Social Sciences Intro to Statistics

Week 1.1 Introduction to R and RStudio

Week 1: Learning goal - Understand what and how to access R and R studio.

Intructor Introductions

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Preferred pronouns: he, him, his

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Student Office Hours: via Zoom and by appointment.

Student Introductions

What we want to know about you:

1. Preferred name
2. Pronouns
3. Department and academic year (i.e. 2nd year in Sociology)
4. And answer one of these two questions:
    - What's something you would eventually like to learn how to do in R?
    - What's something that you have observed or think is important that people aren't paying attention to?

What is this course about?

Who is this class for?

This class is for anyone who wants to work with data, that is people who want to be:

- Researchers working with survey data and doing traditional statistical analyses
- Researchers who want to do "data science" oriented research
- Analysts working at think tanks/non-profits or as institutional researchers
- Journalists who create interactive data visualizations

What is data management?

- All the stuff you have to do to create analysis datasets that are ready to analyze, e.g.:
  - Collect data
  - Read/import data into statistical programming language
  - Clean data
  - Integrate data from multiple sources (e.g, join/merge, append)
  - Change organizational structure of data so it is suitable for analysis
  - Create "analysis variables" from "input variables"
  - Make sure that you have created analysis variables correctly

Syllabus/logistics

Syllabus and course logistics

Course links:

- Link to syllabus #change later to a pdf file that's on github
- Link to resources page of course github website #Change later if needed

Course Structure

Course structure consists of weekly asynchronous course materials and weekly synchronous meetings. Each week we will focus on a particular topic (e.g., creating variables; writing functions). For each unit, students will complete bi-weekly problem sets. Problem sets will be completed in groups and focus on practical application of concepts/skills from the topic of the week.

Synchronous meetings

Synchronous class meetings will be on Zoom. Attendance during the entire period is required, but students may ask instructor/TAs for exceptions due to scheduling conflicts.

Assessment and Grading

Course grade will be based on the following components:

- Weekly problem sets (4 bi-weekly problem sets, 60 percent of total grade)
- Participation (15 percent of total grade)
- Take-home final (25 percent of total grade)

Learning Goals

At the end of this course, students will be able to:

1. Learn how to describe data using summary statistics and graphs.
2. Learn fundamental concepts of inferential statistics.
3. Use R to investigate data, to summarize and visualize data, and perform hypothesis tests
4. Perform and interpret regression analysis with R and by hand.

What is R?

R is a programming language for data visualization and statistical computing. You will often see R used for data mining, bioinformatics, and data analysis. R language has a large number of extension packages, containing reusable code, documentation, and sample data.

According to the Inter-university consortium for political and social research (ICPSR): > R is "an alternative to traditional statistical packages such as SPSS, SAS, and Stata such that it is an extensible, open-source language and computing environment for Windows, Macintosh, UNIX, and Linux platforms. Such software allows for the user to freely distribute, study, change, and improve the software under the Free Software Foundation's GNU General Public License."

- For more info visit R-project.org

Base R vs. R packages

There are "default" packages that come with R. Some of these include:

- `as.character`
- `print`
- `setwd`

And there are R packages developed and shared by others. Some R packages include:

- `tidyverse`
- `stargazer`
- `foreign`

more about these in later weeks...

Installing and Loading R packages

You only need to install a package once. To install an R package use `install.package()` function.

```
#install.packages("tidyverse")
```

However, you need to load a package everytime you plan to use it. To load a package use the `library()` function.

```
library(tidyverse)
```

RStudio

"RStudio is an integrated development environment (IDE) for R. It includes a console, syntax-highlighting editor that supports direct code execution, as well as tools for plotting, history, debugging and workspace management."

R Markdown

R Markdown produces dynamic output formats in html, pdf, MS Word, dashboards, Beamer presentations, etc.

- We will be using R Markdown for lectures and homeworks.

Why learn R? R can do a lot of stuff!

