `port`, up until it produces `eof`.

Examples:

```
> (read-all read (open-input-string "1 2 3"))  
'(1 2 3)  
> (parameterize ([current-input-port (open-input-string "a b c")])  
  (read-all))  
'(a b c)
```

---

```
(read-all-syntax [reader port]) → (syntax/c list?)  
  reader : (-> (or/c syntax? eof-object?)) = read  
  port : input-port? = (current-input-port)
```

This function produces a syntax object containing a list of all the syntax objects produced by calling `(reader)` while `current-input-port` is set to `port`, up until it produces `eof`. The source location of the result spans the entire portion of the port that was read.

Examples:

```
(define port1 (open-input-string "1 2 3"))  
> (port-count-lines! port1)  
> (read-all-syntax read-syntax port1)  
#<syntax:1:0 (1 2 3)>  
(define port2 (open-input-string "a b c"))  
> (port-count-lines! port2)  
> (parameterize ([current-input-port port2])  
  (read-all-syntax))  
#<syntax:1:0 (a b c)>
```

---

```
(port->srcloc port [source span]) → srcloc?
```

```
port : port?  
source : any/c = (object-name port)  
span : exact-nonnegative-integer? = 0
```

Produces a `srcloc` structure representing the current position of a port, using the provided `source` and `span` values to fill in missing fields. This function relies on `port-next-location`, so line counting must be enabled for `port` to get meaningful results.

Examples:

```
(define port (open-input-string "1 2 3"))  
> (port-count-lines! port)  
> (read port)  
1  
> (port->srcloc port)  
(srcloc 'string 1 1 2 0)  
> (port->srcloc port "1 2 3" 1)  
(srcloc "1 2 3" 1 1 2 1)
```

## 24 Pretty-Printing

(require unstable/pretty)

This module provides tools for pretty-printing.

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(pretty-format/write x [columns]) → string?  
x : any/c  
columns : (or/c exact-nonnegative-integer? 'infinity)  
          = (pretty-print-columns)
```

This procedure behaves like `pretty-format`, but it formats values consistently with `write` instead of `print`.

Examples:

```
> (struct both [a b] #:transparent)  
> (pretty-format/write (list (both (list 'a 'b) (list "a" "b"))))  
"(\#(struct:both (a b) (\a\ \b\)))\n"
```

---

```
(pretty-format/display x [columns]) → string?  
x : any/c  
columns : (or/c exact-nonnegative-integer? 'infinity)  
          = (pretty-print-columns)
```

This procedure behaves like `pretty-format`, but it formats values consistently with `display` instead of `print`.

Examples:

```
> (struct both [a b] #:transparent)  
> (pretty-format/display (list (both (list 'a 'b) (list "a" "b"))))  
"(\#(struct:both (a b) (a b)))\n"
```

---

```
(pretty-format/print x [columns]) → string?  
x : any/c  
columns : (or/c exact-nonnegative-integer? 'infinity)  
          = (pretty-print-columns)
```

This procedure behaves the same as `pretty-format`, but is named more explicitly to describe how it formats values. It is included for symmetry with `pretty-format/write` and `pretty-format/display`.

Examples:

```
> (struct both [a b] #:transparent)
> (pretty-format/print (list (both (list 'a 'b) (list "a" "b"))))
"(list (both '(a b) '("\a" \b")))\n"
```

## 25 Requiring Modules

```
(require unstable/require)
```

This module provides tools for importing from modules.

---

```
(require/provide module-path ...)
```

Re-exports all bindings provided by each *module-path*. Equivalent to:

```
(require module-path ...)
(provide (all-from-out module-path ...))
```

---

```
(quote-require require-spec ...)
```

Produces the names exported by the *require-specs* as a list of symbols.

Example:

```
> (quote-require racket/bool racket/function)
'(false true symbol=? false? boolean=? negate curryr curry const)
```

## 26 Sequences

