R PACKAGE DEVELOPMENT AND VALIDATION

Package Elements
& Structure

Welcome

- Functions
- Unit Testing
- Building a package

FUNCTIONS

UDFs (User defined functions)

1. Functions help keep your code DRY
2. Functions abstract concepts
3. Functions are testable

Don’t Repeat Yourself

Don’t Repeat Yourself

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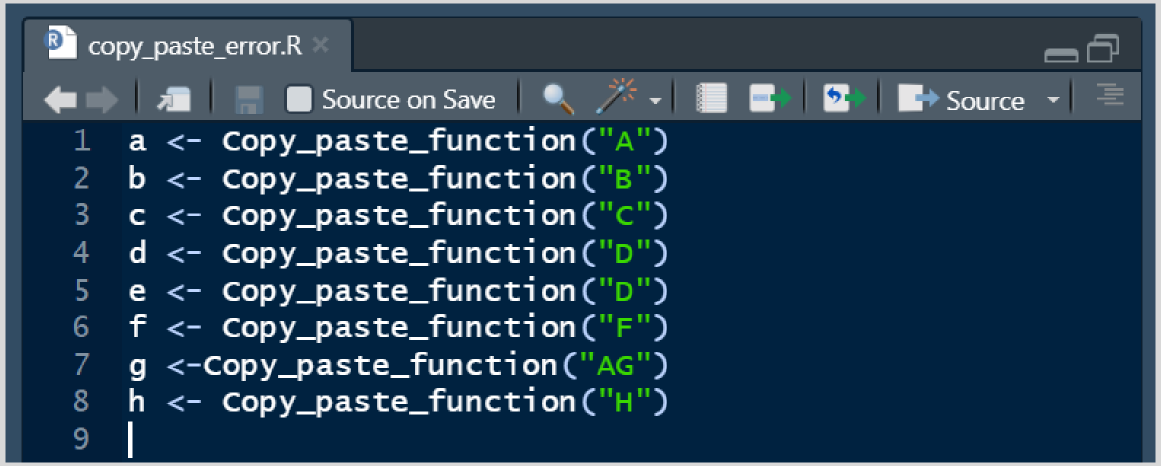
DRY

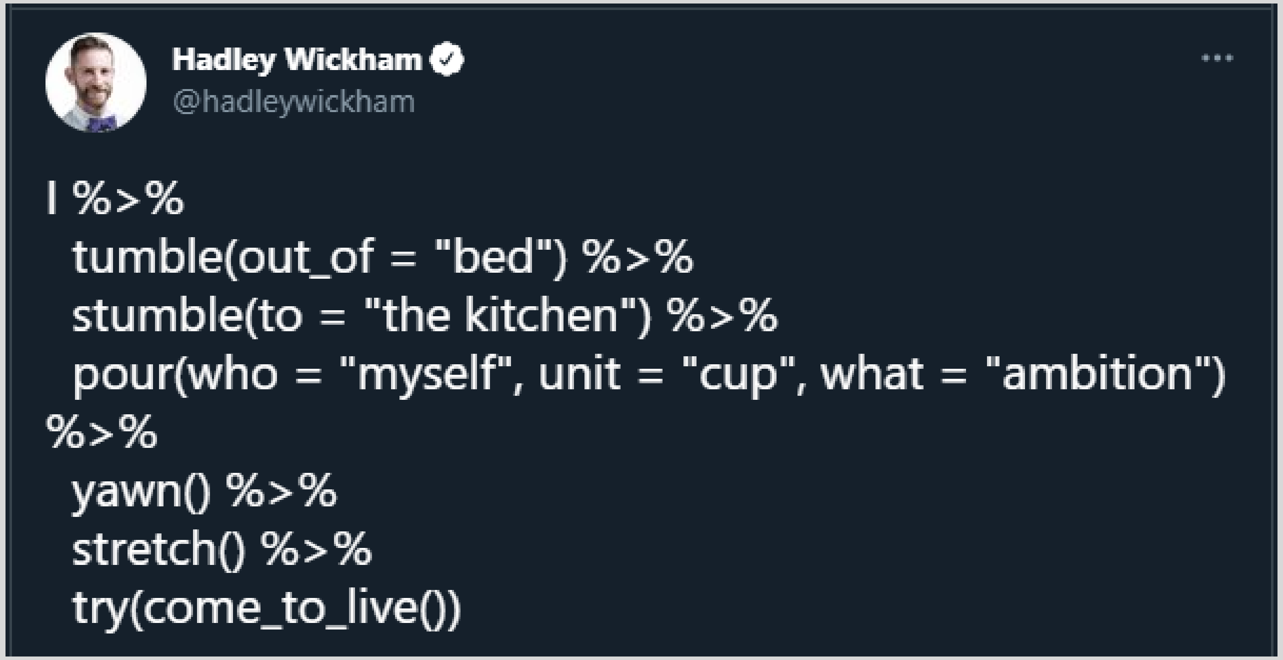
DRY

1. Copy Paste Errors
2. Updating errors
3. Propagation of updates



```r
a <- Copy_paste_function("A")
b <- Copy_paste_function("B")
c <- Copy_paste_function("C")
d <- Copy_paste_function("D")
e <- Copy_paste_function("D")
f <- Copy_paste_function("F")
g <-Copy_paste_function("AG")
h <- Copy_paste_function("H")

