Package ‘testthat’

March 2, 2020

Title  Unit Testing for R
Version  2.3.2
Description  Software testing is important, but, in part because it is
frustrating and boring, many of us avoid it. 'testthat' is a testing framework
for R that is easy to learn and use, and integrates with your existing 'workflow'.
License  MIT + file LICENSE
BugReports  https://github.com/r-lib/testthat/issues
Depends  R (>= 3.1)
Imports  cli, crayon (>= 1.3.4), digest, ellipsis, evaluate, magrittr,
  methods, pkgload, praise, R6 (>= 2.2.0), rlang (>= 0.4.1),
  withr (>= 2.0.0)
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  vctrs (>= 0.1.0), xml2
VignetteBuilder  knitr
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Collate  'auto-test.R' 'capture-condition.R' 'capture-output.R'
  'colour-text.R' 'compare.R' 'compare-character.R'
  'compare-numeric.R' 'compare-time.R' 'context.R' 'describe.R'
  'evaluate-promise.R' 'example.R' 'expect-comparison.R'
  'expect-condition.R' 'expect-equality.R' 'expect-inheritance.R'
  'expect-invisible.R' 'expect-known.R' 'expect-length.R'
  'expect-logical.R' 'expect-messages.R' 'expect-known.R'
  'expect-null.R' 'expect-output.R' 'reporter.R'
  'expect-self-test.R' 'expect-setequal.R' 'expect-silent.R'
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  'reporter-junit.R' 'reporter-list.R' 'reporter-location.R'
  'reporter-minimal.R' 'reporter-multi.R' 'stack.R'
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'reporter-stop.R' 'reporter-summary.R' 'reporter-tap.R'
'reporter-teamcity.R' 'reporter-zzz.R' 'skip.R' 'source.R'
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'test-example.R' 'test-files.R' 'test-path.R' 'test-that.R'
'try-again.R' 'utils-io.R' 'utils.R' 'verify-output.R'
'watcher.R'

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**auto_test**

Watches code and tests for changes, rerunning tests as appropriate.

**Description**

The idea behind `auto_test()` is that you just leave it running while you develop your code. Everytime you save a file it will be automatically tested and you can easily see if your changes have caused any test failures.

**Usage**

```r
auto_test(
  code_path,
  test_path,
  reporter = default_reporter(),
  env = test_env(),
  hash = TRUE
)
```

**Arguments**

- `code_path` path to directory containing code
- `test_path` path to directory containing tests
- `reporter` test reporter to use
- `env` environment in which to execute test suite.
- `hash` Passed on to `watch()`. When FALSE, uses less accurate modification time stamps, but those are faster for large files.
Details

The current strategy for rerunning tests is as follows:

- if any code has changed, then those files are reloaded and all tests rerun
- otherwise, each new or modified test is run

In the future, auto_test() might implement one of the following more intelligent alternatives:

- Use codetools to build up dependency tree and then rerun tests only when a dependency changes.
- Mimic ruby’s autotest and rerun only failing tests until they pass, and then rerun all tests.

See Also

auto_test_package()

auto_test_package  Watches a package for changes, rerunning tests as appropriate.

Description

Watches a package for changes, rerunning tests as appropriate.

Usage

auto_test_package(pkg = ".", reporter = default_reporter(), hash = TRUE)

Arguments

pkg  path to package
reporter  test reporter to use
hash  Passed on to watch(). When FALSE, uses less accurate modification time stamps, but those are faster for large files.

See Also

auto_test() for details on how method works
CheckReporter

Check reporter: 13 line summary of problems

Description
R CMD check displays only the last 13 lines of the result, so this report is designed to ensure that you see something useful there.

See Also

comparison-expectations

Expectation: is returned value less or greater than specified value?

Description
Expectation: is returned value less or greater than specified value?

Usage
expect_lt(object, expected, label = NULL, expected.label = NULL)
expect_lte(object, expected, label = NULL, expected.label = NULL)
expect_gt(object, expected, label = NULL, expected.label = NULL)
expect_gte(object, expected, label = NULL, expected.label = NULL)

Arguments
object Computation and value to compare it to.
Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
expected Single numeric value to compare.
label Used to customise failure messages. For expert use only.
expected.label Used to customise failure messages. For expert use only.

See Also
Other expectations: equality-expectations, expect_error(), expect_length(), expect_match(), expect_message(), expect_named(), expect_null(), expect_output(), expect_silent(), inheritance-expectations, logical-expectations
Examples

```r
a <- 9
expect_lt(a, 10)

## Not run:
expect_lt(11, 10)

## End(Not run)

a <- 11
expect_gt(a, 10)

## Not run:
expect_gt(9, 10)

## End(Not run)
```

Description

This reporter will call a modified version of `recover()` on all broken expectations.

See Also


describe

**describe: a BDD testing language**

Description

A simple BDD DSL for writing tests. The language is similar to RSpec for Ruby or Mocha for JavaScript. BDD tests read like sentences and it should thus be easier to understand what the specification of a function/component is.

Usage

```r
describe(description, code)
```

Arguments

- **description**: description of the feature
- **code**: test code containing the specs
Details

Tests using the `describe` syntax not only verify the tested code, but also document its intended behaviour. Each `describe` block specifies a larger component or function and contains a set of specifications. A specification is defined by an `it` block. Each `it` block functions as a test and is evaluated in its own environment. You can also have nested `describe` blocks.

This test syntax helps to test the intended behaviour of your code. For example: you want to write a new function for your package. Try to describe the specification first using `describe`, before you write any code. After that, you start to implement the tests for each specification (i.e. the `it` block).

Use `describe` to verify that you implement the right things and use `test_that()` to ensure you do the things right.