```
(require unstable/sequence)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(in-syntax stx) → sequence?  
stx : syntax?
```

Produces a sequence equivalent to `(syntax->list lst)`.

An `in-syntax` application can provide better performance for syntax iteration when it appears directly in a `for` clause.

Example:

```
> (for/list ([x (in-syntax #'(1 2 3))])  
  x)  
'(<#<syntax:2:0 1> #<syntax:2:0 2> #<syntax:2:0 3>)
```

---

```
(in-pairs seq) → sequence?  
seq : sequence?
```

Produces a sequence equivalent to `(in-parallel (sequence-lift car seq) (sequence-lift cdr seq))`.

---

```
(in-sequence-forever seq val) → sequence?  
seq : sequence?  
val : any/c
```

Produces a sequence whose values are the elements of `seq`, followed by `val` repeated.

---

```
(sequence-lift f seq) → sequence?  
f : procedure?  
seq : sequence?
```

Produces the sequence of `f` applied to each element of `seq`.

Example:

```
> (for/list ([x (sequence-lift add1 (in-range 10))])  
  x)  
'(1 2 3 4 5 6 7 8 9 10)
```

## 27 Strings

`(require unstable/string)`

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(lowercase-symbol! sb) → symbol?  
sb : (or/c string? bytes?)
```

Returns *sb* as a lowercase symbol.

---

```
(read/string s) → serializable?  
s : string?
```

`reads` a value from *s* and returns it.

---

```
(write/string v) → string?  
v : serializable?
```

`writes` *v* to a string and returns it.

## 28 Structs

```
(require unstable/struct)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(make struct-id expr ...)
```

Creates an instance of *struct-id*, which must be bound as a struct name. The number of *exprs* is statically checked against the number of fields associated with *struct-id*. If they are different, or if the number of fields is not known, an error is raised at compile time.

Examples:

```
> (define-struct triple (a b c))
> (make triple 3 4 5)
#<triple>
> (make triple 2 4)
eval:4:0: make: wrong number of arguments for struct triple
(expected 3, got 2) in: (make triple 2 4)
```

---

```
(struct->list v [#:on-opaque on-opaque]) → (or/c list? #f)
v : any/c
on-opaque : (or/c 'error 'return-false 'skip) = 'error
```

Returns a list containing the struct instance *v*'s fields. Unlike `struct->vector`, the struct name itself is not included.

If any fields of *v* are inaccessible via the current inspector the behavior of `struct->list` is determined by *on-opaque*. If *on-opaque* is `'error` (the default), an error is raised. If it is `'return-false`, `struct->list` returns `#f`. If it is `'skip`, the inaccessible fields are omitted from the list.

Examples:

```
> (define-struct open (u v) #:transparent)
> (struct->list (make-open 'a 'b))
'(a b)
> (struct->list #s(pre 1 2 3))
'(1 2 3)
> (define-struct (secret open) (x y))
> (struct->list (make-secret 0 1 17 22))
struct->list: expected argument of type <non-opaque
struct>; given (secret 0 1 ...)
> (struct->list (make-secret 0 1 17 22) #:on-opaque 'return-false)
```

```
#f
> (struct->list (make-secret 0 1 17 22) #:on-opaque 'skip)
'(0 1)
> (struct->list 'not-a-struct #:on-opaque 'return-false)
#f
> (struct->list 'not-a-struct #:on-opaque 'skip)
'()
```

## 29 Syntax

(require unstable/syntax)

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

This binding was added by Vincent St-Amour.

---

```
(format-unique-id lctx
  [#:source src
   #:props props
   #:cert cert]
  fmt
  v ...) → identifier?

lctx : (or/c syntax? #f)
src : (or/c syntax? #f) = #f
props : (or/c syntax? #f) = #f
cert : (or/c syntax? #f) = #f
fmt : string?
v : (or/c string? symbol? identifier? keyword? char? number?)
```

Like `format-id`, but returned identifiers are guaranteed to be unique.