```

Abstracting Concepts


Hadley Wickham
@hadleywickham

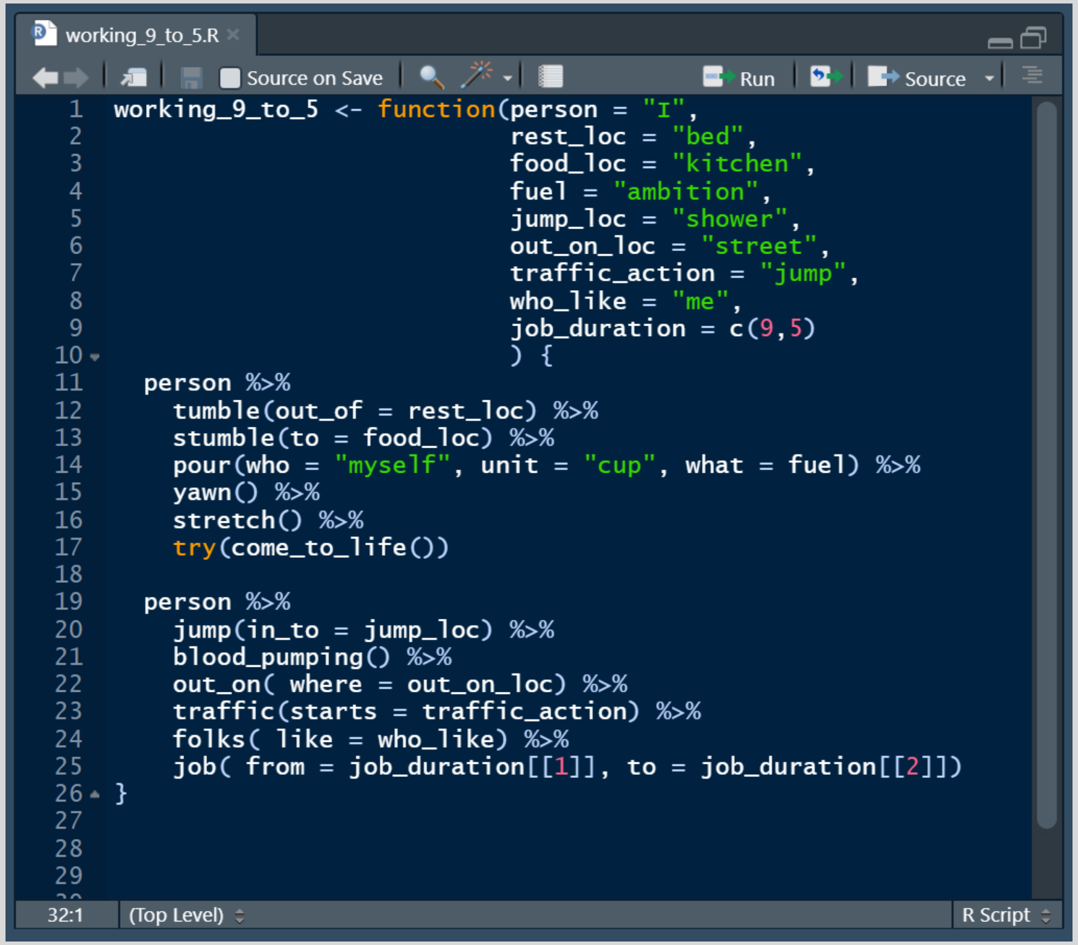
```
I %>%
  tumble(out_of = "bed") %>%
  stumble(to = "the kitchen") %>%
  pour(who = "myself", unit = "cup", what = "ambition")
%>%
  yawn() %>%
  stretch() %>%
  try(come_to_live())
```

Quote Tweet from Hadley Wickham (@hadleywickham)
February 11, 2021

https://twitter.com/hadleywickham/status/1359852563726819332

Abstracting Concepts

- Functions allow you to abstract processes
- Functions can be built from other functions
- Functions can be used for specific returned objects or side effects
  - Side effects: Plots, changes to environment or object



```r
working_9_to_5 <- function(person = "I",
                           rest_loc = "bed",
                           food_loc = "kitchen",
                           fuel = "ambition",
                           jump_loc = "shower",
                           out_on_loc = "street",
                           traffic_action = "jump",
                           who_like = "me",
                           job_duration = c(9,5)
                           ) {
  person %>%
    tumble(out_of = rest_loc) %>%
    stumble(to = food_loc) %>%
    pour(who = "myself", unit = "cup", what = fuel) %>%
    yawn() %>%
    stretch() %>%
    try(come_to_life())

  person %>%
    jump(in_to = jump_loc) %>%
    blood_pumping() %>%
    out_on( where = out_on_loc) %>%
    traffic(starts = traffic_action) %>%
    folks( like = who_like) %>%
    job( from = job_duration[[1]], to = job_duration[[2]])
}
```

