Package ‘testthat’

December 17, 2020

Title  Unit Testing for R
Version  3.0.1
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’.
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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

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 design to ensure that you see something useful there.

See Also

Comparison Expectations

*Does code return a number greater/less than the expected value?*

**Description**

Does code return a number greater/less than the expected 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_named()`, `expect_null()`, `expect_output()`, `expect_reference()`, `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)
```
DebugReporter

Test reporter: start recovery.

Description

This reporter will call a modified version of \texttt{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

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 \texttt{it} block. Each \texttt{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 your write any code. After that, you start to implement the tests for each specification (i.e. the \texttt{it} block).

Use describe to verify that you implement the right things and use \texttt{test_that()} to ensure you do the things right.
Examples

describe("matrix()", {
    it("can be multiplied by a scalar", {
        m1 <- matrix(1:4, 2, 2)
        m2 <- m1 * 2
        expect_equal(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_equal(1 + 1, addition(1, 1))
        })
    })
    describe("division()", {
        it("can divide two numbers", {
            expect_equal(10 / 2, division(10, 2))
        })
        it("can handle division by 0") # not yet implemented
    })
})

equality-expectations  Does code return the expected value?

Description

These functions provide two levels of strictness when comparing a computation to a reference value. expect_identical() is the baseline; expect_equal() relaxes the test to ignore small numeric differences.

In the 2nd edition, expect_identical() uses identical() and expect_equal uses all.equal(). In the 3rd edition, both functions use waldo. They differ only in that expect_equal() sets tolerance = testthat.tolerance() so that small floating point differences are ignored; this also implies that (e.g.) 1 and 1L are treated as equal.

Usage

expect_equal(
    object,
    expected,
tolerance = if (edition_get() >= 3) testthat_tolerance(),
info = NULL,
label = NULL,
expected.label = NULL
)

effect_identical(
    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.

- **tolerance**: passed on to waldo::compare(). If non-NULL, will ignore small floating point differences. It uses same algorithm as all.equal() so the tolerance is usually relative (i.e. mean(abs(x - y) / mean(abs(y)) < tolerance), except when the differences are very small, when it becomes absolute (i.e. mean(abs(x - y) < tolerance). See waldo documentation 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, expected.label**: Used to customise failure messages. For expert use only.

See Also

- **expect_setequal()**/expect_mapequal() to test for set equality.
- **expect_reference()** to test if two names point to same memory address.

Other expectations: comparison-expectations, expect_error(), expect_length(), expect_match(), expect_named(), expect_null(), expect_output(), expect_reference(), expect_silent(), inheritance-expectations, logical-expectations
**Examples**

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

# Use expect_equal() when testing for numeric equality
## Not run:
expect_identical(sqrt(2) ^ 2, 2)

## End(Not run)
expect_equal(sqrt(2) ^ 2, 2)
```

---

**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()`

---

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<th>Does code throw an error, warning, message, or other condition?</th>
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**Description**

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

In the 3rd edition, these functions match a single condition. All additional and non-matching (if `regexp` or `class` are used) conditions will bubble up outside the expectation. If these additional conditions are important you’ll need to catch them with additional `expect_message()`/`expect_warning()` calls; if they’re unimportant you can ignore with `suppressMessages()`/`suppressWarnings()`.

**Usage**

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

expect_warning(
  object,
  regexp = NULL,
  class = NULL,
  ..., 
  all = FALSE,
  info = NULL,
  label = NULL
)

expect_message(
  object,
  regexp = NULL,
  class = NULL,
  ..., 
)```
expect_error

    all = FALSE,
    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
        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.
  all  DEPRECATED If you need to test multiple warnings/messages you now need
        to use multiple calls to expect_message()/expect_warning()

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`.

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 recommend using `expect_snapshot()` instead.

**See Also**

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

**Examples**

```r
# Errors ------------------------------------------------------------------
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)

# Note that `expect_error()` returns the error object so you can test
# its components if needed
err <- expect_error(rlang::abort("a", n = 10))
expect_equal(err$n, 10)

# Warnings ------------------------------------------------------------------
f <- function(x) {
  if (x < 0) {
    warning("x is already negative")
    return(x)
  }
  -x
}
expect_warning(f(-1))
expect_warning(f(-1), "already negative")
expect_warning(f(1), NA)

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

# Messages ------------------------------------------------------------------
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)
```

expect_invisible

Does code return a visible or invisible object?

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

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

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  

Does code return a vector with the specified length?

Description

Does code return a vector with 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

expect_vector() to make assertions about the "size" of a vector

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

Examples

expect_length(1, 1)
expect_length(1:10, 10)

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

## End(Not run)

expect_named  

Does code return a vector with (given) names?