The subsequent bindings were added by Sam Tobin-Hochstadt.

---

```
(syntax-map f stxl ...) → (listof A)
f : (-> syntax? A)
stxl : syntax?
```

Performs `(map f (syntax->list stxl) ...)`.

Example:

```
> (syntax-map syntax-e #'(a b c))
'(a b c)
```

The subsequent bindings were added by Carl Eastlund <cce@racket-lang.org>.

---

```
(syntax-list template ...)
```

This form constructs a list of syntax objects based on the given templates. It is equivalent to `(syntax->list #'(template ...))`.

Example:

```
> (with-syntax ([x ...] #'(1 2 3)]) (syntax-list x ...))
'(#<syntax:3:0 1> #<syntax:3:0 2> #<syntax:3:0 3>)
```

## 29.1 Syntax Object Source Locations

---

```
(syntax-source-directory stx) → (or/c path? #f)
  stx : syntax?
(syntax-source-file-name stx) → (or/c path? #f)
  stx : syntax?
```

These produce the directory and file name, respectively, of the path with which `stx` is associated, or `#f` if `stx` is not associated with a path.

Examples:

```
(define loc
  (list (build-path "/tmp" "dir" "somewhere.ss")
        #f #f #f #f))
(define stx1 (datum->syntax #f 'somewhere loc))
> (syntax-source-directory stx1)
#<path:/tmp/dir/>
> (syntax-source-file-name stx1)
#<path:somewhere.ss>
(define stx2 (datum->syntax #f 'nowhere #f))
> (syntax-source-directory stx2)
#f
> (syntax-source-file-name stx2)
#f
```

## 30 GUI libraries

### 30.1 DrRacket Language Levels

```
(require unstable/gui/language-level)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
language-level@ : unit?
```

This unit imports `drracket:tool^` and exports `language-level^`.

---

```
language-level^ : signature
```

---

```
(make-language-level name
                     path
                     mixin ...
                     [#:number number
                     #:hierarchy hierarchy
                     #:summary summary
                     #:url url
                     #:reader reader])
→ (is-a?/c drracket:language:language<%>)
  name : string?
  path : module-path?
  mixin : (-> class? class?)
  number : integer? = ...
  hierarchy : (listof (cons/c string? integer?)) = ...
  summary : string? = name
  url : (or/c string? #f) = #f
  reader : (->* [] [any/c input-port?] (or/c syntax? eof-object?))
          = read-syntax
```

Constructs a language level as an instance of `drracket:language:language<%>` with the given *name* based on the language defined by the module at *path*. Applies `(drracket:language:get-default-mixin)` and the given *mixins* to `simple-language-level%` to construct the class, and uses the optional keyword arguments to fill in the language's description and reader.

---

```
simple-language-level% : (and/c (implementation?/c drracket:language:language<%>)
                               (implementation?/c drracket:language:module-based-language<%>)
                               (implementation?/c drracket:language:simple-module-based-language<%>))
```

Equal to `(drracket:language:module-based-language->language-mixin (drracket:language:simple-module-based-language->module-based-language-mixin drracket:language:simple-module-based-language%))`.

---

```
(language-level-render-mixin to-sexp
                             show-void?)
→ (make-mixin-contract drracket:language:language<%>)
to-sexp : (-> any/c any/c)
show-void? : boolean?
```

Produces a mixin that overrides `render-value/format` to apply `to-sexp` to each value before printing it, and to skip `void?` values (pre-transformation) if `show-void?` is `#f`.

---

```
(language-level-capability-mixin dict)
→ (make-mixin-contract drracket:language:language<%>)
dict : dict?
```

Produces a mixin that augments `capability-value` to look up each key in `dict`, producing the corresponding value if the key is found and deferring to `inner` otherwise.