Testable

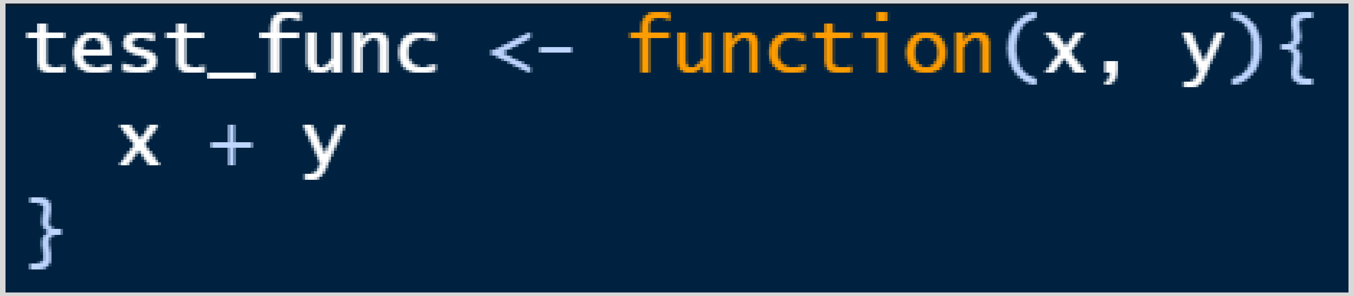
- Specific behavior
- Known input means known output
- Reproducible

UNIT TESTING

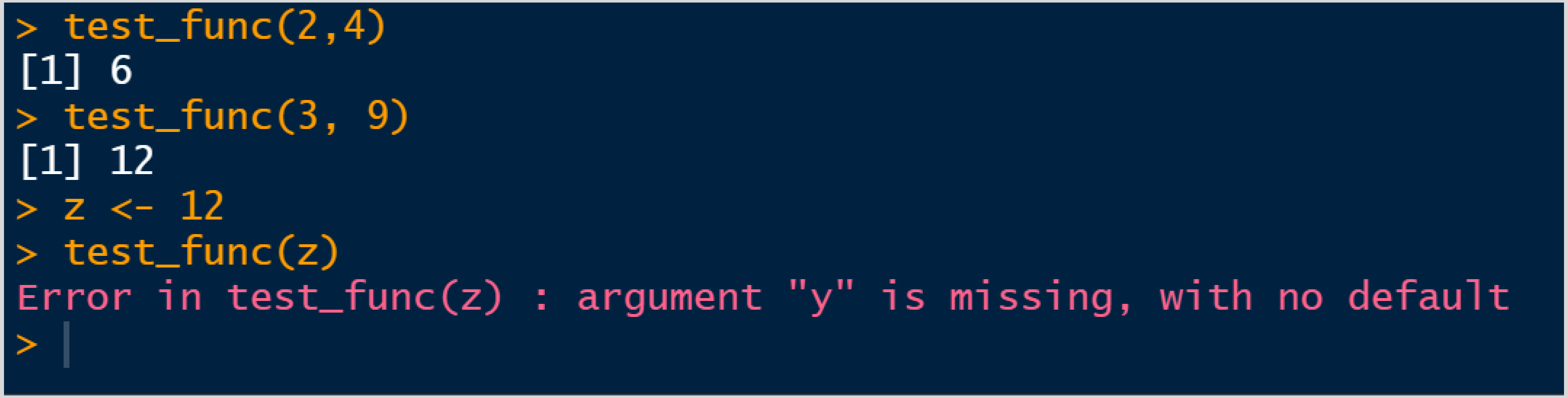
Unit Testing

1. Test to show code behave as function author expects
2. Repeatable to show code behavior does not change over time

Unit Testing



```
test_func <- function(x, y){
  x + y
}
```



```
> test_func(2,4)
[1] 6
> test_func(3, 9)
[1] 12
> z <- 12
> test_func(z)
Error in test_func(z) : argument "y" is missing, with no default
> 
```

🎉 Congratulations!

You were **UNIT TESTING!**

🎉 Congratulations!

You were **Manually UNIT TESTING!**

Test Function behavior as unit tests

- Formalize the testing being done
  - Units
- Given an input, function returns an expected output
  - Expectations

