Test Support

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Contents

1 Using Check Forms **3**

2 Running Tests and Inspecting Test Results **7**

3 Printing Test Results **13**

1 Using Check Forms

```
(require test-engine/racket-tests)
```
package: htdp-lib

This module provides test forms for use in Racket programs, as well as parameters to configure the behavior of test reports.

Each check form may only occur at the top-level; results are collected and reported by the test function. Note that the check forms only register checks to be performed. The checks are actually run by the `test` function. Furthermore, syntax errors in check forms are intentionally delayed to run time so that students can write tests *without* necessarily writing complete function headers.

```
(check-expect expr expected-expr)
```

Checks whether the value of the *expr* expression is `equal?` to the value produced by the *expected-expr*.

It is an error for *expr* or *expected-expr* to produce a function value or an inexact number.

```
(check-random expr expected-expr)
```

Checks whether the value of the *expr* expression is `equal?` to the value produced by the *expected-expr*.

The form supplies the same random-number generator to both parts. If both parts request `random` numbers from the same interval in the same order, they receive the same random numbers.

Examples:

```
> (check-random (random 10) (random 10))
> (check-random
    (begin (random 100) (random 200))
    (begin (random 100) (random 200)))
> (test)
Both tests passed!
```

If the two parts call `random` for different intervals, they are likely to fail:

Examples:

```
> (check-random
    (begin (random 100) (random 200))
    (begin (random 200) (random 100)))
> (test)
```

```
Ran 1 test.
0 tests passed.
Check failures:
                    ┌─────┐               ┌─────┐
        Actual value │ 102 │ differs from │ 51  │, the expected
value.
                    └─────┘               └─────┘

at line 2, column 0
```

It is an error for *expr* or *expected-expr* to produce a function value or an inexact number.

```
(check-satisfied expr property?)
```

Checks whether the value of the *expr* expression satisfies the *property?* predicate (which must evaluate to a function of one argument).

Examples:

```
> (check-satisfied 1 odd?)
> (check-satisfied 1 even?)
> (test)
Ran 2 tests.
1 of the 2 tests failed.
Check failures:
                    ┌───┐
        Actual value │ 1 │ does not satisfy even?.
                    └───┘

at line 3, column 0
```

Changed in version 1.1 of package `htdp-lib`: allow the above examples to run in BSL and BSL+

```
(check-within expr expected-expr delta-expr)

  delta-expr : number?
```

Checks whether the value of the `test` expression is structurally equal to the value produced by the `expected` expression; every number in the first expression must be within `delta` of the corresponding number in the second expression.

It is an error for *expr* or `expected` to produce a function value.

```
(check-random-within expr expected-expr delta-expr)

  delta-expr : number?
```

Combines `check-random` and `check-within`. The *expr* and *expected-expr* expressions are evaluated with the same random-number sequence. Their values must be structurally equal, with every number in the first value within *delta-expr* of the corresponding number in the second value. Inexact numbers are allowed.

Examples:

```
> (check-random-within (exact->inexact (random 100))
                       (+ 0.01 (random 100))
                       0.1)
> (test)
The test passed!
```

It is an error for *expr* or *expected-expr* to produce a function value.

Added in version 1.9 of package `htdp-lib`.

```
(check-error expr)
(check-error expr msg-expr)

  msg-expr : string?
```

Checks that evaluating *expr* signals an error, where the error message matches the string (if any).

```
(check-member-of expr expected-expr ...)
```

Checks whether the value of the *expr* expression is `equal?` to any of the values produced by the *expected-expr*s.

It is an error for *expr* or any of the *expected-expr*s to produce a function value or an inexact number.

```
(check-range expr min-expr max-expr)

  expr : number?
  min-expr : number?
  max-expr : number?
```

Checks whether value of *expr* is between the values of *min-expr* and *max-expr* inclusive.

```
(test)
```

Runs all of the tests specified by check forms in the current module and reports the results. When using the gui module, the results are provided in a separate window, otherwise the results are printed to the current output port.

```
(test-silence) → boolean?
(test-silence silence?) → void?
  silence? : any/c
```

A parameter that stores a boolean, defaults to #f, that can be used to suppress the printed summary from test.

```
(test-execute) → boolean?
(test-execute execute?) → void?
  execute? : any/c
```

A parameter that stores a boolean, defaults to #t, that can be used to suppress evaluation of test expressions.