---

```
language-level-no-executable-mixin : (make-mixin-contract drracket:language:language<%>)

Overrides create-executable to print an error message in a dialog box.
```

---

```
language-level-eval-as-module-mixin : (make-mixin-contract drracket:language:language<%>
                                                           drracket:language:module-based-language<%>)
```

Overrides `front-end/complete-program` to wrap terms from the definition in a module based on the language level's definition module. This duplicates the behavior of the HtDP teaching languages, for instance.

---

```
language-level-macro-stepper-mixin : (make-mixin-contract drracket:language:language<%>)

This mixin enables the macro stepper for its language level.
```

---

```
language-level-check-expect-mixin : (make-mixin-contract drracket:language:language<%>)
```

This mixin overrides `on-execute` to set up the `check-expect` test engine to a language level similarly to the HtDP teaching languages.

---

```
(language-level-metadata-mixin reader-module
                               meta-lines
                               meta->settings
                               settings->meta)
→ (make-mixin-contract drracket:language:language<%>)
reader-module : module-path?
meta-lines : exact-nonnegative-integer?
meta->settings : (-> string? any/c any/c)
settings->meta : (-> symbol? any/c string?)
```

This mixin constructs a language level that stores metadata in saved files allowing Dracket to automatically switch back to this language level upon opening them. It overrides `get-reader-module`, `get-metadata`, `metadata->settings`, and `get-metadata-lines`.

The resulting language level uses the reader from `reader-module`, and is recognized in files that start with a reader directive for that module path within the first `meta-lines` lines. Metadata about the language's settings is marshalled between a string and a usable value (based on a default value) by `meta->settings`, and between a usable value for a current module (with a symbolic name) by `settings->meta`.

## 30.2 Notify-boxes

```
(require unstable/gui/notify)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
notify-box% : class?
superclass: object%
```

A notify-box contains a mutable cell. The notify-box notifies its listeners when the contents of the cell is changed.

Examples:

```
> (define nb (new notify-box% (value 'apple)))
> (send nb get)
'apple
> (send nb set 'orange)
> (send nb listen (lambda (v) (printf "New value: ~s\n" v)))
> (send nb set 'potato)
New value: potato
```

---

```
(new notify-box% [value value]) → (is-a?/c notify-box%)
  value : any/c
```

Creates a notify-box initially containing *value*.

---

```
(send a-notify-box get) → any/c
```

Gets the value currently stored in the notify-box.

---

```
(send a-notify-box set v) → void?
  v : any/c
```

Updates the value stored in the notify-box and notifies the listeners.

---

```
(send a-notify-box listen listener) → void?
  listener : (-> any/c any)
```

Adds a callback to be invoked on the new value when the notify-box's contents change.

---

```
(send a-notify-box remove-listener listener) → void?
  listener : (-> any/c any)
```

Removes a previously-added callback.

---

```
(send a-notify-box remove-all-listeners) → void?
```

Removes all previously registered callbacks.

---

```
(notify-box/pref proc
  [#:readonly? readonly?]) → (is-a?/c notify-box%)
  proc : (case-> (-> any/c) (-> any/c void?))
  readonly? : boolean? = #f
```

Creates a notify-box with an initial value of (*proc*). Unless *readonly?* is true, *proc* is invoked on the new value when the notify-box is updated.

Useful for tying a notify-box to a preference or parameter. Of course, changes made directly to the underlying parameter or state are not reflected in the notify-box.

Examples:

```
> (define animal (make-parameter 'ant))
> (define nb (notify-box/pref animal))
> (send nb listen (lambda (v) (printf "New value: ~s\n" v)))
> (send nb set 'bee)
```

```

New value: bee
> (animal 'cow)
> (send nb get)
'bee
> (send nb set 'deer)
New value: deer
> (animal)
'deer

```

---

```

(define-notify name value-expr)

  value-expr : (is-a?/c notify-box%)

```

Class-body form. Declares *name* as a field and *get-name*, *set-name*, and *listen-name* as methods that delegate to the `get`, `set`, and `listen` methods of *value*.