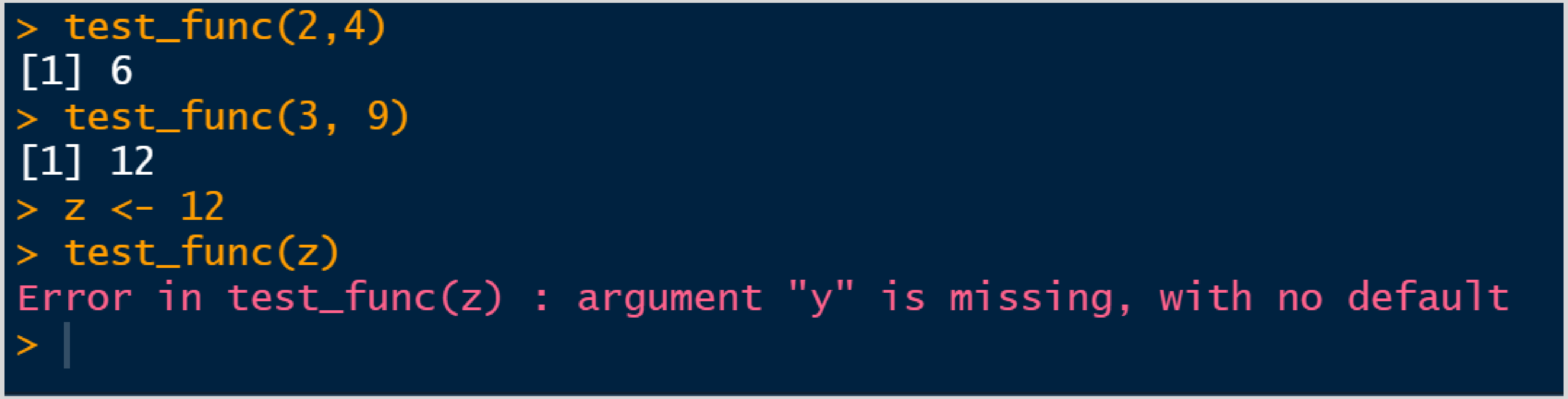
Testthat unit testing framework

Units ➔ test_that()

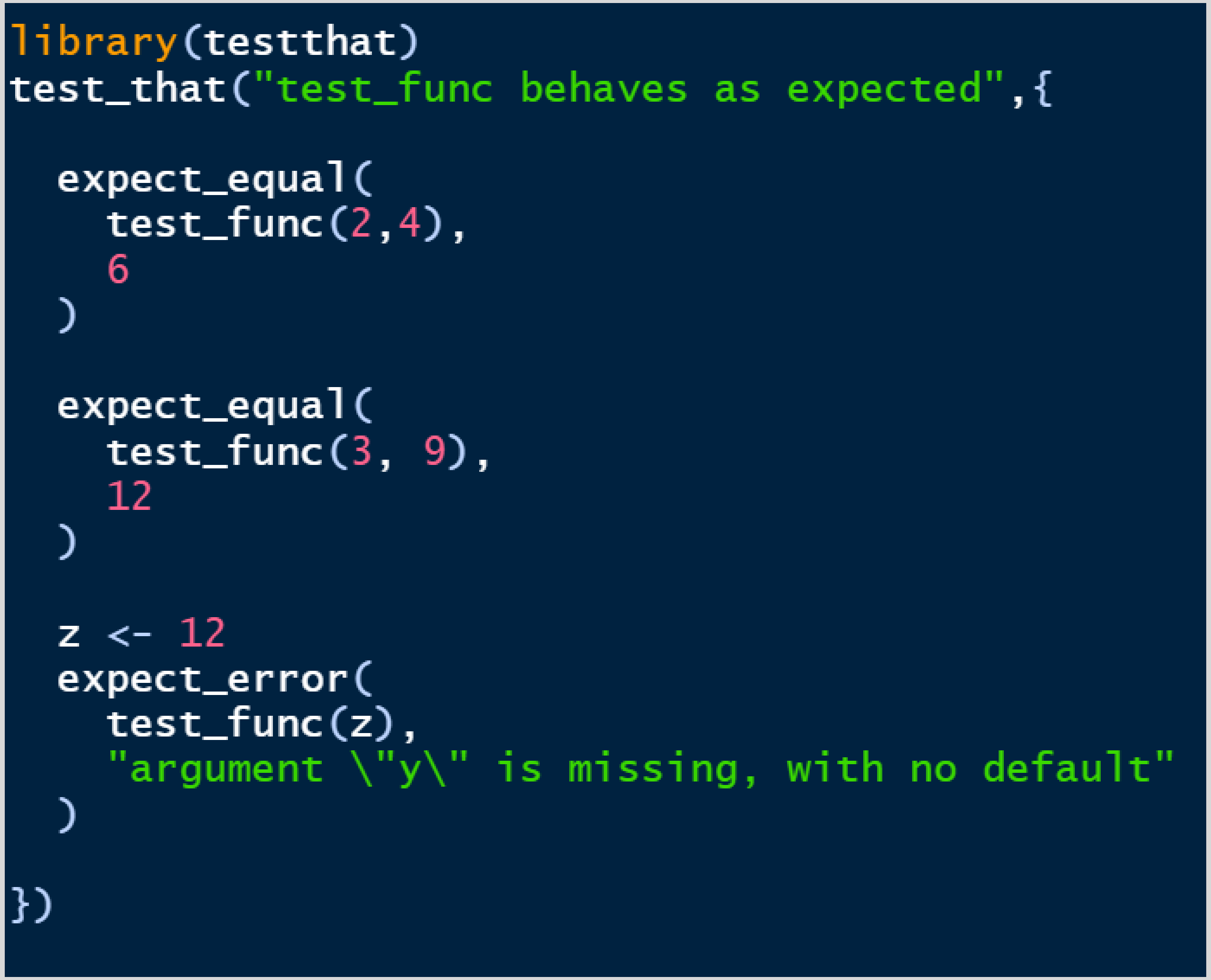
Expectations ➔ expect_* family of functions

- expect_equal()
- expect_true() / expect_false()
- expect_error()
- expect_warning()
- https://testthat.r-lib.org/reference/index.html - full list of expectations