Examples

```r
describe("matrix()", {
  it("can be multiplied by a scalar", {
    m1 <- matrix(1:4, 2, 2)
    m2 <- m1 * 2
    expect_equivalent(matrix(1:4 * 2, 2, 2), m2)
  })
  it("can have not yet tested specs")
})

# Nested specs:
## code
addition <- function(a, b) a + b
division <- function(a, b) a / b

## specs
describe("math library", {
  describe("addition()", {
    it("can add two numbers", {
      expect_equivalent(1 + 1, addition(1, 1))
    })
  })
  describe("division()", {
    it("can divide two numbers", {
      expect_equivalent(10 / 2, division(10, 2))
    })
    it("can handle division by 0") # not yet implemented
  })
})
```

**equality-expectations**  
Expectation: is the object equal to a value?
Description

- `expect_identical()` compares values with `identical()`.
- `expect_equal()` compares values with `all.equal()`
- `expect_equivalent()` compares values with `all.equal()` and `check.attributes = FALSE`
- `expect_reference()` compares the underlying memory addresses.

Usage

```r
expect_equal(  
  object,  
  expected,  
  ...,  
  info = NULL,  
  label = NULL,  
  expected.label = NULL
)

expect_equivalent(  
  object,  
  expected,  
  ...,  
  info = NULL,  
  label = NULL,  
  expected.label = NULL
)

expect_identical(  
  object,  
  expected,  
  info = NULL,  
  label = NULL,  
  expected.label = NULL,  
  ...
)

expect_reference(  
  object,  
  expected,  
  info = NULL,  
  label = NULL,  
  expected.label = NULL
)
```

Arguments

- `object, expected`
  Computation and value to compare it to.
Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See `quasi_label` for more details.

For `expect_equal()` and `expect_equivalent()`, passed on `compare()`, for `expect_identical()` passed on to `identical()`. Used to control the details of the comparison.

Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in `quasi_label`.

Used to customise failure messages. For expert use only.

See Also

- `expect_setequal()` to test for set equality.

Other expectations: `comparison-expectations`, `expect_error()`, `expect_length()`, `expect_match()`, `expect_message()`, `expect_named()`, `expect_null()`, `expect_output()`, `expect_silent()`.

Examples

```r
a <- 10
expect_equal(a, 10)

# Use expect_equal() when testing for numeric equality
sqrt(2) ^ 2 - 1
expect_equal(sqrt(2) ^ 2, 2)

# Neither of these forms take floating point representation errors into account
## Not run:
expect_true(sqrt(2) ^ 2 == 2)
expect_identical(sqrt(2) ^ 2, 2)
## End(Not run)

# You can pass on additional arguments to all.equal:
## Not run:
# Test the ABSOLUTE difference is within .002
expect_equal(10.01, 10, tolerance = .002, scale = 1)
## End(Not run)

# Test the RELATIVE difference is within .002
x <- 10
expect_equal(10.01, expected = x, tolerance = 0.002, scale = x)

# expect_equivalent ignores attributes
a <- b <- 1:3
names(b) <- letters[1:3]
expect_equivalent(a, b)
```
**expect**

The building block of all expect\_functions

---

### Description

Call `expect()` when writing your own expectations. See `vignette("custom-expectation")` for details.

### Usage

```r
expect(ok, failure_message, info = NULL, srcref = NULL, trace = NULL)
```

### Arguments

- **ok**
  - `TRUE` or `FALSE` indicating if the expectation was successful.

- **failure_message**
  - Message to show if the expectation failed.

- **info**
  - Character vector continuing additional information. Included for backward compatibility only and new expectations should not use it.

- **srcref**
  - Location of the failure. Should only needed to be explicitly supplied when you need to forward a srcref captured elsewhere.

- **trace**
  - An optional backtrace created by `rlang::trace_back()`. When supplied, the expectation is displayed with the backtrace.

### Details

While `expect()` creates and signals an expectation in one go, `exp_signal()` separately signals an expectation that you have manually created with `new_expectation()`. Expectations are signalled with the following protocol:

- If the expectation is a failure or an error, it is signalled with `base::stop()`. Otherwise, it is signalled with `base::signalCondition()`.
- The `continue_test` restart is registered. When invoked, failing expectations are ignored and normal control flow is resumed to run the other tests.

### Value

An expectation object. Signals the expectation condition with a `continue_test` restart.

### See Also

`exp_signal()`
Description

expect_error() and expect_condition() check that code throws an error or condition with a message that matches regexp, or a class that inherits from class. See below for more details.

Usage

```r
expect_error(
  object,
  regexp = NULL,
  class = NULL,
  ...,
  info = NULL,
  label = NULL
)
expect_condition(
  object,
  regexp = NULL,
  class = NULL,
  ...,
  info = NULL,
  label = NULL
)
```

Arguments

- **object** Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
- **regexp** Regular expression to test against.
  - A character vector giving a regular expression that must match the error message.
  - If NULL, the default, asserts that there should be a error, but doesn’t test for a specific value.
  - If NA, asserts that there should be no errors.
- **class** Instead of supplying a regular expression, you can also supply a class name. This is useful for "classed" conditions.
- **...** Arguments passed on to expect_match

  - **all** Should all elements of actual value match regexp (TRUE), or does only one need to match (FALSE)
  - **perl** logical. Should Perl-compatible regexps be used?
expect_error

fixed logical. If TRUE, pattern is a string to be matched as is. Overrides all conflicting arguments.

info Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label.

label Used to customise failure messages. For expert use only.

Value

If regexp = NA, the value of the first argument; otherwise the captured condition.

Testing message vs class

When checking that code generates an error, it’s important to check that the error is the one you expect. There are two ways to do this. The first way is the simplest: you just provide a regexp that match some fragment of the error message. This is easy, but fragile, because the test will fail if the error message changes (even if its the same error).

A more robust way is to test for the class of the error, if it has one. You can learn more about custom conditions at https://adv-r.hadley.nz/conditions.html#custom-conditions, but in short, errors are S3 classes and you can generate a custom class and check for it using class instead of regexp. Because this is a more reliable check, you expect_error() will warn if the error has a custom class but you are testing the message. Eliminate the warning by using class instead of regexp. Alternatively, if you think the warning is a false positive, use class = "error" to suppress it for any input.

