Lecture 5: Functions

Last time

```r
nsim <- 1000
n <- 100 # sample size
beta0 <- 0.5 # intercept
beta1 <- 1 # slope
results <- rep(NA, nsim)

for(i in 1:nsim){
  x <- runif(n, min=0, max=1)
  noise <- rchisq(n, 1)
  y <- beta0 + beta1*x + noise

  lm_mod <- lm(y ~ x)
  ci <- confint(lm_mod, "x", level = 0.95)

  results[i] <- ci[1] < 1 & ci[2] > 1
}
mean(results)
```

What if I want to repeat my simulations with a different sample size n?

Simulation code for multiple sample sizes

```
1  nsim <- 1000
2  beta0 <- 0.5 # intercept
3  beta1 <- 1 # slope
4  results <- rep(NA, nsim)
5
6  n <- 100 # sample size
7  for(i in 1:nsim){
8    ...
9  }
10
11 n <- 200 # new sample size
12 for(i in 1:nsim){
13   ...
14 }
```

these portions of code will be the same

Are there any issues with this code?

Repeated blocks can be an issue

1. Easier to make errors
2. Harder to fix errors
3. Harder to keep track of any changes
4. Harder to read code

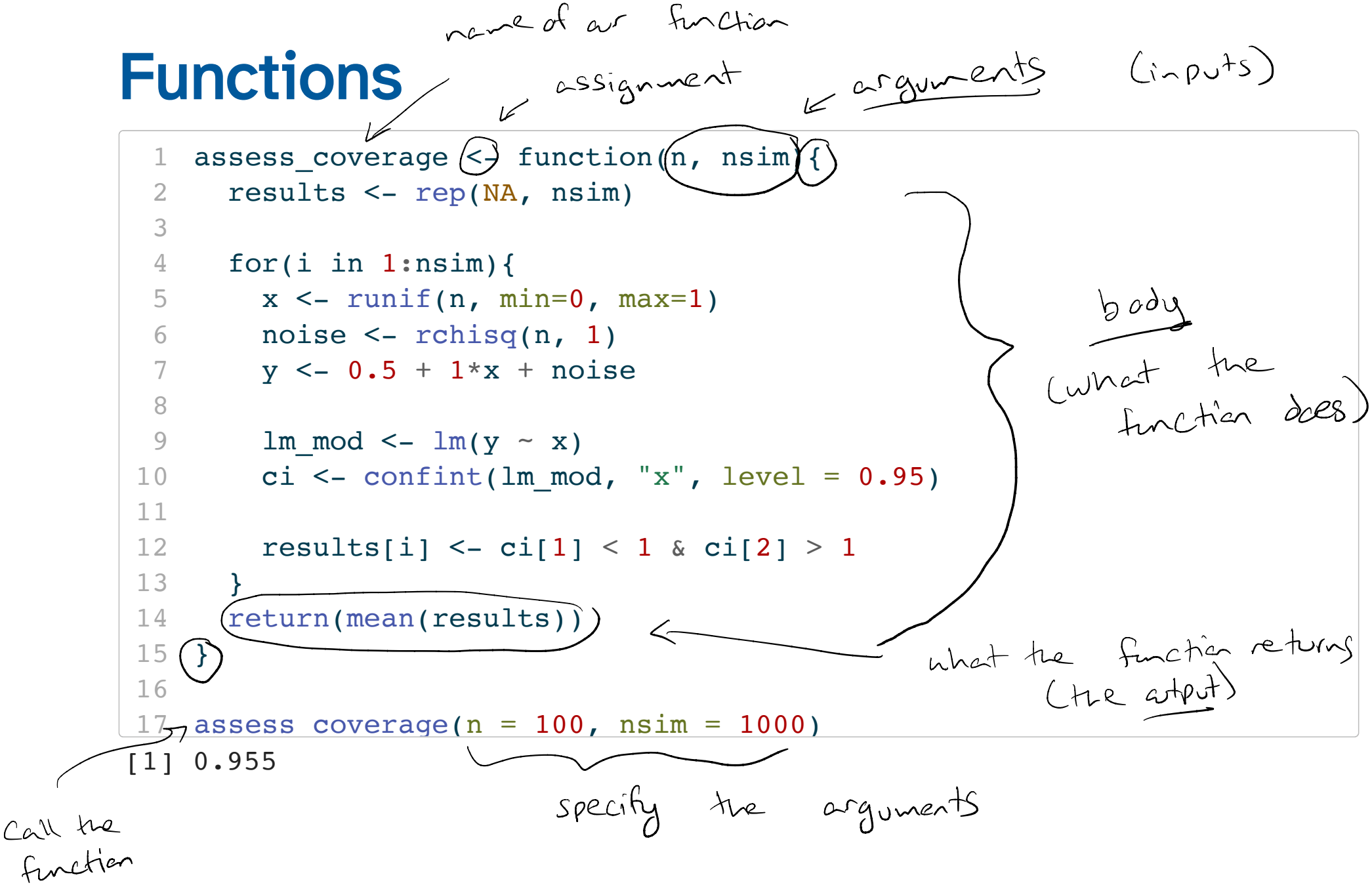
Coding best practices

So far:

- No magic numbers
- Comment your code
- Use informative names
- Set a seed for reproducibility

Also: *don't repeat the same chunk of code multiple times*

Functions




```
1  assess_coverage <- function(n, nsim){
2    results <- rep(NA, nsim)
3
4    for(i in 1:nsim){
5      x <- runif(n, min=0, max=1)
6      noise <- rchisq(n, 1)
7      y <- 0.5 + 1*x + noise
8
9      lm_mod <- lm(y ~ x)
10     ci <- confint(lm_mod, "x", level = 0.95)
11
12     results[i] <- ci[1] < 1 & ci[2] > 1
13   }
14   return(mean(results))
15 }
16
17 assess_coverage(n = 100, nsim = 1000)
```

```
[1] 0.955
```

Functions

Now I can change the value of `n` without re-writing all the code!

```
1 assess_coverage(n = 100, nsim = 1000)
```

```
[1] 0.938
```

```
1 assess_coverage(n = 200, nsim = 1000)
```

```
[1] 0.94
```

Function components

Here is a simple function to calculate the absolute value:

argument

```
1 my_abs <- function(x){
2   return(ifelse(x >= 0, x, -1*x))
3 }
4
5 my_abs(-3)
```

body

output: absolute value of x

```
[1] 3
```

```
1 my_abs(c(-2, 5))
```

```
[1] 2 5
```

- **name:** `my_abs`
- **arguments:** `x`
- **body:** everything in the curly braces `{ }`

This function is vectorized
(b/c we used the ifelse function)

Function arguments

- The *arguments* `n` and `nsim` allow us to change the sample size and number of simulations
- What other parts of the simulation might we want to change?

```
1  assess_coverage <- function(n, nsim){
2    results <- rep(NA, nsim)
3
4    for(i in 1:nsim){
5      x <- runif(n, min=0, max=1)
6      noise <- rchisq(n, 1)
7      y <- 0.5 + 1*x + noise
8
9      lm_mod <- lm(y ~ x)
10     ci <- confint(lm_mod, "x", level = 0.95)
11
12     results[i] <- ci[1] < 1 & ci[2] > 1
13   }
```

Function arguments

```r
assess_coverage <- function(n, nsim, beta0, beta1){
  results <- rep(NA, nsim)

  for(i in 1:nsim){
    x <- runif(n, min=0, max=1)
    noise <- rchisq(n, 1)
    y <- beta0 + beta1*x + noise

    lm_mod <- lm(y ~ x)
    ci <- confint(lm_mod, "x", level = 0.95)

    results[i] <- ci[1] < beta1 & ci[2] > beta1
  }
  return(mean(results))
}
```

added beta0 and beta1 to the arguments

Ordering and arguments

```
1 my_power <- function(x, y){
2   return(x^y)
3 }
```

```
1 my_power(x = 2, y = 3)
```

```
[1] 8
```

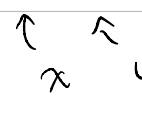
```
1 my_power(y = 3, x = 2)
```

```
[1] 8
```

```
1 my_power(2, 3)
```

```
[1] 8
```

```
1 my_power(3, 2)
```



```
[1] 9
```

- If you don't name the arguments when calling a function, R assumes you passed them in the order of the function definition

Function defaults

```
1 my_power <- function(x, y){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power(3)
```

Function defaults

```
my_power <- function(x, y){
  return(x^y)
}
```

What will happen when I run the following code?

```
my_power(3)
```

```
Error in my_power(3): argument "y" is missing, with no default
```

Function defaults

```
1 my_power <- function(x, y=2){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power(3)
```

Function defaults

default value of y (the value of y to use if y is not specified when calling the function)

```
1 my_power <- function(x, y=2){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power(3)
```

```
[1] 9
```

Function defaults

```
1 my_power <- function(x, y=2){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power(2, 3)
```

8? 4?

Function defaults

```
1 my_power <- function(x, y=2){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power(2, 3)
```

```
[1] 8
```

x=2 y=3

(can use values other than the default if we specify them)

Function defaults

```
my_power <- function(x=2, y=4){
  return(x^y)
}
```

What will happen when I run the following code?

```
my_power()
```

Function defaults

```
1 my_power <- function(x=2, y=4){
2   return(x^y)
3 }
```

What will happen when I run the following code?

```
1 my_power()
```

```
[1] 16
```

assume x=2 (default values)
y=4

Ex: rnorm(n, mean=0, sd=1)

rnorm(100) (use N(0,1))

rnorm(100, mean=3) (use N(3,1))

etc.

Class activity

https://sta279-s24.github.io/class_activities/ca_lecture_5.html