Introduction to R and R Studio

Grinnell College

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Lab Today

Two parts:

1. Intro to R
   - Elements of R
   - Data frames
   - Data basics

2. R Markdown
   - Knit to PDF
   - Markdown formatting (headers, bold/italics, etc)
   - Code chunks

Why R?

R provides several significant advantages:

- Able to read in data from a variety of different sources and formats
- Create sophisticated data visuals
- Large repositories of pre-built functions
- Open-source software so rapid developements
- Free

Also widely used across a number of disciplines

How you will be coding in R

Broadly you will be using pattern recognition

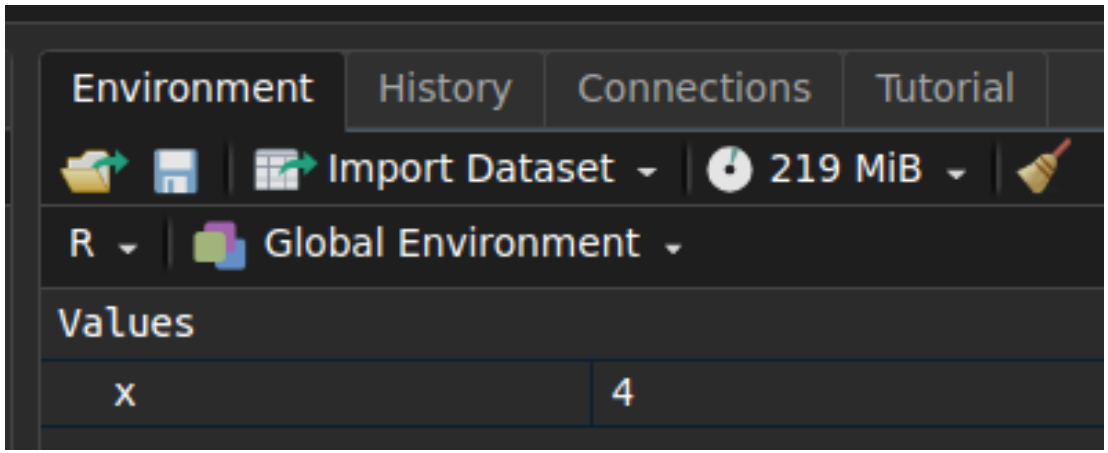
- I give you working code that does X
- You tweak the code to do X'
- Eventually you do more of it on your own
- I am always willing to help you with your coding.

Basic Elements of R

Data in R is stored by assigning it to a name using <−. This relationship between a name and a value describes a *variable*

```
> x <- 4
> x
[1] 4
```

We can see all of the names we have assigned in the *environment* tab in the top right of RStudio



How is data stored in R?

R is an object-orientated language. Once names have been assigned, we can use just use that name as we would their assigned values

```
> x <- 4
> y <- 3
> sqrt(x^2 + y^2)
[1] 5
```

A name can only be associated with one object in a single environment (exceptions are outside of this class)

Basic Elements of R

1. Vectors
   - All of one "type" (numeric, character, T/F, etc...)
   - c(1,4,5) for example creates a numeric vector with three values 1,4, and 5.
     - ★ The "c" is used to denote a vector is about to begin

2. Data frames
   - Classic way people organize their data
   - Shaped like a rectangular table
   - Rows are observations, columns are variables (vectors)

3. Functions
   - Prewritten pieces of code
   - Things like `mean()`, `sqrt()` or `plot()`

Data in Practice

We often uses a tabular form to store observations (rows) and variables (columns). This makes it simple to add or remove observations and variables with relative ease

Total Bill	Tip	Sex	Smoker	Day	Time	Size
13.42	1.58	Male	Yes	Fri	Lunch	2
16.27	2.50	Female	Yes	Fri	Lunch	2
10.09	2.00	Female	Yes	Fri	Lunch	2
20.45	3.00	Male	No	Sat	Dinner	4
13.28	2.72	Male	No	Sat	Dinner	2
22.12	2.88	Female	Yes	Sat	Dinner	2
24.01	2.00	Male	Yes	Sat	Dinner	4
15.69	3.00	Male	Yes	Sat	Dinner	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮

Data in Practice

In R, tabular data is typically stored as a `data.frame`

```
> tips
     total_bill  tip    sex smoker  day   time size
  1:      16.99 1.01 Female     No  Sun Dinner    2
  2:      10.34 1.66   Male     No  Sun Dinner    3
  3:      21.01 3.50   Male     No  Sun Dinner    3
  4:      23.68 3.31   Male     No  Sun Dinner    2
  5:      24.59 3.61 Female     No  Sun Dinner    4
 ---
240:      29.03 5.92   Male     No  Sat Dinner    3
241:      27.18 2.00 Female    Yes  Sat Dinner    2
242:      22.67 2.00   Male    Yes  Sat Dinner    2
243:      17.82 1.75   Male     No  Sat Dinner    2
244:      18.78 3.00 Female     No Thur Dinner    2
```

Functions in R

The general format that functions in R use is....

$$\text{function}(\text{parameter}_1, \text{parameter}_2, \text{etc...})$$

- *function* is the thing/function we want R to perform
- *parameters* come in two types
  - Required inputs you are required to input
  - Default parameters are assumed until told otherwise
  - $\log(5) = \log(5, \text{base} = \exp(1))$

Finding Help Part I

R has a learning curve and can be frustrating

- ?function brings up the help page for "function"
- ??guess is a word search in all the help pages for "guess"

- Help pages are organized in a a standard way, generally
  - "Title" and "Description" of the function
  - "Usage" is where the function lists out the parameters
  - "Arguments" is where the paratmers are defined (USEFUL!!!)
  - "Details" for relevant stuff that doesn't fit elsewhere
  - "Value" lists what the output of the function will be
  - "Examples" toy examples of the function

Finding Help Part II

- Lab mates
- Myself or your mentor
- Stack Overflow
  - Some of my most used functions I learned from here
- Each other
- Examples

Using R Markdown

- R Markdown describes a specific type of file that is used in R (.Rmd)
- Uses *markdown* language to easily add headers, or write things in **bold** or *italics*
- Alongside written text allows us to write and compute R code
  - Very efficent for writing statistical reports
- Can (and should?) be knit into pdf and submitted to canvas

Go forth and conquer

1. Find lab on course website
2. Do it