



R Packages: Test R Code



**It's not that you don't test
your code, it's that you
don't automate your tests.**

—Hadley Wickham

testthat: Unit tests for R



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Automate tests (*use_test()*)
using expectations



testthat: Unit tests for R



Automate tests (`use_test()`)
using expectations

Run tests with `test()`,
`test_file()`, `Cmd/Ctrl` +
`Shift` + `T`.



testthat: Unit tests for R



Automate tests (`use_test()`)
using expectations

Run tests with `test()`,
`test_file()`, Cmd/Ctrl +
Shift + T.

Also runs during R CMD Check
(`check()`)





workflow alert



experimenting
in the console



use_test()
test()
check()



```
use_test("themes")
```

```
shinRa
```

```
├── .Rbuildignore
```

```
├── .gitignore
```

```
├── DESCRIPTION
```

```
├── NAMESPACE
```

```
├── R/
```

```
│   ├── themes.R
```

```
├── man
```

```
│   ├── theme_mako.Rd
```

```
└── tests
```

```
    ├── testthat
```

```
        └── test-themes.R
```

```
    └── testthat.R
```

```
└── shinRa.Rproj
```



Test files

test/testthat/test-themes.R

```
test_that("theme works", {  
  expect_true(ggplot2::is.theme(theme_mako()))  
  expect_error(theme_mako(base_size = "14"))  
})
```



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```



Test files

```
test()
```

```
## Loading shinRa
## Testing shinRa
## ✓ | OK F W S | Context
## ✓ | 2 | themes
##
## == Results ==
## OK: 2
## Failed: 0
## Warnings: 0
## Skipped: 0
```



Test files

test/testthat/test-themes.R

```
test_that("theme works", {  
  expect_true(ggplot2::is.theme(theme_mako()))  
  expect_error(theme_mako(base_size = "14"))  
  expect_equal(theme_mako(), ggplot2::theme_dark())  
})
```



```
test()
```

```
Loading shinRa
```

```
✓ | OK F W S | Context
```

```
x | 2 1 | themes
```

```
test-themes.R:4: failure: theme works
```

```
theme_mako() not equal to ggplot2::theme_dark().
```

```
Component "line": Component "size": Mean relative difference: 0.2142857
```

```
Component "rect": Component "size": Mean relative difference: 0.2142857
```

```
Component "text": Component "size": Mean relative difference: 0.2142857
```

```
Component "axis.title.x": Component "margin": Mean relative difference: 0.2142857
```

```
Component "axis.title.x.top": Component "margin": Mean relative difference: 0.2142857
```

```
Component "axis.title.y": Component "margin": Mean relative difference: 0.2142857
```

```
Component "axis.title.y.right": Component "margin": Mean relative difference: 0.2142857
```

```
Component "axis.text.x": Component "margin": Mean relative difference: 0.2142857
```

```
Component "axis.text.x.top": Component "margin": Mean relative difference: 0.21
```



Test files

test/testthat/test-themes.R

```
test_that("theme works", {  
  expect_true(ggplot2::is.theme(theme_mako()))  
  expect_error(theme_mako(base_size = "14"))  
  expect_equal(theme_mako(), ggplot2::theme_dark())  
})
```



Expectations (`expect_*()`)

function	expectation
<code>expect_equal(x, y)</code>	the same, more or less
<code>expect_identical(x, y)</code>	the exact same
<code>expect_message/warning/error(x, y)</code>	a message, warning, or error
<code>expect_true(x)</code>	TRUE
<code>expect_is(x, y)</code>	x is class y

MANY more. See <https://r-pkgs.org/tests.html>



Your Turn 1

Use `use_test()` to create a new file. Call it "resident_connection"

Change the test description (the first argument of `test_that()`) to "connection is returning valid data"

In the `test_that()` function, remove the default expectations. Replace them with this code

Re-load your package.

Press the "Run tests" button in RStudio (above the script pane) or run `test_file("tests/testthat/test-resident_connection.R")` in the console.



Your Turn 1

```
use_test("resident_connection")
```

In test-resident_connection.R

```
test_that("connection is returning valid data", {  
  # `resident_data` is a tibble, isn't empty, and has the right columns  
  resident_data <- get_resident_data()  
  expect_is(resident_data, c("tbl_df", "tbl", "data.frame"))  
  expect_gt(nrow(resident_data), 0)  
  expect_named(resident_data, c("sector", "residents"))  
  
  # `resident_data_dt` is a data.table  
  resident_data_dt <- get_resident_data(data_table = TRUE)  
  expect_is(resident_data_dt, c("data.table", "data.frame"))  
})
```



Your Turn 2

Run all the tests in the package using `test()`. Fix the broken tests.