2 Running Tests and Inspecting Test Results

```
(require test-engine/test-engine)
```
package: htdp-lib

This module defines language-agnostic procedures for running test code to execute checks, and recording and inspecting their results.

A *test* is a piece of code run for testing, a *check* is a single assertion within that code: Typically the tests are first registered, then they are run, and then their results are inspected. Both tests and the results of failed checks are recorded in a data structure called a *test object*. There is always a current test object associated with the current namespace.

```
(struct test-object (tests
                     successful-tests
                     failed-checks
                     signature-violations))
  tests : (listof (-> boolean?))
  successful-tests : (listof (-> boolean?))
  failed-checks : (listof failed-check?)
  signature-violations : (listof signature-violation?)
```

The four components of a `test-object` are all in reverse order:

The first one is the list of tests (each represented by a thunk), the others are succeeded tests, failed checks and signature violations, respectively.

The thunks are expected to always run to completion. They shouöd return `#t` upon success, and `#f` upon failure.

```
(empty-test-object) → test-object?
```

Creates an empty test object.

```
(current-test-object) → test-object?
```

Returns the current test object.

```
(initialize-test-object!) → any
```

Initializes the test object. Note that this is not necessary before using `current-test-object` and the various other functions operating on it: These will automatically initialize as necessary. Use this function to reset the current test object.

```
(add-test! thunk) → any
  thunk : (-> boolean?)
```

Register a test, represented by a thunk. The thunk, when called, is expected to call `add-failed-check!` and `add-signature-violation!` as appropriate.

```
(add-failed-check! failed-check) → any
  failed-check : failed-check?
```

Record a test failure.

```
(add-signature-violation! violation) → any
  violation : signature-violation?
```

Record a signature violation.

```
(run-tests!) → test-object?
```

Run the tests, calling the thunks registered via `add-test!` in the order they were registered.

```
(struct failed-check (reason srcloc?))
  reason : fail-reason?
  srcloc? : (or/c #f srcloc?)
```

This is a description of a failed check. The source location, if present, is from an expression that may have caused the failure, possibly an exception.

```
(struct fail-reason (srcloc))
  srcloc : srcloc?
```

Common supertype of all objects describing a reason for a failed check. The `srcloc` is the source location of the check.

```
(struct unexpected-error fail-reason (srcloc expected exn))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
```

An error happened instead of regular termination.

```
(struct unexpected-error/markup unexpected-error (srcloc
                                                  expected
                                                  exn
                                                  error-markup))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
  error-markup : markup?
```

An error happened instead of regular termination. This also contains markup describing the error.

```
(struct unexpected-error/check-* unexpected-error/markup (srcloc
                                                          expected
                                                          exn
                                                          error-markup
                                                          form-name))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
  error-markup : markup?
  form-name : (or/c symbol? string?)
```

An error happened instead of regular termination. This also contains markup describing the error and the name of the check form.

```
(struct unexpected-error/range unexpected-error/markup (srcloc
                                                        expected
                                                        exn
                                                        error-markup
                                                        min
                                                        max))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
  error-markup : markup?
  min : real?
  max : real?
```

An error happened instead of regular termination in a `check-range` form. This also contains markup describing the error.

```
(struct unexpected-error/member unexpected-error/markup (srcloc
                                                         expected
                                                         exn
                                                         error-markup
                                                         set))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
  error-markup : markup?
  set : any/c
```

An error happened instead of regular termination in a `check-member-of` form. This also contains markup describing the error.

```
(struct unequal fail-reason (srcloc actual expected))
  srcloc : srcloc?
  actual : any/c
  expected : any/c
```

A value was supposed to be equal to another, but wasn't. Generated by `check-expect`.

```
(struct not-within fail-reason (srcloc actual expected range))
  srcloc : srcloc?
  actual : any/c
  expected : any/c
  range : real?
```

A value was supposed to be equal to another within a certain range, but wasn't. Generated by `check-within`.

```
(struct incorrect-error fail-reason (srcloc expected exn))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
```

An exception was expected, but a different one occurred. Generated by `check-error`.

```
(struct incorrect-error/markup incorrect-error (srcloc
                                                expected
                                                exn
                                                error-markup))
  srcloc : srcloc?
  expected : any/c
  exn : exn?
  error-markup : markup?
```