If you are using expect_error() to check that an error message is formatted in such a way that it makes sense to a human, we now recommend using verify_output() instead.

See Also

Other expectations: comparison-expectations, equality-expectations, expect_length(), expect_match(), expect_message(), expect_named(), expect_null(), expect_output(), expect_silent(), inheritance-expectations, logical-expectations

Examples

f <- function() stop("My error!")
expect_error(f())
expect_error(f(), "My error!")

# You can use the arguments of grepl to control the matching
expect_error(f(), "my error!", ignore.case = TRUE)

# If you are working with classed conditions, it's better to test for
# the class name, rather than the error message (which may change over time)
custom_err <- function(var) {
  rlang::abort("A special error", var = var, .subclass = "testthat_special")
}
expect_error(custom_err("a"), class = "testthat_special")

# Note that `expect_error()` returns the error object so you can test
# its components if needed
err <- expect_error(custom_err("a"), class = "testthat_special")
expect_equal(err$var, "a")

---

**expect_invisible**  
*Expectation: does expression return visibly or invisibly?*

**Description**

Use this to test whether a function returns a visible or invisible output. Typically you'll use this to check that functions called primarily for their side-effects return their data argument invisibly.

**Usage**

```r
expect_invisible(call, label = NULL)
expect_visible(call, label = NULL)
```

**Arguments**

- **call**: A function call.
- **label**: Used to customise failure messages. For expert use only.

**Value**

The evaluated call, invisibly.

**Examples**

```r
expect_invisible(x <- 10)
expect_visible(x)

# Typically you'll assign the result of the expectation so you can # also check that the value is as you expect.
greet <- function(name) {
  message("Hi ", name)
  invisible(name)
}
out <- expect_invisible(greet("Hadley"))
expect_equal(out, "Hadley")
```
expect_length  
*Expectation: does a vector have the specified length?*

**Description**

Expectation: does a vector have the specified length?

**Usage**

`expect_length(object, n)`

**Arguments**

- `object`  
  Object to test. 
  Supports limited unquoting to make it easier to generate readable failures within 
  a function or for loop. See `quasi_label` for more details.

- `n`  
  Expected length.

**See Also**

Other expectations: `comparison-expectations, equality-expectations, expect_error(), expect_match(), expect_message(), expect_named(), expect_null(), expect_output(), expect_silent()`, `inheritance-expectations, logical-expectations`

**Examples**

```r
expect_length(1, 1)
expect_length(1:10, 10)

## Not run:
expect_length(1:10, 1)

## End(Not run)
```

expect_match  
*Expectation: does string match a regular expression?*

**Description**

Expectation: does string match a regular expression?
expect_match

Usage

```r
expect_match(
  object,
  regexp,
  perl = FALSE,
  fixed = FALSE,
  ...,  
  all = TRUE,
  info = NULL,
  label = NULL
)
```

Arguments

- **object**: Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See `quasi_label` for more details.
- **regexp**: Regular expression to test against.
- **perl**: logical. Should Perl-compatible regexps be used?
- **fixed**: logical. If `TRUE`, `pattern` is a string to be matched as is. Overrides all conflicting arguments.
- **...**: Arguments passed on to `base::grepl`
  - `ignore.case` if `FALSE`, the pattern matching is `case sensitive` and if `TRUE`, case is ignored during matching.
  - `useBytes` logical. If `TRUE` the matching is done byte-by-byte rather than character-by-character. See ‘Details’.
- **all**: Should all elements of actual value match `regexp` (TRUE), or does only one need to match (FALSE)
- **info**: Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in `quasi_label`.
- **label**: Used to customise failure messages. For expert use only.

Details

`expect_match()` is a wrapper around `grepl()`. See its documentation for more detail about the individual arguments.

See Also

Other expectations: `comparison-expectations`, `equality-expectations`, `expect_error()`, `expect_length()`, `expect_message()`, `expect_named()`, `expect_null()`, `expect_output()`, `expect_silent()`, `inheritance-expectations`, `logical-expectations`
Examples

```r
expect_match("Testing is fun", "fun")
expect_match("Testing is fun", "f.n")

## Not run:
expect_match("Testing is fun", "horrible")

# Zero-length inputs always fail
expect_match(character(), ".")

## End(Not run)
```

---

**expect_message**

*Expectation: does code produce warnings or messages?*

**Description**

Use `expect_message()` and `expect_warning()` to check if the messages or warnings match the given regular expression.

**Usage**

```r
expect_message(
  object,
  regexp = NULL,
  \ldots,
  all = FALSE,
  info = NULL,
  label = NULL
)
```

```r
expect_warning(
  object,
  regexp = NULL,
  \ldots,
  all = FALSE,
  info = NULL,
  label = NULL
)
```

**Arguments**

- **object**
  - Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See `quasi_label` for more details.

- **regexp**
  - Regular expression to test against.
• A character vector giving a regular expression that must match the message/warning
• If NULL, the default, asserts that there should be a message/warning, but doesn’t test for a specific value.
• If NA, asserts that there shouldn’t be any messages or warnings.

Arguments passed on to `expect_match`

`perl` logical. Should Perl-compatible regexps be used?

`fixed` logical. If TRUE, pattern is a string to be matched as is. Overrides all conflicting arguments.

`all` Do messages/warnings need to match the regexp (TRUE), or does only one need to match (FALSE)?

`info` Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in `quasi_label`.

`label` Used to customise failure messages. For expert use only.

Value
The first argument, invisibly.

See Also
Other expectations: `comparison-expectations`, `equality-expectations`, `expect_error()`, `expect_length()`, `expect_match()`, `expect_named()`, `expect_null()`, `expect_output()`, `expect_silent()`, `inheritance-expectations`, `logical-expectations`

Examples

```r
f <- function(x) {
  if (x < 0) {
    message("**x** is already negative")
    return(x)
  }
  -x
}
expect_message(f(-1))
expect_message(f(-1), "already negative")
expect_message(f(1), NA)

# To test message and output, store results to a variable
expect_message(out <- f(-1), "already negative")
expect_equal(out, -1)

# You can use the arguments of grepl to control the matching
expect_message(f(-1), "**x**", fixed = TRUE)
expect_message(f(-1), "NEGATIVE", ignore.case = TRUE)
```
expect_named

Expectation: does object have names?