Description

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

Usage

expect_named(
  object,
  expected,
  ignore.order = FALSE,
  ignore.case = 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.

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.

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_null(), expect_output(), expect_reference(), 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**

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` 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.
expect_setequal

See Also

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

Examples

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

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

---

**expect_setequal**

Does code return a vector containing the expected 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 `y`.

**Usage**

```r
expect_setequal(object, expected)
expect_mapequal(object, expected)
```

**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` 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.

**Details**

Note that `expect_setequal()` ignores names, and you will be warned if both `object` and `expected` have them.
Examples

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

```
x <- list(b = 2, a = 1)
expect_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)))
```

Description

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

Usage

```
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.

See Also

Other expectations: `comparison-expectations`, `equality-expectations`, `expect_error()`, `expect_length()`, `expect_match()`, `expect_named()`, `expect_null()`, `expect_output()`, `expect_reference()`, `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_snapshot**  

**Snapshot testing**

**Description**

**Experimental**

Snapshot tests (aka golden tests) are similar to unit tests except that the expected result is stored in a separate file that is managed by testthat. Snapshot tests are useful for when the expected value is large, or when the intent of the code is something that can only be verified by a human (e.g. this is a useful error message). Learn more in vignette("snapshotting").

- `expect_snapshot()` captures all messages, warnings, errors, and output from code.
- `expect_snapshot_output()` captures just output printed to the console.
- `expect_snapshot_error()` captures just error messages.
- `expect_snapshot_value()` captures the return value.

(These functions supersede `verify_output()`, `expect_known_output()`, `expect_known_value()`, and `expect_known_hash()`.)

**Usage**

```r
eexpect_snapshot(x, cran = FALSE, error = FALSE)
```

```r
eexpect_snapshot_output(x, cran = FALSE)
```

```r
eexpect_snapshot_error(x, class = "error", cran = FALSE)
```

```r
eexpect_snapshot_value(
  x,
  style = c("json", "json2", "deparse", "serialize"),
  cran = FALSE,
  ...
)
```

**Arguments**

- `x` Code to evaluate.
- `cran` Should these expectations be verified on CRAN? By default, they are not, because snapshot tests tend to be fragile because they often rely on minor details of dependencies.
- `error` Do you expect the code to throw an error? The expectation will fail (even on CRAN) if an unexpected error is thrown or the expected error is not thrown.
- `class` Expected class of condition, e.g. use `error` for errors, `warning` for warnings, `message` for messages. The expectation will always fail (even on CRAN) if a condition of this class isn’t seen when executing `x`.
style  Serialization style to use:
• json uses `jsonlite::fromJSON()` and `jsonlite::toJSON()`. This produces the simplest output but only works for relatively simple objects.
• json2 uses `jsonlite::serializeJSON()` and `jsonlite::unserializeJSON()` which are more verbose but work for a wider range of types.
• deparse uses `deparse()`, which generates a depiction of the object using R code.
• serialize() produces a binary serialization of the object using `serialize()`. This is all but guaranteed to work for any R object, but produces a completely opaque serialization.

... For `expect_snapshot_value()` only, passed on to `waldo::compare()` so you can control the details of the comparison.

Workflow
The first time that you run a snapshot expectation it will run x, capture the results, and record in `tests/testthat/snap/{test}.json`. Each test file gets its own snapshot file, e.g. `test-foo.R` will get `snap/foo.json`.

It’s important to review the JSON files and commit them to git. They are designed to be human readable, and you should always review new additions to ensure that the salient information has been capture. They should also be carefully reviewed in pull requests, to make sure that snapshots have updated in the expected way.

On subsequent runs, the result of x will be compared to the value stored on disk. If it’s different, the expectation will fail, and a new file `snap/{test}.new.json` will be created. If the change was deliberate, you can approve the change with `snapshot_accept()` and then the tests will pass the next time you run them.

Note that snapshotting can only work when executing a complete test file (with `test_file()`, `test_dir()`, or friends) because there’s otherwise no way to figure out the snapshot path. If you run snapshot tests interactively, they’ll just display the current value.

---

**expect_snapshot_file**  
*Snapshot testing for whole files*

**Description**
Whole file snapshot testing is designed for testing objects that don’t have a convenient textual representation, with initial support for images (.png, .jpg, .svg), data frames (.csv), and text files (.R, .txt, .json,...).

The first time `expect_snapshot_file()` is run, it will create `_snaps/{test}/[name].{ext}` containing reference output. Future runs will be compared to this reference: if different, the test will fail and the new results will be saved in `_snaps/{test}/[name].new.{ext}`. To review failures, call `snapshot_review()`.

We generally expect this function to be used via a wrapper that takes care of ensuring that output is as reproducible as possible, e.g. automatically skipping tests where it’s known that images can’t be reproduced exactly.
expect_snapshot_file

Usage

expect_snapshot_file(path, name = basename(path), binary = TRUE, cran = FALSE)

Arguments

- **path**: Path to file to snapshot.
- **name**: Snapshot name, taken from path by default.
- **binary**: If FALSE, files are compared line-by-line, ignoring the difference between Windows and Mac/Linux line endings.
- **cran**: Should these expectations be verified on CRAN? By default, they are not, because snapshot tests tend to be fragile because they often rely on minor details of dependencies.

Examples

