



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
- 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