Description
You can either check for the presence of names (leaving expected blank), specific names (by suppling a vector of names), or absence of names (with NULL).

Usage

```r
expect_named(
  object,  # Object to test.
  expected,  # Character vector of expected names. Leave missing to match any names. Use NULL to check for absence of names.
  ignore.order = FALSE,  # If TRUE, sorts names before comparing to ignore the effect of order.
  ignore.case = FALSE,
  info = NULL,
  label = NULL
)
```

Arguments

- **object**: Object to test.
- **expected**: Character vector of expected names. Leave missing to match any names. Use NULL to check for absence of names.
- **ignore.order**: If TRUE, sorts names before comparing to ignore the effect of order.
expect_null

ignore.case
If TRUE, lowercases all names to ignore the effect of case.

info
Extra information to be included in the message. This argument is soft-deprecated
and should not be used in new code. Instead see alternatives in quasi_label.

label
Used to customise failure messages. For expert use only.

See Also

Other expectations: comparison-expectations, equality-expectations, expect_error(),
expect_length(), expect_match(), expect_message(), expect_null(), expect_output(), expect_silent(),
inheritance-expectations, logical-expectations

Examples

```r
x <- c(a = 1, b = 2, c = 3)
expect_named(x)
expect_named(x, c("a", "b", "c"))

# Use options to control sensitivity
expect_named(x, c("B", "C", "A"), ignore.order = TRUE, ignore.case = TRUE)

# Can also check for the absence of names with NULL
z <- 1:4
expect_named(z, NULL)
```

Description

This is a special case because NULL is a singleton so it's possible check for it either with expect_equal(x, NULL)
or expect_type(x, "NULL").

Usage

```r
expect_null(object, info = NULL, label = NULL)
```

Arguments

- **object**
  Object to test.
  Supports limited unquoting to make it easier to generate readable failures within
  a function or for loop. See quasi_label for more details.

- **info**
  Extra information to be included in the message. This argument is soft-deprecated
  and should not be used in new code. Instead see alternatives in quasi_label.

- **label**
  Used to customise failure messages. For expert use only.
See Also

Other expectations: comparison-expectations, equality-expectations, expect_error(), expect_length(), expect_match(), expect_message(), expect_named(), expect_output(), expect_silent(), inheritance-expectations, logical-expectations

Examples

```r
x <- NULL
y <- 10

expect_null(x)
show_failure(expect_null(y))
```

---

**expect_output**

**Expectation: does code print output to the console?**

Description

Test for output produced by `print()` or `cat()`. This is best used for very simple output; for more complex cases use `verify_output()`.

Usage

```r
expect_output(
  object,
  regexp = NULL,
  ...,
  info = NULL,
  label = NULL,
  width = 80
)
```

Arguments

- **object** Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See [quasi_label](https://example.com) for more details.
- **regexp** Regular expression to test against.
  - A character vector giving a regular expression that must match the output.
  - If `NULL`, the default, asserts that there should output, but doesn’t check for a specific value.
  - If `NA`, asserts that there should be no output.
- **...** Arguments passed on to `expect_match`

  all Should all elements of actual value match `regexp` (TRUE), or does only one need to match (FALSE)
perl logical. Should Perl-compatible regexps be used?

fixed logical. If TRUE, pattern is a string to be matched as is. Overrides all conflicting arguments.

info Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label.

label Used to customise failure messages. For expert use only.

width Number of characters per line of output. This does not inherit from `getOption("width")` so that tests always use the same output width, minimising spurious differences.

Value

The first argument, invisibly.

See Also

Other expectations: comparison-expectations, equality-expectations, expect_error(), expect_length(), expect_match(), expect_message(), expect_named(), expect_null(), expect_silent(), inheritance-expectations, logical-expectations

Examples

```r
str(mtcars)
eexpect_output(str(mtcars), "32 obs")
eexpect_output(str(mtcars), "11 variables")

# You can use the arguments of grepl to control the matching
eexpect_output(str(mtcars), "11 VARIABLES", ignore.case = TRUE)
eexpect_output(str(mtcars), "$ mpg", fixed = TRUE)
```

---

**expect_setequal**  
*Expectation: do two vectors contain the same values?*

Description

- `expect_setequal(x, y)` tests that every element of `x` occurs in `y`, and that every element of `y` occurs in `x`.
- `expect_mapequal(x, y)` tests that `x` and `y` have the same names, and that `x[names(y)]` equals `x`.

Usage

```
eexpect_setequal(object, expected)
eexpect_mapequal(object, expected)
```
### expect_silent

**Expectation:** is the code silent?

### Description

Checks that the code produces no output, messages, or warnings.

### Usage

```r
expect_silent(object)
```

### Arguments

- **object**: Object to test.
  
  Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See `quasi_label` for more details.

### Value

The first argument, invisibly.

### Examples

```r
eexpect_setequal(letters, rev(letters))
show_failure(expect_setequal(letters[-1], rev(letters)))

x <- list(b = 2, a = 1)
eexpect_mapequal(x, list(a = 1, b = 2))
show_failure(expect_mapequal(x, list(a = 1)))
show_failure(expect_mapequal(x, list(a = 1, b = "x")))
show_failure(expect_mapequal(x, list(a = 1, b = 2, c = 3)))
```
expect_vector

See Also

Other expectations: comparison-expectations, equality-expectations, expect_error(), expect_length(), expect_match(), expect_message(), expect_named(), expect_null(), expect_output(), inheritance-expectations, logical-expectations

Examples

expect_silent("123")

f <- function() {
  message("Hi!")
  warning("Hey!!")
  print("OY!!!")
}
## Not run:
expect_silent(f())
## End(Not run)

expect_vector(object, ptype = NULL, size = NULL)

Arguments

object
- Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.

ptype
- (Optional) Vector prototype to test against. Should be a size-0 (empty) generalised vector.

size
- (Optional) Size to check for.