```r
# To use expect_snapshot_file() you'll typically need to start by writing
# a helper function that creates a file from your code, returning a path
save_png <- function(code, width = 400, height = 400) {
  path <- tempfile(fileext = ".png")
  png(path, width = width, height = height)
  on.exit(dev.off())
  code

  path
}
path <- save_png(plot(1:5))
path

## Not run:
expect_snapshot_file(save_png(hist(mtcars$mpg)), "plot.png")

## End(Not run)

# You'd then also provide a helper that skips tests where you can't
# be sure of producing exactly the same output
expect_snapshot_plot <- function(name, code) {
  # Other packages might affect results
  skip_if_not_installed("ggplot2", "2.0.0")
  # Or maybe the output is different on some operation systems
  skip_on_os("windows")
  # You'll need to carefully think about and experiment with these skips
  path <- save_png(code)
  expect_snapshot_file(path, paste0(name, ".png"))
}
```
expect_vector  
Does code return a vector with the expected size and/or prototype?

Description

expect_vector() is a thin wrapper around `vctrs::vec_assert()`, converting the results of that function into the expectations used by testthat. This means that it used the vctrs of `ptype` (prototype) and `size`. See details in [https://vctrs.r-lib.org/articles/type-size.html](https://vctrs.r-lib.org/articles/type-size.html)

Usage

```r
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

```r
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)
```
FailReporter

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

Does code return an object inheriting from the expected base type, S3 class, or S4 class?

Description

See 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.

See expect_vector() for testing properties of objects created by vctrs.
Usage

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_named(), expect_null(), expect_output(), expect_reference(), expect_silent(), logical-expectations

Examples

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")
is_testing  

Determine testing status

Description

- `is_testing()` determine if code is being run as part of a test
- `is_parallel()` if the test is being run in parallel.
- `testing_package()` gives name of the package being tested.

These are thin wrappers that retrieve the values of environment variables. To avoid creating a run-time dependency on testthat, you can inline the source of these functions directly into your package.

Usage

```r
is_testing()
is_parallel()
testing_package()
```

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**

*Does code return TRUE or 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**

```r
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_named(), expect_null(), expect_output(), expect_reference(), expect_silent(), inheritance-expectations

Examples

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)

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

ProgressReporter is designed for interactively use. It’s goal is to give you actionable insights to help you understand the status of your code. This reporter also praises you from time-to-time if all your tests pass. It’s the default reporter for test_dir().

ParallelProgressReporter is very similar to ProgressReporter, but works better for packages that want parallel tests.

CompactProgressReporter is a minimal version of ProgressReporter designed for use with single files. It’s the default reporter for test_file().

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**

`skip_if()` and `skip_if_not()` allow you to skip tests, immediately concluding a `test_that()` block without executing any further expectations. This allows you to skip a test without failure, if for some reason it can’t be run (e.g. it depends on the feature of a specific operating system, or it requires a specific version of a package).

See vignette("skipping") for more details.
Usage

skip(message)

skip_if_not(condition, message = NULL)

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 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.

Helpers

• skip_if_not_installed("pkg") skips tests if package "pkg" is not installed or cannot be loaded (using requireNamespace()). Generally, you can assume that suggested packages are installed, and you do not need to check for them specifically, unless they are particularly difficult to install.
• skip_if_offline() skips if an internet connection is not available (using `curl::nslookup()`).
• skip_if_translated("msg") skips tests if the "msg" is translated.
• skip_on_bioc() skips on Bioconductor (using the BBS_HOME env var).
• skip_on_cran() skips on CRAN (using the NOT_CRAN env var set by devtools and friends).
• skip_on_covr() skips when covr is running (using the R_COVR env var).
• skip_on_ci() skips on continuous integration systems like GitHub Actions, travis, and appveyor (using the CI env var). It supersedes the older skip_on_travis() and skip_on_appveyor() functions.
• skip_on_os() skips on the specified operating system(s) ("windows", "mac", "linux", or "solaris").

Examples

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

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
})
```

---

**snapshot_accept**  
**Snapshot management**

**Description**

• `snapshot_accept()` accepts all modified snapshots.
• `snapshot_review()` opens a Shiny app that shows a visual diff of each modified snapshot. This is particularly useful for whole file snapshots created by `expect_snapshot_file()`.