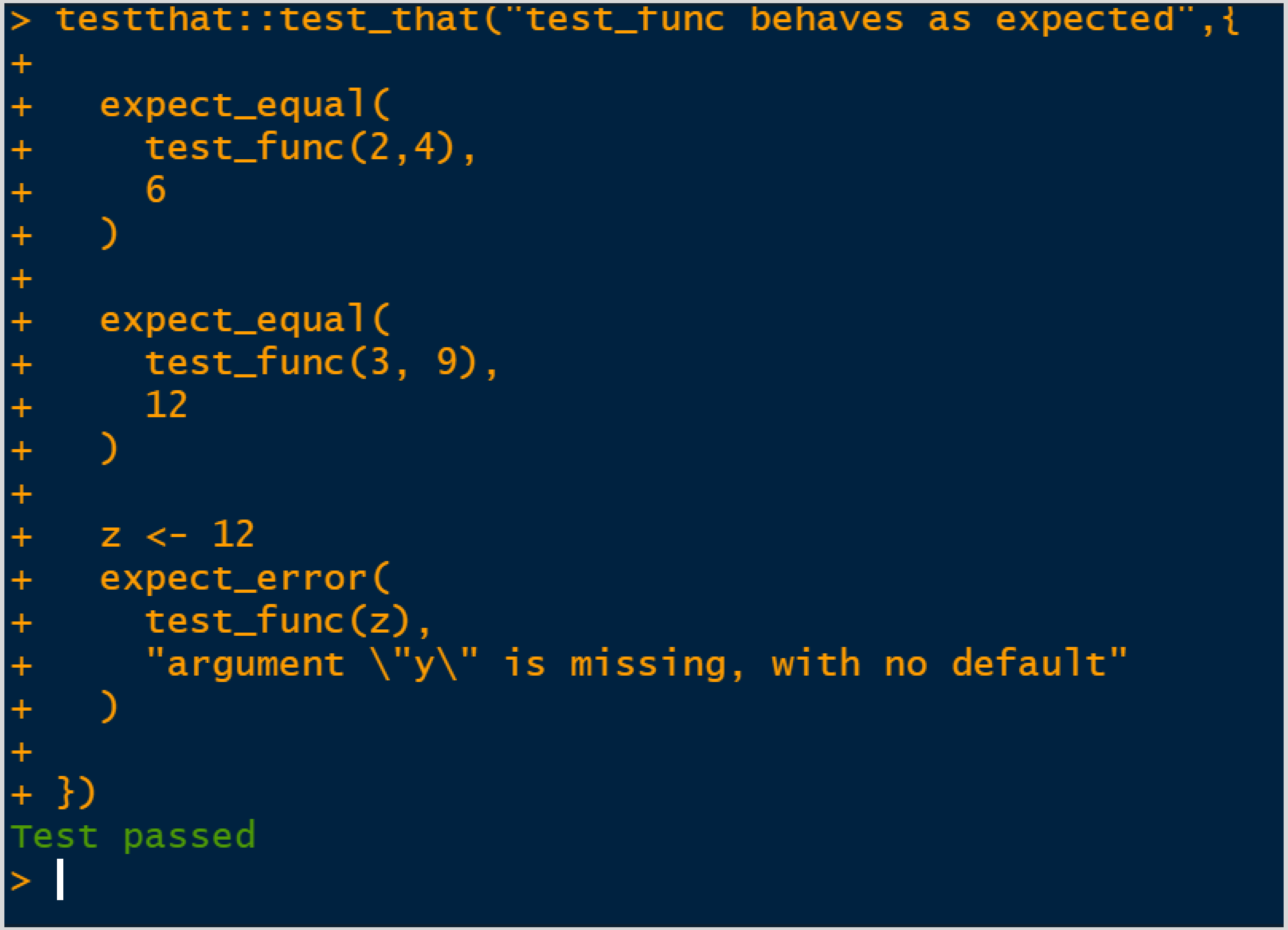
Formalize Testing



```
> test_func(2,4)
[1] 6
> test_func(3, 9)
[1] 12
> z <- 12
> test_func(z)
Error in test_func(z) : argument "y" is missing, with no default
> 
```

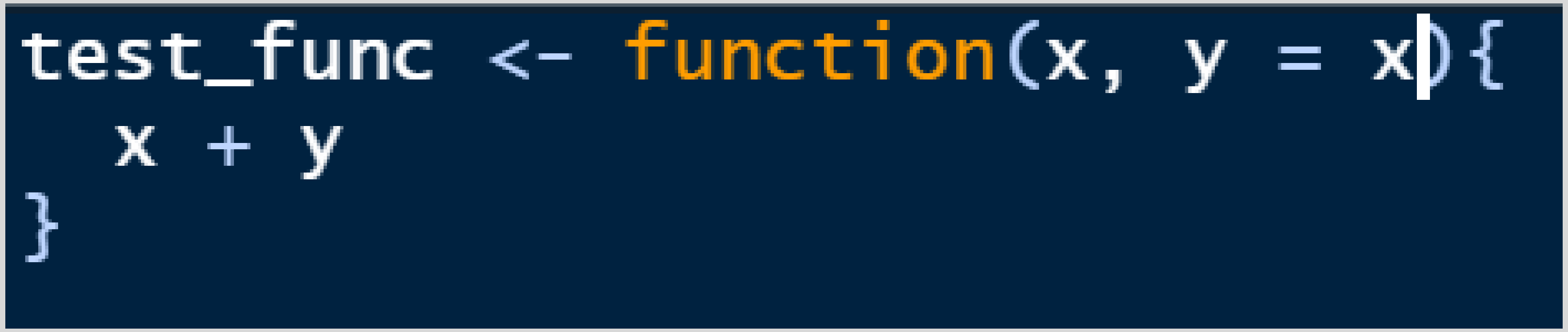


```r
library(testthat)
test_that("test_func behaves as expected",{

  expect_equal(
    test_func(2,4),
    6
  )

  expect_equal(
    test_func(3, 9),
    12
  )

  z <- 12
  expect_error(
    test_func(z),
    "argument \"y\" is missing, with no default"
  )

})
```

