# Option Contracts

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```
(require racket/contract/option)
        package: option-contract-lib
```

This module introduces *option contracts*, a flavor of behavioral software contracts. With option contracts developers control in a programmatic manner whether, when, and how often contracts are checked. Using this flavor of contracts, Racketeers can mimic any compiler flag system but also create run-time informed checking systems.

```
(option/c  c
           [#:with-contract with
            #:tester tester
            #:invariant invariant
            #:immutable immutable
            #:flat? flat?
            #:struct struct-id])   → contract?
  c : contract?
  with : boolean? = #f
  tester : (or/c (-> any boolean?) 'dont-care) = 'dont-care
  invariant : (or/c (-> any boolean?) 'dont-care) = 'dont-care
  immutable : (or/c #t #f 'dont-care) = 'dont-care
  flat? : boolean? = #f
  struct-id : (or/c identifier? 'none) = 'none
```

Returns a contract that recognizes vectors or hashes or instances of struct *struct-id*. The data structure must match *c* and pass the *tester*.

When an option/c contract is attached to a value, first the contract *c* is attached to the value and then the result is checked against *tester*, if *tester* is a predicate. After that, contract checking is disabled for the value, if *with* is #f. If *with* is #t contract checking for the value remains enabled for *c*.

If waive-option is applied to a value guarded by an option/c contract, then waive-

`option` returns the value after removing the `option/c` guard. If `exercise-option` is applied to a value guarded by an `option/c` contract, then `exercise-option` returns the value with contract checking enabled for *`c`*. If the *`invariant`* argument is a predicate, then `exercise-option` returns the value with contract checking enabled for `(invariant/c` *`c invariant`* `#:immutable` *`immutable`* `#:flat?` *`flat?`* `#:struct` *`struct-id`*`)`.

The arguments *`flat?`* and *`immutable`* should be provided only if *`invariant`* is a predicate. In any other case, the result is a contract error.

Examples:

```
> (module server0 racket
    (require racket/contract/option)
    (provide
     (contract-out
      [vec (option/c (vectorof number?))]))
    (define vec (vector 1 2 3 4)))
> (require 'server0)
> (vector-set! vec 1 'foo)
> (vector-ref vec 1)
'foo
> (module server1 racket
    (require racket/contract/option)
    (provide
     (contract-out
      [vec (option/c (vectorof number?) #:with-contract #t)]))
    (define vec (vector 1 2 3 4)))
> (require 'server1)
> (vector-set! vec 1 'foo)
vec: contract violation
  expected: number?
  given: 'foo
  in: an element of
      the option of
      (option/c
       (vectorof number?)
       #:with-contract
       #t)
  contract from: server1
  blaming: top-level
   (assuming the contract is correct)
  at: eval:6:0
> (module server2 racket
    (require racket/contract/option)
    (provide
     (contract-out
```

```
      [vec (option/c (vectorof number?) #:tester sorted?)]))
    (define vec (vector 1 42 3 4))
    (define (sorted? vec)
      (for/and ([el vec]
                [cel (vector-drop vec 1)])
               (<= el cel))))
> (require 'server2)
vec: contract violation;

  in: option contract tester #<procedure:sorted?> of
      (option/c
       (vectorof number?)
       #:tester
       #<procedure:sorted?>)
  contract from: server2
  blaming: server2
   (assuming the contract is correct)
  at: eval:9:0
```

```
(exercise-option x) → any/c
  x : any/c
```

Returns `x` with contract checking enabled if an `option/c` guards `x`. In any other case it returns `x`. The result of `exercise-option` loses the guard related to `option/c`, if it has one to begin with, and thus its contract checking status cannot change further.

Examples:

```
> (module server3 racket
    (require racket/contract/option)
    (provide (contract-out [foo (option/c (-> number? symbol?))]))
    (define foo (λ (x) x)))
> (require 'server3 racket/contract/option)
(define e-foo (exercise-option foo))
> (foo 42)
42
> (e-foo 'wrong)
foo: contract violation
  expected: number?
  given: 'wrong
  in: the 1st argument of
      the option of
      (option/c (-> number? symbol?))
  contract from: server3
  blaming: top-level
   (assuming the contract is correct)
```

```
  at: eval:11:0
> ((exercise-option e-foo) 'wrong)
foo: contract violation
  expected: number?
  given: 'wrong
  in: the 1st argument of
      the option of
      (option/c (-> number? symbol?))
  contract from: server3
  blaming: top-level
   (assuming the contract is correct)
  at: eval:11:0
```

### transfer/c : contract?

A contract that accepts any value. If the value is guarded with an `option/c` contract, `transfer/c` modifies the blame information for the `option/c` contract by adding the providing module and its client to the positive and negative blame parties respectively. If the value is not a value guarded with an `option/c` contract, then `transfer/c` is equivalent to `any/c`.

Examples:

```
> (module server4 racket
    (require racket/contract/option)
    (provide (contract-out [foo (option/c (-> number? symbol?))]))
    (define foo (λ (x) x)))
> (module middleman racket
    (require racket/contract/option 'server4)
    (provide (contract-out [foo transfer/c])))
> (require 'middleman racket/contract/option)
(define e-foo (exercise-option foo))
> (e-foo 1)
foo: broke its own contract
  promised: symbol?
  produced: 1
  in: the range of
      the option of
      (option/c (-> number? symbol?))
  contract from: server4
  blaming multiple parties:
  middleman
  server4
   (assuming the contract is correct)
  at: eval:17:0
> (module server5 racket
    (require racket/contract/option)
```

```
    (provide (contract-out [boo transfer/c]))
    (define (boo x) x))
> (require 'server5)
> (boo 42)
42
```

(waive-option x) → any/c
  x : any/c

If an option/c guards x, then waive-option returns x without the option/c guard. In any other case it returns x. The result of waive-option loses the guard related to option/c, if it had one to begin with, and thus its contract checking status cannot change further.

Examples:

```
> (module server6 racket
    (require racket/contract/option)
    (provide (contract-out [bar (option/c (-> number? symbol?))]))
    (define bar (λ (x) x)))
> (require 'server6 racket/contract/option)
(define e-bar (waive-option bar))
> (e-bar 'wrong)
'wrong
> ((waive-option e-bar) 'wrong)
'wrong
```

(tweak-option x) → any/c
  x : any/c

If an option/c guards x and contract checking for x is enabled, then tweak-option returns x with contract checking for x disabled. If an option/c guards x and contract checking for x is disabled, then tweak-option returns x with contract checking for x enabled. In any other case it returns x. The result of tweak-option retains the guard related to option/c if it has one to begin with and thus its contract checking status can change further using tweak-option, exercise-option or waive-option.

Examples:

```
> (module server7 racket
    (require racket/contract/option)
    (provide (contract-out [bar (option/c (-> number? symbol?))]))
    (define bar (λ (x) x)))
> (require 'server7 racket/contract/option)
(define t-bar (tweak-option bar))
```

```
> (t-bar 'wrong)
bar: contract violation
  expected: number?
  given: 'wrong
  in: the 1st argument of
        the option of
        (option/c (-> number? symbol?))
  contract from: server7
  blaming: top-level
   (assuming the contract is correct)
  at: eval:30:0
> ((tweak-option t-bar) 'wrong)
'wrong
> ((waive-option t-bar) 'wrong)
'wrong
> ((exercise-option t-bar) 'wrong)
bar: contract violation
  expected: number?
  given: 'wrong
  in: the 1st argument of
        the option of
        (option/c (-> number? symbol?))
  contract from: server7
  blaming: top-level
   (assuming the contract is correct)
  at: eval:30:0
```

```
(has-option? v) → boolean?
  v : any/c
```

Returns `#t` if `v` has an option contract.

```
(has-option-with-contract? v) → boolean?
  v : any/c
```

Returns `#t` if `v` has an option contract with contract checking enabled.

```
(invariant/c  c
              invariant
             [#:immutable immutable
              #:flat? flat?
              #:struct struct-id])   → contract?
  c : contract?
  invariant : (-> any boolean?)
  immutable : (or/c #t #f 'dont-care) = 'dont-care
```

```
flat? : boolean? = #f
struct-id : (or/c identifier? 'none) = 'none
```

Returns a contract that recognizes vectors or hashes or instances of struct *struct-id*. The data structure must match *c* and satisfy the *invariant* argument.

If the *flat?* argument is #t, then the resulting contract is a flat contract, and the *c* arguments must also be flat contracts. Such flat contracts will be unsound if applied to a mutable data structure, as they will not check future operations on the vector.

If the *immutable* argument is #t and the *c* arguments are flat contracts, the result will be a flat contract. If the *c* arguments are chaperone contracts, then the result will be a chaperone contract.

Examples:

```
> (module server8 racket
    (require racket/contract/option)
    (provide
      change
      (contract-out
       [vec (invariant/c
             any/c
             sorted?)]))
   (define vec (vector 1 2 3 4 5))
   (define (change) (vector-set! vec 2 42))
   (define (sorted? vec)
     (for/and ([el vec]
               [cel (vector-drop vec 1)])
       (<= el cel))))
> (require 'server8)
> (vector-set! vec 2 42)
vec: contract violation
  expected vector that satisfies #<procedure:sorted?> given:
'#(1 2 42 4 5)
  in: (invariant/c any/c #<procedure:sorted?>)
  contract from: server8
  blaming: top-level
   (assuming the contract is correct)
  at: eval:37:0
> (change)
> (vector-ref vec 2)
vec: broke its own contract
  expected vector that satisfies #<procedure:sorted?> given:
'#(1 2 42 4 5)
  in: (invariant/c any/c #<procedure:sorted?>)
```

*contract from: server8*
*blaming: server8*
*(assuming the contract is correct)*
*at: eval:37:0*