The *value-expr* argument must evaluate to a notify-box, not just the initial contents for a notify box.

Useful for aggregating many notify-boxes together into one “configuration” object.

Examples:

```

> (define config%
  (class object%
    (define-notify food (new notify-box% (value 'apple)))
    (define-notify animal (new notify-box% (value 'ant)))
    (super-new)))
> (define c (new config%))
> (send c listen-food
  (lambda (v) (when (eq? v 'honey) (send c set-
    animal 'bear))))
> (let ([food (get-field food c)])
  (send food set 'honey))
> (send c get-animal)
'bear

```

---

```

(menu-option/notify-box parent
  label
  notify-box)
→ (is-a?/c checkable-menu-item%)
parent : (or/c (is-a?/c menu%) (is-a?/c popup-menu%))
label : label-string?
notify-box : (is-a?/c notify-box%)

```

Creates a `checkable-menu-item%` tied to `notify-box`. The menu item is checked whenever `(send notify-box get)` is true. Clicking the menu item toggles the value of

`notify-box` and invokes its listeners.

---

```
(checkbox/notify-box parent
  label
  notify-box) → (is-a?/c checkbox%)
parent : (or/c (is-a?/c frame%) (is-a?/c dialog%)
  (is-a?/c panel%) (is-a?/c pane%))
label : label-string?
notify-box : (is-a?/c notify-box%)
```

Creates a `checkbox%` tied to `notify-box`. The check-box is checked whenever (`send notify-box get`) is true. Clicking the check box toggles the value of `notify-box` and invokes its listeners.

---

```
(choice/notify-box parent
  label
  choices
  notify-box) → (is-a?/c choice%)
parent : (or/c (is-a?/c frame%) (is-a?/c dialog%)
  (is-a?/c panel%) (is-a?/c pane%))
label : label-string?
choices : (listof label-string?)
notify-box : (is-a?/c notify-box%)
```

Creates a `choice%` tied to `notify-box`. The choice control has the value (`send notify-box get`) selected, and selecting a different choice updates `notify-box` and invokes its listeners.

If the value of `notify-box` is not in `choices`, either initially or upon an update, an error is raised.

---

```
(menu-group/notify-box parent
  labels
  notify-box)
→ (listof (is-a?/c checkable-menu-item%))
parent : (or/c (is-a?/c menu%) (is-a?/c popup-menu%))
labels : (listof label-string?)
notify-box : (is-a?/c notify-box%)
```

Returns a list of `checkable-menu-item%` controls tied to `notify-box`. A menu item is checked when its label is (`send notify-box get`). Clicking a menu item updates `notify-box` to its label and invokes `notify-box`'s listeners.

### 30.3 Preferences

```
(require unstable/gui/prefs)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

---

```
(pref:get/set pref) → (case-> (-> any/c) (-> any/c void?))  
  pref : symbol?
```

Returns a procedure that when applied to zero arguments retrieves the current value of the preference (`framework/preferences`) named `pref` and when applied to one argument updates the preference named `pref`.

### 30.4 Slideshow Presentations

```
(require unstable/gui/slideshow)
```

This library is *unstable*; compatibility will not be maintained. See *Unstable* for more information.

#### 30.4.1 Text Formatting

---

```
(with-size size expr)
```

Sets `current-font-size` to `size` while running `expr`.

---

```
(with-scale scale expr)
```

Multiplies `current-font-size` by `scale` while running `expr`.

---

```
(big text)  
(small text)
```

Scale `current-font-size` by  $3/2$  or  $2/3$ , respectively, while running `text`.

---