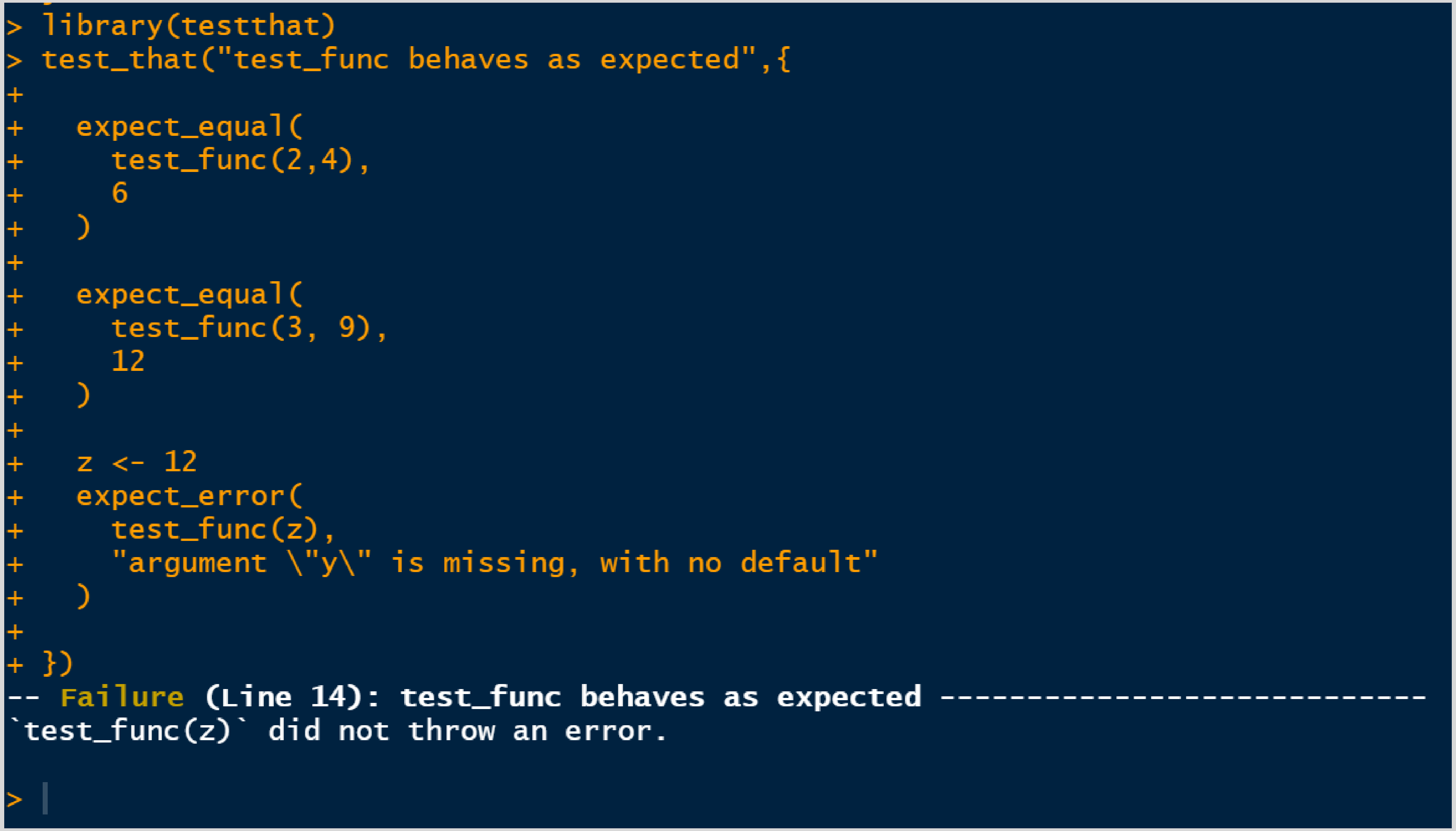

```
> testthat::test_that("test_func behaves as expected",{
+ 
+   expect_equal(
+     test_func(2,4),
+     6
+   )
+ 
+   expect_equal(
+     test_func(3, 9),
+     12
+   )
+ 
+   z <- 12
+   expect_error(
+     test_func(z),
+     "argument \"y\" is missing, with no default"
+   )
+ 
+ })
Test passed
> 
```