An exception was expected, but a different one occurred. Also includes markup describing the error. Generated by `check-error`.

```
(struct expected-error fail-reason (srcloc message value))
  srcloc : srcloc?
  message : (or/c #f string?)
  value : any/c
```

An error was expected, but a value came out instead. Generated by `check-error`.

```
(struct not-mem fail-reason (srcloc actual set))
  srcloc : srcloc?
  actual : any/c
  set : (listof any/c)
```

The value produced was not part an the expected set. Generated by `check-member-of`.

```
(struct not-range fail-reason (srcloc actual min max))
  srcloc : srcloc?
  actual : real?
  min : real?
  max : real?
```

The value produced was not part an the expected range. Generated by `check-range`.

```
(struct satisfied-failed fail-reason (srcloc actual name))
  srcloc : srcloc?
  actual : any/c
  name : string?
```

The value produced did not satisfy a predicate. The `name` field is the name of the predicate. Generated by `check-satisfied`.

```
(struct unsatisfied-error fail-reason (srcloc name exn))
  srcloc : srcloc?
  name : string?
  exn : exn?
```

A value was supposed to satsify a predicate, but an error happened instead. The `name` field is the name of the predicate. Generated by `check-satisfied`.

```
(struct unsatisfied-error/markup unsatisfied-error (srcloc
                                                    name
                                                    exn
                                                    error-markup))
  srcloc : srcloc?
  name : string?
  exn : exn?
  error-markup : markup?
```

A value was supposed to satsify a predicate, but an error happened instead. The `name` field is the name of the predicate. Also includes markup describing the error. Generated by `check-satisfied`.

```
(struct violated-signature fail-reason (srcloc
                                        obj
                                        signature
                                        blame-srcloc))
  srcloc : srcloc?
  obj : any/c
  signature : signature?
  blame-srcloc : (or/c #f srcloc?)
```

A signature was violated, and this was communicated via an exception. Note that signature violations should really be (and usually are) communicated via `add-signature-violation!`.

```
(struct signature-got (value))
  value : any/c
```

The value that violated the signature.

```
(struct signature-violation (obj
                             signature
                             message
                             srcloc
                             blame-srcloc))
  obj : any/c
  signature : signature?
  message : (or/c string? signature-got?)
  srcloc : (or/c #f srcloc?)
  blame-srcloc : (or/c #f srcloc?)
```

Signature `signature` was violated by object `obj`. The `srcloc` field is the location of the signature. The optional `blame-srcloc` points at the source code to blame for the violation.

```
(struct property-fail fail-reason (srcloc result))
  srcloc : srcloc?
  result : check-result?
```

A counterexample for a property was found, described in the `result` field.

```
(struct property-error fail-reason (srcloc exn))
  srcloc : srcloc?
  exn : exn?
```

A property check produced an unexpected exception.

3 Printing Test Results

This module is responsible for output of test results: Where the output goes, and some aspects of the formatting can be customized via parameters.

```
(require test-engine/test-markup)
```
package: htdp-lib

```
(render-value-parameter) → (any/c . -> . string?)
(render-value-parameter render-value-proc) → void?
  render-value-proc : (any/c . -> . string?)
```

This parameter determines how `test-object->markup` renders a value for display in an error message in a language-specific way. The default is `(lambda (v) (format "~V" v))`.

```
(display-test-results-parameter) → (markup? . -> . any)
(display-test-results-parameter display-test-proc) → void?
  display-test-proc : (markup? . -> . any)
```

This parameter determines how to output the test results. The default prints to `(current-output-port)`.

```
(display-test-results! markup) → any
  markup : markup?
```

This just calls the procedure bound to `display-test-results-parameter`.

```
(get-rewritten-error-message-parameter)
 → (exn? . -> . string?)
(get-rewritten-error-message-parameter get-rewritten-error-message-proc)
 → void?
  get-rewritten-error-message-proc : (exn? . -> . string?)
```

This parameter determines how to get an error message from an exception, possibly after reformulation and/or translation.

```
(get-rewritten-error-message exn) → string?
  exn : exn?
```

This just calls the procedure bound to `get-rewritten-error-message-parameter`.

```
(test-object->markup test-object) → markup?
  test-object : test-object?
```

This generates a test report as markup, using `render-value-parameter` and `get-rewritten-error-message-parameter`.