```
(with-font font expr)
```

Sets `current-main-font` to `font` while running `expr`.

---

`(with-style style expr)`

Adds *style* to `current-main-font` (via `cons`) while running *expr*.

---

`(bold text)`  
`(italic text)`  
`(subscript text)`  
`(superscript text)`  
`(caps text)`

Adds the attributes for bold, italic, superscript, subscript, or small caps text, respectively, to `current-main-font` while running *text*.

### 30.4.2 Pict Colors

---

`(color c p) → pict?`  
`c : color/c`  
`p : pict?`

Applies color *c* to picture *p*. Equivalent to `(colorize p c)`.

---

`(red pict) → pict?`  
`pict : pict?`  
`(orange pict) → pict?`  
`pict : pict?`  
`(yellow pict) → pict?`  
`pict : pict?`  
`(green pict) → pict?`  
`pict : pict?`  
`(blue pict) → pict?`  
`pict : pict?`  
`(purple pict) → pict?`  
`pict : pict?`  
`(black pict) → pict?`  
`pict : pict?`  
`(brown pict) → pict?`  
`pict : pict?`  
`(gray pict) → pict?`  
`pict : pict?`  
`(white pict) → pict?`  
`pict : pict?`

```
(cyan pict) → pict?  
  pict : pict?  
(magenta pict) → pict?  
  pict : pict?
```

These functions apply appropriate colors to picture *p*.

---

```
(light color) → color/c  
  color : color/c  
(dark color) → color/c  
  color : color/c
```

These functions produce lighter or darker versions of a color.

---

```
color/c : flat-contract?
```

This contract recognizes color strings, `color%` instances, and RGB color lists.

### 30.4.3 Pict Manipulation

---

```
(fill pict width height) → pict?  
  pict : pict?  
  width : (or/c real? #f)  
  height : (or/c real? #f)
```

Extends *pict*'s bounding box to a minimum *width* and/or *height*, placing the original picture in the middle of the space.

### Conditional Manipulations

These *pict* transformers all take boolean arguments that determine whether to transform the *pict* or leave it unchanged. These transformations can be useful for staged slides, as the resulting *pict* always has the same size and shape, and its contents always appear at the same position, but changing the boolean argument between slides can control when the transformation occurs.

---

```
(show pict [show?]) → pict?  
  pict : pict?  
  show? : truth/c = #t
```

```
(hide pict [hide?]) → pict?  
  pict : pict?  
  hide? : truth/c = #t
```

These functions conditionally show or hide an image, essentially choosing between *pict* and (*ghost pict*). The only difference between the two is the default behavior and the opposite meaning of the *show?* and *hide?* booleans. Both functions are provided for mnemonic purposes.

---

```
(strike pict [strike?]) → pict?  
  pict : pict?  
  strike? : truth/c = #t
```

Displays a strikethrough image by putting a line through the middle of *pict* if *strike?* is true; produces *pict* unchanged otherwise.

---

```
(shade pict [shade? #:ratio ratio]) → pict?  
  pict : pict?  
  shade? : truth/c = #t  
  ratio : (real-in 0 1) = 1/2
```

Shades *pict* to show with *ratio* of its normal opacity; if *ratio* is 1 or *shade?* is #f, shows *pict* unchanged.

### Conditional Combinations

These pict control flow operators decide which pict of several to use. All branches are evaluated; the resulting pict is a combination of the pict chosen by normal conditional flow with *ghost* applied to all the other pict. The result is a picture large enough to accommodate each alternative, but showing only the chosen one. This is useful for staged slides, as the pict chosen may change with each slide but its size and position will not.

---

```
(pict-if maybe-combine test-expr then-expr else-expr)  
  
maybe-combine =  
  | #:combine combine-expr
```

Chooses either *then-expr* or *else-expr* based on *test-expr*, similarly to *if*. Combines the chosen, visible image with the other, invisible image using *combine-expr*, defaulting to *pict-combine*.

---

```
(pict-cond maybe-combine [test-expr pict-expr] ...)
```

```
maybe-combine =  
  | #:combine combine-expr
```

Chooses a *pict-expr* based on the first successful *test-expr*, similarly to *cond*. Combines the chosen, visible image with the other, invisible images using *combine-expr*, defaulting to *pict-combine*.

---