Repeatably Test Function when it updates

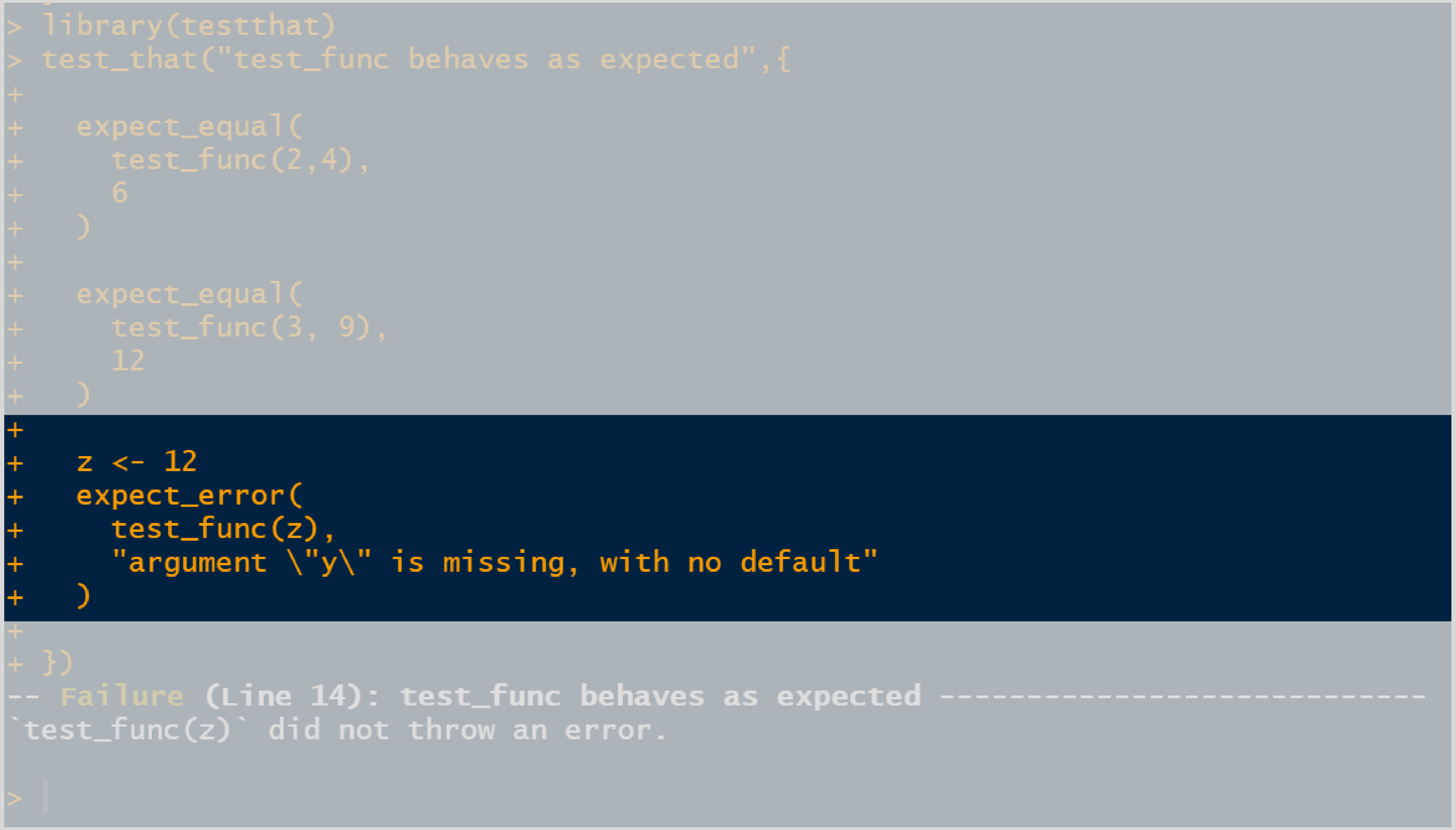
- When you update the function, you can now test that your expectations still hold!



