



# *Programming I*

# Introduction



- Important Reading to Consider
  - Chapters 15-17 in R4DS
  - Chapters 14-18 in RP4DS
  - Chapter 7 in AoRP
  - Chapter 4 in FCSPR
- Programming Steps
  - Understand the Problem
  - Inputs and Outputs
  - Create Code
  - Test the Code (Simple Case)
  - Generalize the Code
  - Test Problematic Cases
  - Edit Code to Handle Issues
  - Consider Efficiency

## Setup for Lecture



- Open Tutorial 9
- Packages Required:
  - Tidyverse
  - Ecdat
- Knit Document As You Go
- Read Introduction
- Prepare Your Minds for the Matrix



## Part 1: If-Else



- General Construction:

- “If”

```
if (CONDITION) {  
    ACTION  
}
```

- “If-Else”

```
if (CONDITION) {  
    ACTION 1  
} else {  
    ACTION 2  
}
```

- ifelse()

```
ifelse(CONDITION,ACTION1,ACTION2)
```

## Part 1: If-Else



- Run Chunk 1
  - Check if Larger than 0
  - If True, Take Log
  - Result When  $x = 3$ ?
  - Result When  $x = -3$ ?
- Run Chunk 2
  - Notice the Difference
  - If-Else to Handle Errors
- Run Chunk 3
  - Situation Not Considered
  - Replace *BLANK* to Lead to Potential Problem

## Part 1: If-Else



- Run Chunk 4
  - Replace BLANK with Different Options and Check
  - How Would You Explain this Code to Your Granny?
- Run Chunk 5
  - What is the Difference Between y1 and y2?
  - Always Look for a Vectorized Solution for Efficiency
- Run Chunk 6
  - Nested ifelse() Statements
  - How Would You Explain this to your Mother?

## Part 2: Loops



- General Construction

- “for” Loop

```
for (INDEX in VECTOR) {  
    ACTION FOR EACH INDEX  
}
```

- “while” Loop

```
while (CONDITION) {  
    ACTION UNTIL CONDITION = FALSE  
}
```

- Nested “for” Loops

```
for (INDEX1 in VECTOR1) {  
    for (INDEX2 in VECTOR2) {  
        ACTION  
    }  
}
```

## Part 2: Loops



- Mental Process
  - I Want to Do \_\_\_\_\_  
for Every \_\_\_\_\_  
until \_\_\_\_\_
  - What Type of Object Do You Want Returned?
  - Initiate a Starting Point Based on the Desired Output
  - Try R Code on Single Instance
  - Create the Loop



## Part 2: Loops



- Geometric Series

$$\sum_{k=0}^{\infty} ar^k = \frac{a}{1-r}, \text{ for } |r| < 1$$

- Run Chunk 1

- What  $a$  did you choose?
- What  $r$  did you choose?
- What is the theoretical limit?
- What pattern exists?

- Run Chunk 2

- Choose  $a$  and  $r$  that work?
- Choose  $a$  and  $r$  that don't work?
- Modify: `if(k>100) break`

## Part 2: Loops



- Geometric Series (Cont.)

$$\sum_{k=0}^{\infty} ar^k = \frac{a}{1-r}, \text{ for } |r| < 1$$

- Run Chunk 3
  - Suppose We Want to Save at Every Step
  - Why? Picture to Examine the Path of the Summation
  - Choose Small  $K < 15$
  - Choose Large  $K > 50$
  - What do You Observe?
  - How Would You Explain This Code to Your Stranded Brother ?

Closing



Disperse  
and Make  
Reasonable  
Decisions