Examples

if (requireNamespace("vctrs") && packageVersion("vctrs") > "0.1.0.9002") {
  expect_vector(1:10, ptype = integer(), size = 10)
  show_failure(expect_vector(1:10, ptype = integer(), size = 5))
  show_failure(expect_vector(1:10, ptype = character(), size = 5))
}
fail

Default expectations that always succeed or fail.

Description

These allow you to manually trigger success or failure. Failure is particularly useful to a precondition or mark a test as not yet implemented.

Usage

```r
fail(message = "Failure has been forced", info = NULL)
succeed(message = "Success has been forced", info = NULL)
```

Arguments

- `message`: a string to display.
- `info`: Character vector continuing additional information. Included for backward compatibility only and new expectations should not use it.

Examples

```r
## Not run:
test_that("this test fails", fail())
test_that("this test succeeds", succeed())
## End(Not run)
```

FailReporter

Test reporter: fail at end.

Description

This reporter will simply throw an error if any of the tests failed. It is best combined with another reporter, such as the `SummaryReporter`.

See Also

Inheritance Expectations

Expectation: does the object inherit from a S3 or S4 class, or is it a base type?

Description

See [https://adv-r.hadley.nz/oo.html](https://adv-r.hadley.nz/oo.html) for an overview of R's OO systems, and the vocabulary used here.

- `expect_type(x, type)` checks that `typeof(x)` is `type`.
- `expect_s3_class(x, class)` checks that `x` is an S3 object that `inherits()` from class
- `expect_s4_class(x, class)` checks that `x` is an S4 object that `is()` class.

Usage

```r
expect_type(object, type)
expect_s3_class(object, class, exact = FALSE)
expect_s4_class(object, class)
```

Arguments

- `object` Object to test.
  - Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See `quasi_label` for more details.
- `type` String giving base type (as returned by `typeof()`).
- `class` character vector of class names
- `exact` If `FALSE`, the default, checks that `object` inherits from `class`. If `TRUE`, checks that object has a class that's identical to `class`.

See Also

Other expectations: `comparison_expectations`, `equality_expectations`, `expect_error()`, `expect_length()`, `expect_match()`, `expect_message()`, `expect_named()`, `expect_null()`, `expect_output()`, `expect_silent()`, `logical_expectations`

Examples

```r
x <- data.frame(x = 1:10, y = "x", stringsAsFactors = TRUE)
# A data frame is an S3 object with class data.frame
expect_s3_class(x, "data.frame")
show_failure(expect_s4_class(x, "data.frame"))
# A data frame is built from a list:
expect_type(x, "list")
```
# An integer vector is an atomic vector of type "integer"
expect_type(x$x, "integer")
# It is not an S3 object
show_failure(expect_s3_class(x$x, "integer"))

# Above, we requested data.frame() converts strings to factors:
show_failure(expect_type(x$y, "character"))
expect_s3_class(x$y, "factor")
expect_type(x$y, "integer")

---

**JUnitReporter**  
Test reporter: summary of errors in jUnit XML format.

**Description**

This reporter includes detailed results about each test and summaries, written to a file (or stdout) in jUnit XML format. This can be read by the Jenkins Continuous Integration System to report on a dashboard etc. Requires the `xml2` package.

**Details**

To fit into the jUnit structure, `context()` becomes the `<testsuite>` name as well as the base of the `<testcase>` classname. The `test_that()` name becomes the rest of the `<testcase>` classname. The deparsed `expect_that()` call becomes the `<testcase>` name. On failure, the message goes into the `<failure>` node message argument (first line only) and into its text content (full message).

Execution time and some other details are also recorded.

References for the jUnit XML format: [http://llg.cubic.org/docs/junit/](http://llg.cubic.org/docs/junit/)

---

**ListReporter**  
List reporter: gather all test results along with elapsed time and file information.

**Description**

This reporter gathers all results, adding additional information such as test elapsed time, and test filename if available. Very useful for reporting.

**See Also**

LocationReporter

Test reporter: location

Description
This reporter simply prints the location of every expectation and error. This is useful if you’re trying to figure out the source of a segfault, or you want to figure out which code triggers a C/C++ breakpoint.

See Also

logical-expectations  Expectation: is the object true/false?

Description
These are fall-back expectations that you can use when none of the other more specific expectations apply. The disadvantage is that you may get a less informative error message.

Usage
expect_true(object, info = NULL, label = NULL)
expect_false(object, info = NULL, label = NULL)

Arguments
object  Object to test.
        Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
info    Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label.
label   Used to customise failure messages. For expert use only.

Details
Attributes are ignored.
See Also

is_false() for complement

Other expectations: comparison-expectations, equality-expectations, expect_error(), expect_length(),
expect_match(), expect_message(), expect_named(), expect_null(), expect_output(), expect_silent(),
inheritance-expectations

Examples

```r
expect_true(2 == 2)
  # Failed expectations will throw an error
  ## Not run:
  expect_true(2 != 2)

  ## End(Not run)
  expect_true(!(2 != 2))
  # or better:
  expect_false(2 != 2)

  a <- 1:3
  expect_true(length(a) == 3)
  # but better to use more specific expectation, if available
  expect_equal(length(a), 3)
```

---

**MinimalReporter**  
**Test reporter: minimal.**

Description

The minimal test reporter provides the absolutely minimum amount of information: whether each expectation has succeeded, failed or experienced an error. If you want to find out what the failures and errors actually were, you’ll need to run a more informative test reporter.

See Also

---

## MultiReporter

**Multi reporter: combine several reporters in one.**

### Description

This reporter is useful to use several reporters at the same time, e.g. adding a custom reporter without removing the current one.