Hint: The bug is in `R/summarize_data.R`

Re-run the tests until all of them pass



Your Turn 2

```
segment_reactor_output <- function(reactor_num, data_table = FALSE) {  
  reactor_output <- hack_shinra_data(data_table = data_table)  
  dplyr::filter(reactor_output, .data$reactor == reactor_num)  
}
```





`use_r()` 🤝 `use_test()`

Organizing tests (VERY soft guidelines)



Organizing tests (VERY soft guidelines)

One *test file* for each R file



Organizing tests (VERY soft guidelines)

One test file for each R file

One *test* for every behavior tested



Organizing tests (VERY soft guidelines)

One test file for each R file

One test for every behavior tested

One *expectation* for every aspect of the test



What should I test? (VERY soft guidelines)



What should I test? (VERY soft guidelines)

External behavior.



What should I test? (VERY soft guidelines)

External behavior.

Don't bother with simple code
(unless it's not that simple after all
😬)





Find a *bug*, write a **test**

Skipping tests (`skip_*()`)

function

`skip()`

`skip_if()`

`skip_on_cran()`

`skip_on_travis()`

`skip_on_os()`

MANY more. See `?testthat::skip`



R CMD Check



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The gold standard



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Builds pkg and docs, checks code quality, runs examples, runs tests, and more!



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check () or Cmd/Ctrl + Shift + E

See all the details at <https://r-pkgs.org/r-cmd-check.html>





check early, check often

Your Turn 3

Run `check()` **or** Cmd/Ctrl + Shift + E

Fix the warnings. Re-run `check()` **until you get a clean bill of health.**

Hint: `segment_reactor_output()` **is in**
`R/summarize_data.R`



Your Turn 3

```
use_package("dplyr")
```

```
#' Segment Shinra reactor data
#'  
#' @param reactor_num The reactor number to segment by.  
#' @inheritParams hack_shinra_data  
#'  
#' @return a tibble or data.table filtered by `reactor_num`  
#' @export  
#'  
#' @examples  
#'  
#' segment_reactor_output(7)  
#'  
segment_reactor_output <- function(reactor_num, data_table = FALSE) {  
  reactor_output <- hack_shinra_data(data_table = data_table)  
  
  dplyr::filter(reactor_output, .data$reactor == reactor_num)  
}
```



R CMD Check Results

result	meaning	fix required for CRAN?
Error	A severe problem. Always fix.	Yes
Warning	A probable problem. Almost always fix.	Yes
Note	A potential issue. Strive to fix.	More or less



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result	meaning	fix required for CRAN?
Error	A severe problem. Always fix.	Yes
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Note	A potential issue. Strive to fix.	More or less

Shoot for all 0s under almost all circumstances!



Types of test files

type	file	run
test	test-*.R	alphabetical order
helper	helper-*.R	before tests, from <code>load_all()</code>
setup	setup-*.R	before tests, not from <code>load_all()</code>
teardown	teardown-*.R	after tests

All located in `tests/testthat/`



Your Turn 4

Both `test-count-donations.R` **and** `test-tables.R` **use** `donations_test_data`. **Let's move it to a helper file. First, create the file with** `fs::file_create("tests/testthat/helper-donations_data.R")`. **Open it manually or use** `edit_file()`.

Move the code to create `donations_test_data` **into** `helper-donations_data.R`.

Remove the `donations_test_data` **code from the two test files.**

Run the tests.



Your Turn 4

```
fs::file_create("tests/testthat/helper-donations_data.R")
```

In tests/testthat/helper-donations_data.R

```
donations_test_data <- data.frame(  
  donor_id = 1:15,  
  sector = c(7L, 2L, 8L, 6L, 5L, 5L, 8L, 1L, 5L, 4L, 4L, 3L, 7L, 5L,  
  donation = c(  
    529.58, 16.64, 410.88, 448.73, 211.62, 642.53, 410.93,  
    707.38, 30.19, 573.02, 286.31, 734.73, 971.81, 30, 465.92  
  )  
)
```



Test Coverage

Lines of code tested (via the [covr](#) R pkg)



Test Coverage

Lines of code tested (via the covr
R pkg)

```
test_coverage()
```



Test Coverage

Lines of code tested (via the covr R pkg)

`test_coverage()`

`use_coverage()` (via [codecov](#),
[coveralls](#))



GitHub Actions

Run R CMD Check with every
commit



GitHub Actions

Run R CMD Check with every
commit

```
use_github_action_check_standard()
```



GitHub Actions

Run R CMD Check with every
commit

```
use_github_action_check_standard()
```

See also `use_github_action()`

+ [r-lib/actions](https://github.com/r-lib/actions)





Resources

Advanced R, ch. 22: "Debugging"