```
(pict-case test-expr maybe-combine [literals pict-expr] ...)
```

```
maybe-combine =  
  | #:combine combine-expr
```

Chooses a *pict-expr* based on *test-expr* and each list of *literals*, similarly to *case*. Combines the chosen, visible image with the other, invisible images using *combine-expr*, defaulting to *pict-combine*.

---

```
(pict-match test-expr maybe-combine [pattern pict-expr] ...)
```

```
maybe-combine =  
  | #:combine combine-expr
```

Chooses a *pict-expr* based on *test-expr* and each *pattern*, similarly to *match*. Combines the chosen, visible image with the other, invisible images using *combine-expr*, defaulting to *pict-combine*.

---

*pict-combine*

This syntax parameter determines the default *pict* combining form used by the above macros. It defaults to [lbl-superimpose](#).

---

```
(with-pict-combine combine-id body ...)
```

Sets *pict-combine* to refer to *combine-id* within each of the *body* terms, which are spliced into the containing context.

#### 30.4.4 Staged Slides

---

```
(staged [name ...] body ...)
```

Executes the *body* terms once for each stage *name*. The terms may include expressions and mutually recursive definitions. Within the body, each *name* is bound to a number from 1 to

the number of stages in order. Furthermore, during execution `stage` is bound to the number of the current stage and `stage-name` is bound to a symbol representing the `name` of the current stage. By comparing `stage` to the numeric value of each `name`, or `stage-name` to quoted symbols of the form `'name`, the user may compute based on the progression of the stages.

---

```
stage
stage-name
```

These keywords are bound during the execution of `staged` and should not be used otherwise.

---

```
(slide/staged [name ...] arg ...)
```

Creates a staged slide. Equivalent to `(staged [name ...] (slide arg ...))`.

Within a staged slide, the boolean arguments to `hide`, `show`, `strike`, and `shade` can be used to determine in which stages to perform a transformation. The macros `pict-if`, `pict-cond`, `pict-case`, and `pict-match` may also be used to create images which change naturally between stages.

### 30.4.5 Tables

---

```
(tabular row
  ...
  [#:gap gap
   #:hgap hgap
   #:vgap vgap
   #:align align
   #:halign halign
   #:valign valign]) → pict?
row : (listof (or/c string? pict?))
gap : natural-number/c = gap-size
hgap : natural-number/c = gap
vgap : natural-number/c = gap
align : (->* [] [] #:rest (listof pict?) pict?)
       = lbl-superimpose
halign : (->* [] [] #:rest (listof pict?) pict?) = align
valign : (->* [] [] #:rest (listof pict?) pict?) = align
```

Constructs a table containing the given `rows`, all of which must be of the same length. Applies `t` to each string in a `row` to construct a `pict`. The `hgap`, `vgap`, `halign`, and `valign` are used to determine the horizontal and vertical gaps and alignments as in `table` (except that every row and column is uniform).

### 30.4.6 Multiple Columns

---

```
(two-columns one two)
```

Constructs a two-column pict using *one* and *two* as the two columns. Sets `current-para-width` appropriately in each column.

---

```
(mini-slide pict ...) → pict?  
  pict : pict?
```

Appends each *pict* vertically with space between them, similarly to the `slide` function.

---

```
(columns pict ...) → pict?  
  pict : pict?
```

Combines each *pict* horizontally, aligned at the top, with space in between.

---

```
(column width body ...)
```

Sets `current-para-width` to *width* during execution of the *body* expressions.

---

```
(column-size n [r]) → real?  
  n : exact-positive-integer?  
  r : real? = (/ n)
```

Computes the width of one column out of *n* that takes up a ratio of *r* of the available space (according to `current-para-width`).

The subsequent bindings were added by Vincent St-Amour.

---

```
(ellipse/border w  
  h  
  #:color color  
  #:border-color border-color  
  #:border-width border-width) → pict?  
  