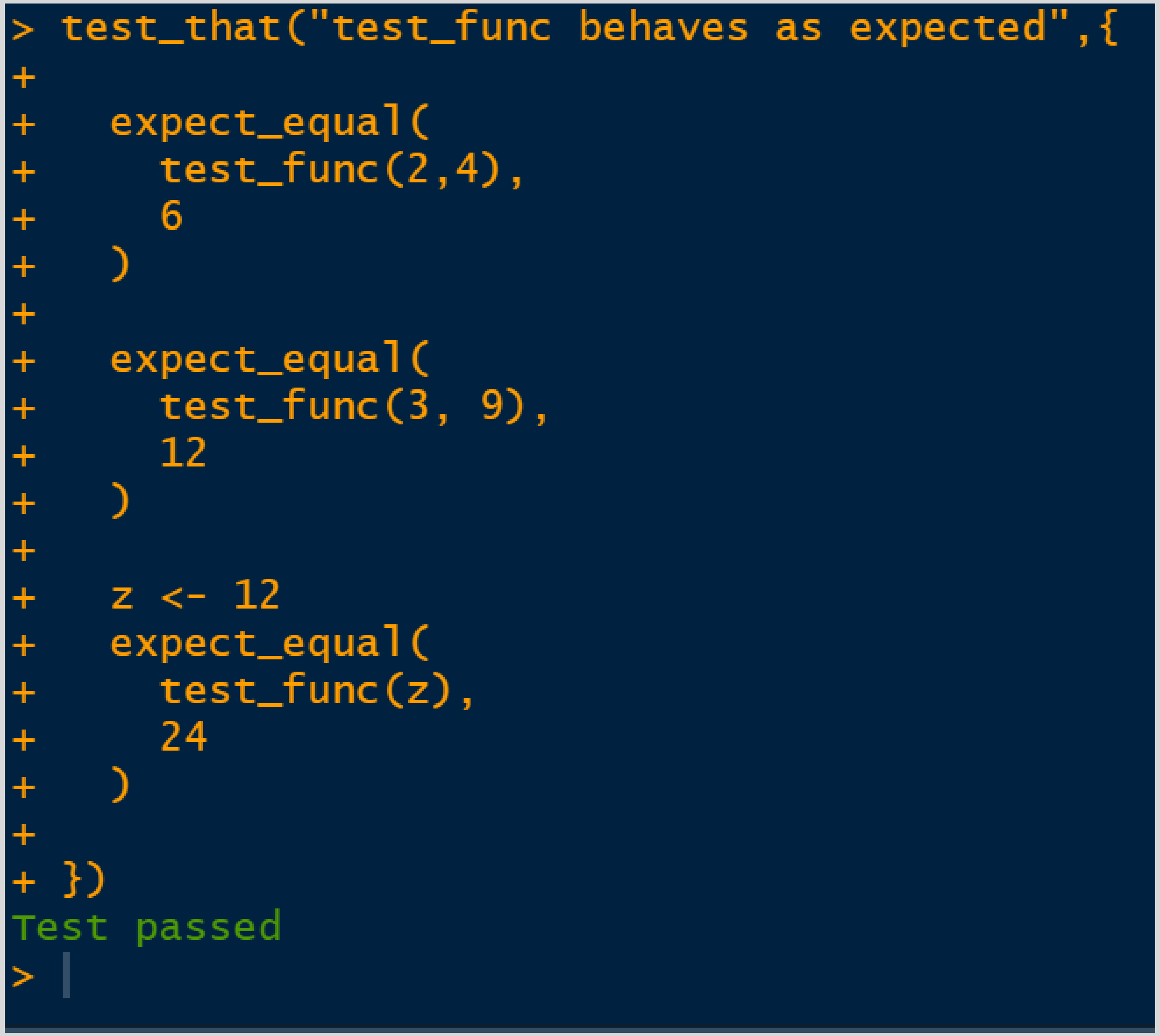
```
test_func <- function(x, y = x){
  x + y
}
```



```
> library(testthat)
> test_that("test_func behaves as expected",{
+
+   expect_equal(
+     test_func(2,4),
+     6
+   )
+
+   expect_equal(
+     test_func(3, 9),
+     12
+   )
+
+   z <- 12
+   expect_error(
+     test_func(z),
+     "argument \"y\" is missing, with no default"
+   )
+
+ })
-- Failure (Line 14): test_func behaves as expected ----------------------------
`test_func(z)` did not throw an error.

> 
```



```
> library(testthat)
> test_that("test_func behaves as expected",{
+ 
+   expect_equal(
+     test_func(2,4),
+     6
+   )
+ 
+   expect_equal(
+     test_func(3, 9),
+     12
+   )
+ 
+   z <- 12
+   expect_error(
+     test_func(z),
+     "argument \"y\" is missing, with no default"
+   )
+ 
+ })
-- Failure (Line 14): test_func behaves as expected ----------------------------
`test_func(z)` did not throw an error.

> 
```



```
> test_that("test_func behaves as expected",{
+ 
+   expect_equal(
+     test_func(2,4),
+     6
+   )
+ 
+   expect_equal(
+     test_func(3, 9),
+     12
+   )
+ 
+   z <- 12
+   expect_equal(
+     test_func(z),
+     24
+   )
+ 
+ })
Test passed
> 
```

WHATS A PACKAGE

A collection of functions with a set of conventions that is intended to make code reusable and shareable

MAKING YOUR PACKAGE

usethis::create_package()

DESCRIPTION File	Basic package information – name, version, authors, dependencies
NAMESPACE File	What information does R need to know – Functions that are shared, dependencies, methods
R Folder (/R)	Folder to house the R code of the package

.Rbuildignore, .gitignore, .Rproj.user

usethis::use_r()

Creates a new R script

Within /R

Organize Code within R Script to be related

Give a meaningful name to the script

```
usethis::use_r("new_file_name")
```

usethis::use_test()

Creates a new test script for unit testing

Unit testing allows the developer to repeatedly test across all expectations

Creates tests/testthat folders

Creates new test within tests/testthat folder

Organize tests within to be related

```
usethis::use_test(“new-test-name”)
```

usethis

- Automates workflows and creation of files and folders done as part of package development
  - Creating the R package skeleton – usethis::create_package()
  - Adding a license – usethis::use_license()
  - Create a new R script – usethis::use_r()
  - Add package to DESCRIPTION file – usethis::use_package()
  - Create a new test – usethis::use_test()
  - Create Vignette – useths::use_vignette()

usethis.r-lib.org

MATERIALS 02-E1

Materials/Materials-02-Package_Elements_and_Structure/Materials-02-E01-Package_Basics/