### See Also


---

## ProgressReporter

**Test reporter: interactive progress bar of errors.**

### Description

This reporter is a reimagining of SummaryReporter designed to make the most information available up front, while taking up less space overall. It is the default reporting reporter used by test_dir() and test_file().

### Details

As an additional benefit, this reporter will praise you from time-to-time if all your tests pass.

### See Also


---

## RstudioReporter

**Test reporter: RStudio**

### Description

This reporter is designed for output to RStudio. It produces results in any easily parsed form.

### See Also

**SilentReporter**

*Test reporter: gather all errors silently.*

**Description**

This reporter quietly runs all tests, simply gathering all expectations. This is helpful for programmatically inspecting errors after a test run. You can retrieve the results with the `expectations()` method.

**See Also**


---

**skip**

*Skip a test.*

**Description**

This function allows you to skip a test if it’s not currently available. This will produce an informative message, but will not cause the test suite to fail.

**Usage**

```r
skip(message)

skip_if_not(condition, message = deparse(substitute(condition)))

skip_if(condition, message = NULL)

skip_if_not_installed(pkg, minimum_version = NULL)

skip_if_offline(host = "r-project.org")

skip_on_cran()

skip_on_os(os)

skip_on_travis()

skip_on_appveyor()

skip_on_ci()
```
skip_on_covr()
skip_on_bioc()

skip_if_translated(msgid = "'%s' not found")

**Arguments**

- **message**: A message describing why the test was skipped.
- **condition**: Boolean condition to check. `skip_if_not()` will skip if `FALSE`, `skip_if()` will skip if `TRUE`.
- **pkg**: Name of package to check for minimum_version
- **minimum_version**: Minimum required version for the package
- **host**: A string with a hostname to lookup
- **os**: Character vector of system names. Supported values are "windows", "mac", "linux" and "solaris".
- **msgid**: R message identifier used to check for translation: the default uses a message included in most translation packs. See the complete list in `R-base.pot`.

**Details**

`skip*` functions are intended for use within `test_that()` blocks. All expectations following the `skip*` statement within the same `test_that` block will be skipped. Test summaries that report skip counts are reporting how many `test_that` blocks triggered a `skip*` statement, not how many expectations were skipped.

**Helpers**

- `skip_if_not()` works like `stopifnot()`, generating a message automatically based on the first argument.
- `skip_if_offline()` skips tests if an internet connection is not available using `curl::nslookup()`.
- `skip_on_cran()` skips tests on CRAN, using the `NOT_CRAN` environment variable set by devtools.
- `skip_on_travis()` skips tests on Travis CI by inspecting the `TRAVIS` environment variable.
- `skip_on_appveyor()` skips tests on AppVeyor by inspecting the `APPVEYOR` environment variable.
- `skip_on_ci()` skips tests on continuous integration systems by inspecting the CI environment variable.
- `skip_on_covr()` skips tests when covr is running by inspecting the `R_COVR` environment variable.
- `skip_on_bioc()` skips tests on Bioconductor by inspecting the `BBS_HOME` environment variable.
- `skip_if_not_installed()` skips a tests if a package is not installed or cannot be loaded (useful for suggested packages). It loads the package as a side effect, because the package is likely to be used anyway.
Examples

```r
if (FALSE) skip("No internet connection")

## The following are only meaningful when put in test files and
## run with `test_file`, `test_dir`, `test_check`, etc.

test_that("skip example", {
  expect_equal(1, 1L) # this expectation runs
  skip('skip')
  expect_equal(1, 2) # this one skipped
  expect_equal(1, 3) # this one is also skipped
})
```

---

**StopReporter**  
*Test reporter: stop on error.*

**Description**

The default reporter, executed when `expect_that` is run interactively. It responds by `stop()` ping on failures and doing nothing otherwise. This will ensure that a failing test will raise an error.

**Details**

This should be used when doing a quick and dirty test, or during the final automated testing of R CMD check. Otherwise, use a reporter that runs all tests and gives you more context about the problem.

**See Also**


---

**SummaryReporter**  
*Test reporter: summary of errors.*

**Description**

This is a reporter designed for interactive usage: it lets you know which tests have run successfully and as well as fully reporting information about failures and errors.

**Details**

You can use the `max_reports` field to control the maximum number of detailed reports produced by this reporter. This is useful when running with `auto_test()`

As an additional benefit, this reporter will praise you from time-to-time if all your tests pass.
TapReporter

See Also


---

TapReporter

Test reporter: TAP format.

Description

This reporter will output results in the Test Anything Protocol (TAP), a simple text-based interface between testing modules in a test harness. For more information about TAP, see http://testanything.org

See Also


---

TeamcityReporter

Test reporter: Teamcity format.

Description

This reporter will output results in the Teamcity message format. For more information about Teamcity messages, see http://confluence.jetbrains.com/display/TCD7/Build%20Script+Interaction+with+TeamCity

See Also

Description

Code in a `setup()` block is run immediately in a clean environment. Code in a `teardown()` block is run upon completion of a test file, even if it exits with an error. Multiple calls to `teardown()` will be executed in the order they were created.

Usage

```r
setup(code, env = parent.frame())
```

```r
tear down(code, env = parent.frame())
```

Arguments

- **code**: Code to evaluate
- **env**: Environment in which code will be evaluated. For expert use only.

Examples

```r
## Not run:
tmp <- tempfile()
setup(writeLines(tmp, "some test data"))
tear down(unlink(tmp))

## End(Not run)
```

test_dir

*Run all tests in directory or package*

Description

Use `test_dir()` for a collection of tests in a directory; use `test_package()` interactively at the console, and `test_check()` inside of R CMD check.