w : real?  
h : real?  
color : color/c  
border-color : color/c  
border-width : real?
```

```

(circle/border diameter
  #:color color
  #:border-color border-color
  #:border-width border-width) → pict?
diameter : real?
color : color/c
border-color : color/c
border-width : real?
(rectangle/border w
  h
  #:color color
  #:border-color border-color
  #:border-width border-width) → pict?
w : real?
h : real?
color : color/c
border-color : color/c
border-width : real?
(rounded-rectangle/border w
  h
  #:color color
  #:border-color border-color
  #:border-width border-width) → pict?
w : real?
h : real?
color : color/c
border-color : color/c
border-width : real?

```

These functions create shapes with border of the given color and width.

The subsequent bindings were added by Scott Owens.

---

```
(blank-line) → pict?
```

Adds a blank line of the current font size's height.

---

```

(pin-label-line label
  pict
  src-pict
  src-coord-fn
  dest-pict
  dest-coord-fn
  #:start-angle start-angle
  #:end-angle end-angle
  #:start-pull start-pull
  #:end-pull end-pull
  #:line-width line-width
  #:color color
  #:under? under?
  #:x-adjust x-adjust
  #:y-adjust y-adjust) → pict?

label : pict?
pict : pict?
src-pict : pict-path?
src-coord-fn : (-> pict-path? (values real? real?))
dest-pict : pict-path?
dest-coord-fn : (-> pict-path? (values real? real?))
start-angle : (or/c real? #f)
end-angle : (or/c real? #f)
start-pull : real?
end-pull : real?
line-width : (or/c real? #f)
color : (or/c #f string? (is-a?/c color%))
under? : any/c
x-adjust : real?
y-adjust : real?

```

```

(pin-arrow-label-line label
                      arrow-size
                      pict
                      src-pict
                      src-coord-fn
                      dest-pict
                      dest-coord-fn
                      #:start-angle start-angle
                      #:end-angle end-angle
                      #:start-pull start-pull
                      #:end-pull end-pull
                      #:line-width line-width
                      #:color color
                      #:under? under?
                      #:hide-arrowhead? hide-arrowhead?
                      #:x-adjust x-adjust
                      #:y-adjust y-adjust)

```

```

→ pict?
label : pict?
arrow-size : real?
pict : pict?
src-pict : pict-path?
src-coord-fn : (-> pict-path? (values real? real?))
dest-pict : pict-path?
dest-coord-fn : (-> pict-path? (values real? real?))
start-angle : (or/c real? #f)
end-angle : (or/c real? #f)
start-pull : real?
end-pull : real?
line-width : (or/c real? #f)
color : (or/c #f string? (is-a?/c color%))
under? : any/c
hide-arrowhead? : any/c
x-adjust : real?
y-adjust : real?

```

```

(pin-arrows-label-line label
  arrow-size
  pict
  src-pict
  src-coord-fn
  dest-pict
  dest-coord-fn
  #:start-angle start-angle
  #:end-angle end-angle
  #:start-pull start-pull
  #:end-pull end-pull
  #:line-width line-width
  #:color color
  #:under? under?
  #:hide-arrowhead? hide-arrowhead?
  #:x-adjust x-adjust
  #:y-adjust y-adjust)

```

```

→ pict?
label : pict?
arrow-size : real?
pict : pict?
src-pict : pict-path?
src-coord-fn : (-> pict-path? (values real? real?))
dest-pict : pict-path?
dest-coord-fn : (-> pict-path? (values real? real?))
start-angle : (or/c real? #f)
end-angle : (or/c real? #f)
start-pull : real?
end-pull : real?
line-width : (or/c real? #f)
color : (or/c #f string? (is-a?/c color%))
under? : any/c
hide-arrowhead? : any/c
x-adjust : real?
y-adjust : real?

```

These functions behave like `pin-line`, `pin-arrow-line` and `pin-arrows-line` with the addition of a label attached to the line.