**Usage**

```r
snapshot_accept(files = NULL, path = "tests/testthat")

snapshot_review(files = NULL, path = "tests/testthat")
```

**Arguments**

- `files`  
  Optionally, filter affects to snapshots from specified test files. Can be full path to test (tests/testthat/test-foo.R), file name (test-foo.R), or test name (foo).

- `path`  
  Path to tests.
StopReporter

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.

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+Script+Interaction+with+TeamCity

See Also


teardown_env

Run code after all test files

Description

This environment has no purpose other than as a handle for withr::defer(): use it when you want to run code after all tests have been run. Typically, you’ll use withr::defer(cleanup(), teardown_env()) immediately after you’ve made a mess in a setup-* .R file.

Usage

teardown_env()
test_file

Run all tests in a single file

Description
Helper, setup, and teardown files located in the same directory as the test will also be run.

Usage
test_file(path, reporter = default_compact_reporter(), package = NULL, ...)

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.
- package: If these tests belong to a package, the name of the package.
- ...: Additional parameters passed on to test_dir()

Value
A list (invisibly) containing data about the test results.

Special files
There are two types of .R file that have special behaviour:
- Test files start with test and are executed in alphabetical order.
- Setup files start with setup and are executed before tests. If clean up is needed after all tests have been run, you can use withr::defer(clean_up(), teardown_env()). See vignette("test-fixtures") for more details.

There are two other types of special file that we no longer recommend using:
- Helper files start with helper and are executed before tests are run. They’re also loaded by devtools::load_all(), so there’s no real point to them and you should just put your helper code in R/.
- Teardown files start with teardown and are executed after the tests are run. Now we recommend interleave setup and cleanup code in setup-files, making it easier to check that you automatically clean up every mess that you make.

All other files are ignored by testthat.

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.
Examples

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

---

### `test_package`

**Run all tests in a package**

### Description

- `test_local()` tests a local source package.
- `test_package()` tests an installed package.
- `test_check()` checks a package during R CMD check.

Tests live in `tests/testthat`

### Usage

```r
test_package(package, reporter = check_reporter(), ...)

  test_check(package, reporter = check_reporter(), ...)

  test_local(path = ".", reporter = NULL, ...)
```

### Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>package</code></td>
<td>If these tests belong to a package, the name of the package.</td>
</tr>
<tr>
<td><code>reporter</code></td>
<td>Reporter to use to summarise output. Can be supplied as a string (e.g. &quot;summary&quot;) or as an R6 object (e.g. SummaryReporter$new()). See <code>Reporter</code> for more details and a list of built-in reporters.</td>
</tr>
<tr>
<td><code>...</code></td>
<td>Additional arguments passed to <code>test_dir()</code></td>
</tr>
<tr>
<td><code>path</code></td>
<td>Path to directory containing tests.</td>
</tr>
</tbody>
</table>

### Value

A list (invisibly) containing data about the test results.

### 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")
```
**Special files**

There are two types of `.R` file that have special behaviour:

- Test files start with `test` and are executed in alphabetical order.
- Setup files start with `setup` and are executed before tests. If clean up is needed after all tests have been run, you can use `withr::defer(clean_up(), teardown_env())`. See vignette("test-fixtures") for more details.

There are two other types of special file that we no longer recommend using:

- Helper files start with `helper` and are executed before tests are run. They’re also loaded by `devtools::load_all()`, so there’s no real point to them and you should just put your helper code in `R/`.
- Teardown files start with `teardown` and are executed after the tests are run. Now we recommend interleave setup and cleanup code in setup-files, making it easier to check that you automatically clean up every mess that you make.

All other files are ignored by testthat.

**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.

---

**test_path**

*Locate file in testing directory.*

**Description**

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

**Usage**

```
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. Braces `{}` should always be used in order to get accurate location data for test failures.

**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**

```r
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 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.

You will also need to:

- Add xml2 to Suggests, with e.g. `usethis::use_package("xml2","Suggests")`
- Add testthat to LinkingTo, with e.g. `usethis::use_package("testthat","LinkingTo")`

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:

```
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:

```
#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.
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