In your own code, you can use `is_testing()` to determine if code is being run as part of a test and `testing_package()` to retrieve the name of the package being tested. You can also check the underlying env var directly `identical(Sys.getenv("TESTTHAT"), "true")` to avoid creating a run-time dependency on testthat.
test_dir

Usage

test_dir(
    path,  # Path to directory containing tests.
    filter = NULL,  # If not NULL, only tests with file names matching this regular expression will be executed. Matching be performed on the file name after it has been stripped of "test-" and ".R".
    reporter = default_reporter(),  # Reporter to use to summarise output. Can be supplied as a string (e.g. "summary") or as an R6 object (e.g. SummaryReporter$new()).
    env = test_env(),  
    ...,  
    encoding = "unknown",  
    load_helpers = TRUE,  
    stop_on_failure = FALSE,  
    stop_on_warning = FALSE,  
    wrap = TRUE  
)

test_package(  
    package,  # Path to package containing tests.
    filter = NULL,  
    reporter = check_reporter(),  
    ...,  
    stop_on_failure = TRUE,  
    stop_on_warning = FALSE  
)

test_check(  
    package,  
    filter = NULL,  
    reporter = check_reporter(),  
    ...,  
    stop_on_failure = TRUE,  
    stop_on_warning = FALSE,  
    wrap = TRUE  
)

is_testing()

testing_package()

Arguments

path        Path to directory containing tests.
filter      If not NULL, only tests with file names matching this regular expression will be executed. Matching be performed on the file name after it has been stripped of "test-" and ".R".
reporter    Reporter to use to summarise output. Can be supplied as a string (e.g. "summary") or as an R6 object (e.g. SummaryReporter$new()).
            See Reporter for more details and a list of built-in reporters.
env         Environment in which to execute the tests. Expert use only.
Additional arguments passed to `grep()` to control filtering.

**encoding**

Deprecated. All files now assumed to be UTF-8.

**load_helpers**

Source helper files before running the tests? See `source_test_helpers()` for more details.

**stop_on_failure**

If TRUE, throw an error if any tests fail.

For historical reasons, the default value of `stop_on_failure` is TRUE for `test_package()` and `test_check()` but FALSE for `test_dir()`, so if you're calling `test_dir()` you may want to consider explicitly setting `stop_on_failure = TRUE`.

**stop_on_warning**

If TRUE, throw an error if any tests generate warnings.

**wrap**

Automatically wrap all code within `test_that()`? This ensures that all expectations are reported, even if outside a test block.

**package**

Name of installed package.

Value

A list of test results.

Test files

For package code, tests should live in `tests/testthat`.

There are four classes of `.R` files that have special behaviour:

- Test files start with `test` and are executed in alphabetical order.
- Helper files start with `helper` and are executed before tests are run and from `devtools::load_all()`.
- Setup files start with `setup` and are executed before tests, but not during `devtools::load_all()`.
- Teardown files start with `teardown` and are executed after the tests are run.

Environments

Each test is run in a clean environment to keep tests as isolated as possible. For package tests, that environment that inherits from the package's namespace environment, so that tests can access internal functions and objects.

R CMD check

To run testthat automatically from R CMD check, make sure you have a `tests/testthat.R` that contains:

```r
library(testthat)
library(yourpackage)

test_check("yourpackage")
```

Examples

```r
test_dir(testthat_examples(), reporter = "summary")
test_dir(testthat_examples(), reporter = "minimal")
```
Run all tests in specified file

Description

Execute code in the specified file, displaying results using a reporter. Use this function when you want to run a single file’s worth of tests. You are responsible for ensuring that the functions to test are available in the global environment.

Usage

test_file(
  path,
  reporter = default_reporter(),
  env = test_env(),
  start_end_reporter = TRUE,
  load_helpers = TRUE,
  encoding = "unknown",
  wrap = TRUE
)

Arguments

path Path to file.
reporter Reporter to use to summarise output. Can be supplied as a string (e.g. "summary") or as an R6 object (e.g. SummaryReporter$new()). See Reporter for more details and a list of built-in reporters.
env Environment in which to execute the tests. Expert use only.
start_end_reporter Should the reporters start_reporter() and end_reporter() methods be called? For expert use only.
load_helpers Source helper files before running the tests? See source_test_helpers() for more details.
encoding Deprecated. All files now assumed to be UTF-8.
wrap Automatically wrap all code within test_that()? This ensures that all expectations are reported, even if outside a test block.

Details

Any errors that occur in code run outside of test_that() will generate a test failure and terminate execution of that test file.

Value

Invisibly, a list with one element for each test.
Examples

```r
path <- testthat_example("success")
test_file(path, reporter = "minimal")
```

# test_file() invisibly returns a list, with one element for each test.
# This can be useful if you want to compute on your test results.
out <- test_file(path, reporter = "minimal")
str(out[[1]])

---

test_path

*Locate file in testing directory.*

---

Description

This function is designed to work both interatively and during tests, locating files in the `tests/testthat` directory.

Usage

```r
test_path(....)
```

Arguments

... Character vectors giving path component.

Value

A character vector giving the path.

---

test_that

*Create a test.*

---

Description

A test encapsulates a series of expectations about small, self-contained set of functionality. Each test is contained in a context and contains multiple expectations.

Usage

```r
test_that(desc, code)
```

Arguments

- **desc** test name. Names should be kept as brief as possible, as they are often used as line prefixes.
- **code** test code containing expectations
Details

Tests are evaluated in their own environments, and should not affect global state.
When run from the command line, tests return NULL if all expectations are met, otherwise it raises an error.

Examples

test_that("trigonometric functions match identities", {
  expect_equal(sin(pi / 4), 1 / sqrt(2))
  expect_equal(cos(pi / 4), 1 / sqrt(2))
  expect_equal(tan(pi / 4), 1)
})

# Failing test:
## Not run:
test_that("trigonometric functions match identities", {
  expect_equal(sin(pi / 4), 1)
})

## End(Not run)

use_catch

Use Catch for C++ Unit Testing

Description

Add the necessary infrastructure to enable C++ unit testing in R packages with Catch and testthat.

Usage

use_catch(dir = getwd())

Arguments

dir

The directory containing an R package.

