Lecture 3: Functions

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Last time

```
n <- 1000
m = 2^32
a = 1664525
c = 1013904223

x0 <- 1

x <- rep(NA, n)
x[1] <- x0
for(i in 2:n){
  x[i] <- (a * x[i-1] + c) %% m
}

u <- x/m
```

What if I wanted to run the LCG with a different seed, or a different number of samples, or different parameters?

LCG code changing the settings

```
n <- 1000
m = 2^32
a = 1664525
c = 1013904223

x0 <- 1

...

n <- 5000
m = 1024
a = 1
c = 1

x0 <- 12

...
```

Functions

```
my_lcg <- function(n, x0, m, a, c){
  x <- rep(NA, n)
  x[1] <- x0
  for(i in 2:n){
    x[i] <- (a * x[i-1] + c) %% m
  }
  return(x/m)
}

head(my_lcg(n = 1000, x0 = 1, m = 2^32,
            a = 1664525, c = 1013904223))
```

```
## [1] 2.328306e-10 2.364555e-01 3.692707e-01 5.042420e-01
## [6] 5.054363e-02
```

```
head(my_lcg(n = 5000, x0 = 12, m = 1024, a = 1, c = 1))
```

```
## [1] 0.01171875 0.01269531 0.01367188 0.01464844 0.01562
```

Function defaults

```
my_lcg <- function(n, x0, m = 2^32,
                   a = 1664525, c = 1013904223){
  x <- rep(NA, n)
  x[1] <- x0
  for(i in 2:n){
    x[i] <- (a * x[i-1] + c) %% m
  }
  return(x/m)
}

my_lcg(n = 5, x0 = 1, m = 2^32,
       a = 1664525, c = 1013904223)
```

```
## [1] 2.328306e-10 2.364555e-01 3.692707e-01 5.042420e-01
```

```
my_lcg(n = 5, x0 = 1)
```

```
## [1] 2.328306e-10 2.364555e-01 3.692707e-01 5.042420e-01
```

What if we don't want to specify a seed?

- In R, functions for simulating random variables don't *require* us to specify a seed:

```
runif(5)
```

```
## [1] 0.7896950 0.1879501 0.4728500 0.1790625 0.3693306
```

- But even if we don't manually set a seed, R's random number generators still require one!

How might R choose a seed, if we don't specify one ourselves?

Getting the system time

```
Sys.time()
```

```
## [1] "2025-01-11 09:24:48 EST"
```

Getting the system time

```
Sys.time() |>
  lubridate::second()
```

```
## [1] 48.57291
```

```
(Sys.time() |> lubridate::second()) * 100000
```

```
## [1] 4857634
```

What if we don't want to specify a seed?

```
my_lcg <- function(n, x0 = NA, m = 2^32,
                   a = 1664525, c = 1013904223){
  if(is.na(x0)){
    x0 <- ((Sys.time() |>
              lubridate::second()) * 100000) %% m
  }

  x <- rep(NA, n)
  x[1] <- x0
  for(i in 2:n){
    x[i] <- (a * x[i-1] + c) %% m
  }
  return(x/m)
}

my_lcg(n = 5)
```

```
## [1] 0.001131162 0.083768899 0.663071837 0.884992848 0.95
```

What if we don't want to specify a seed?

```
my_lcg(n = 5)
```

```
## [1] 0.001131225 0.188753437 0.051198487 0.396858916 0.82
```

```
my_lcg(n = 5)
```

```
## [1] 0.001201529 0.211493830 0.002825943 0.089415424 0.44
```

Homework 1

https://sta379-s25.github.io/homework/hw1.html

- Function practice and probability review
- Accept and submit coding portion of assignment on GitHub Classroom
- Collaboration encouraged on homework, but everyone must submit their own work and acknowledge collaborators