Details

Calling use_catch() will:

1. Create a file src/test-runner.cpp, which ensures that the testthat package will understand how to run your package’s unit tests,
2. Create an example test file src/test-example.cpp, which showcases how you might use Catch to write a unit test,
3. Add a test file tests/testthat/test-cpp.R, which ensures that testthat will run your compiled tests during invocations of devtools::test() or R CMD check, and
4. Create a file R/catch-routine-registration.R, which ensures that R will automatically register this routine when tools::package_native_routine_registration_skeleton() is invoked.
C++ unit tests can be added to C++ source files within the src directory of your package, with a format similar to R code tested with testthat. Here’s a simple example of a unit test written with testthat + Catch:

```cpp
context("C++ Unit Test") {
  test_that("two plus two is four") {
    int result = 2 + 2;
    expect_true(result == 4);
  }
}
```

When your package is compiled, unit tests alongside a harness for running these tests will be compiled into your R package, with the C entry point `run_testthat_tests()`. testthat will use that entry point to run your unit tests when detected.

Functions

All of the functions provided by Catch are available with the CATCH_ prefix – see here for a full list. testthat provides the following wrappers, to conform with testthat’s R interface:

<table>
<thead>
<tr>
<th>Function</th>
<th>Catch</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>context</td>
<td>CATCH_TEST_CASE</td>
<td>The context of a set of tests.</td>
</tr>
<tr>
<td>test_that</td>
<td>CATCH_SECTION</td>
<td>A test section.</td>
</tr>
<tr>
<td>expect_true</td>
<td>CATCH_CHECK</td>
<td>Test that an expression evaluates to true.</td>
</tr>
<tr>
<td>expect_false</td>
<td>CATCH_CHECK_FALSE</td>
<td>Test that an expression evaluates to false.</td>
</tr>
<tr>
<td>expect_error</td>
<td>CATCH_CHECK_THROWS</td>
<td>Test that evaluation of an expression throws an exception.</td>
</tr>
<tr>
<td>expect_error_as</td>
<td>CATCH_CHECK_THROWS_AS</td>
<td>Test that evaluation of an expression throws an exception of a specific class</td>
</tr>
</tbody>
</table>

In general, you should prefer using the testthat wrappers, as testthat also does some work to ensure that any unit tests within will not be compiled or run when using the Solaris Studio compilers (as these are currently unsupported by Catch). This should make it easier to submit packages to CRAN that use Catch.

Symbol Registration

If you’ve opted to disable dynamic symbol lookup in your package, then you’ll need to explicitly export a symbol in your package that testthat can use to run your unit tests. testthat will look for a routine with one of the names:

```cpp
C_run_testthat_tests
C_run_testthat_tests
run_testthat_tests
```

See Controlling Visibility and Registering Symbols in the Writing R Extensions manual for more information.
Advanced Usage

If you’d like to write your own Catch test runner, you can instead use the `testthat::catchSession()` object in a file with the form:

```c++
#define TESTTHAT_TEST_RUNNER
#include <testthat.h>

void run()
{
    Catch::Session& session = testthat::catchSession();
    // interact with the session object as desired
}
```

This can be useful if you’d like to run your unit tests with custom arguments passed to the Catch session.

Standalone Usage

If you’d like to use the C++ unit testing facilities provided by Catch, but would prefer not to use the regular `testthat` R testing infrastructure, you can manually run the unit tests by inserting a call to:

```r
.Call("run_testthat_tests", PACKAGE = <pkgName>)
```

as necessary within your unit test suite.

See Also

Catch, the library used to enable C++ unit testing.

---

**verify_output**

Verify output

Description

This is a regression test that records interwoven code and output into a file, in a similar way to knitting an .Rmd (but see caveats below).

`verify_output()` designed particularly for testing print methods and error messages, where the primary goal is to ensure that the output is helpful to a human. Obviously, you can’t test that with code, so the best you can do is make the results explicit by saving them to text file. This makes the output easy to see in code reviews, and ensures that you don’t change the output accidentally.

`verify_output()` is designed to be used with git: to see what has changed from the previous run, you’ll need to use git diff or similar.
Usage

```r
verify_output(
  path,
  code,
  width = 80,
  crayon = FALSE,
  unicode = FALSE,
  env = caller_env()
)
```

Arguments

- **path**: Path to record results. This should usually be a call to `test_path()` to ensure that the same path is used when run interactively (when the working directory is typically the project root), and when run as an automated test (when the working directory will be `tests/testthat`).

- **code**: Code to execute. This will usually be a multiline expression contained within `{}` (similarly to `test_that()` calls).

- **width**: Width of console output

- **crayon**: Enable crayon package colouring?

- **unicode**: Enable cli package UTF-8 symbols? If you set this to `TRUE`, call `skip_if(!cli::is_utf8_output())` to disable the test on your CI platforms that don't support UTF-8 (e.g. Windows).

- **env**: The environment to evaluate `code` in.

Syntax

`verify_output()` can only capture the abstract syntax tree, losing all whitespace and comments. To mildly offset this limitation:

- Strings are converted to R comments in the output.
- Strings starting with `#` are converted to headers in the output.

CRAN

On CRAN, `verify_output()` will never fail, even if the output changes. This avoids false positives because tests of print methods and error messages are often fragile due to implicit dependencies on other packages, and failure does not imply incorrect computation, just a change in presentation.

Examples

```r
# The first argument would usually be `test_path("informative-name.txt")`
# but that is not permitted in examples
path <- tempfile()
verify_output(path, {
  head(mtcars)
  log(-10)
}
```
"a" * 3
})
writeLines(readLines(path))

# Use strings to create comments in the output
verify_output(tempfile(), {
    "Print method"
    head(mtcars)

    "Warning"
    log(-10)

    "Error"
    "a" * 3
})

# Use strings starting with # to create headings
verify_output(tempfile(), {
    "# Base functions"
    head(mtcars)
    log(-10)
    "a" * 3
})
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