How we have used R+RStudio+RMarkdown in our research team

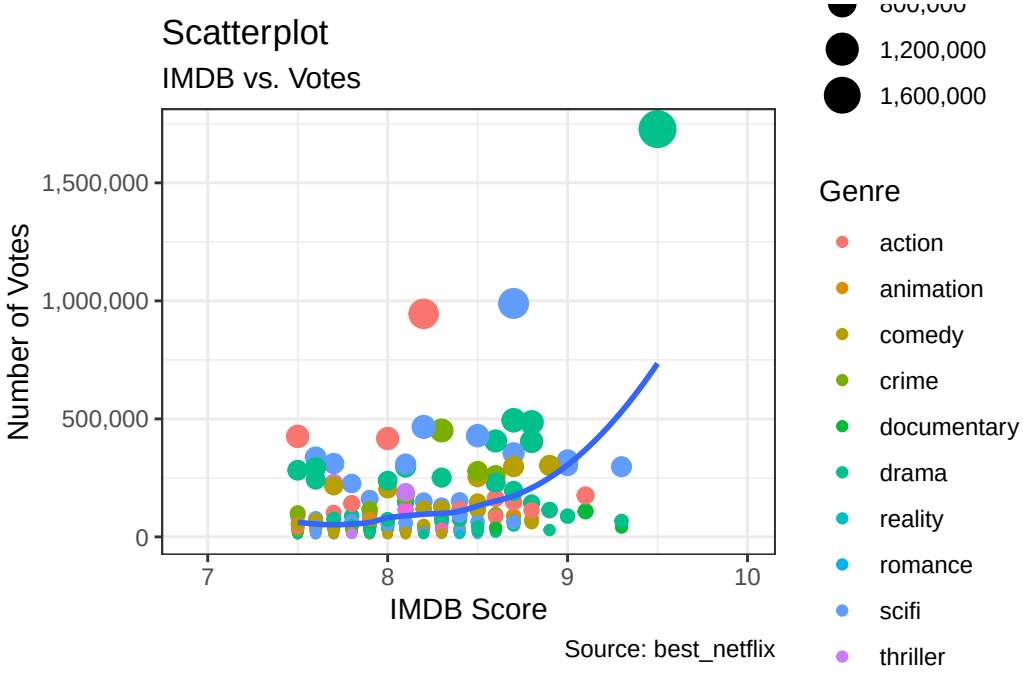
- Stuff traditional statistical software (e.g., SPSS, Stata) can do
  - Data manipulation, creating analysis datasets
  - Descriptive statistics and statistical models
  - Graphs
- Stuff traditional statistical software cannot do
  - Static policy reports
  - Static presentations
    - All lectures for this class written in RMarkdown
  - Interactive presentations
  - Interactive maps
  - Interactive dashboards
  - Interactive graphs

Some of the other stuff R can create/do:

- Websites; journals; books; web- scraping; network analysis; machine learning/artificial intelligence

Graphs

- We can create graphs with ggplot2 package



Directories and filepaths

Directories and filepaths

- Give you a very brief overview of "directories" (i.e., folders) and "filepaths" (tells you where folder is located) in R
- Why? After this overview we will ask you to create the directory structure you will use for all files related to this class

Working directory

(Current) Working directory

- the folder/directory in which you are currently working
- this is where R looks for files
- Files located in your current working directory can be accessed without specifying a filepath because R automatically looks in this folder

Function `getwd()` shows current working directory

```
getwd()
```

```
[1] "/Users/bellelee/Downloads/SSS Lectures/Lectures/Week 1 Lectures"
```

Command `list.files()` lists all files located in working directory

```
list.files()
```

Working directory, "Code chunks" vs. "console" and "R scripts"

When you run **code chunks** in RMarkdown files (.Rmd), the working directory is set to the filepath where the .Rmd file is stored

```
getwd()
```

```
[1] "/Users/bellelee/Downloads/SSS Lectures/Lectures/Week 1 Lectures"
```

```
list.files()
```

When you run code from the **R Console** or an **R Script**, the working directory is:

- if you are working on an R "Project", the working director is the main directory for the project

```
getwd()
```

Absolute vs. relative filepath

Absolute file path: The absolute file path is the complete list of directories needed to locate a file or folder.
`setwd("/Users/pm/Desktop/SSSclass/lectures/lecture2")`

Relative file path: The relative file path is the path relative to your current location/directory. Assuming your current working directory is in the "lecture2" folder and you want to change your directory to the data folder, your relative file path would look something like this:
`setwd("../../data")`

```
File path shortcuts
```

Key	Description
~	tilde is a shortcut for user's home directory (mine is my name pm)
../	moves up a level
../../	moves up two level

Create "R project" and directory structure

What is an R project? Why are you doing this?

What is an "R project"?

- helps you keep all files for a project in one place
- When you open an R project, the file-path of your current working directory is automatically set to the file-path of your R-project

Why are we asking you to create R project and download a specific directory structure?

- We want you to be able to run the .Rmd files for each lecture on your own computer
- Sometimes these .Rmd files point to certain sub-folders
- If you create R project and create directory structure we recommend, you will be able to run .Rmd files from your own computer without making any changes to file-paths!

Follow these steps to create "R project" and directory structure

1. Download this zip folder: [LINK HERE] #need to update
    - this zip file contains the shell file directory you should use for this class
    - Unzip the folder
        - contains folder named "SSS class"; this is the folder that will contain all materials for this course
        - "rclass" contains two folders: "data" and "lectures"
    - Move "rclass" folder to your preferred location (e.g, documents, desktop, dropbox, etc)
2. In RStudio, click on "File" » "New Project" » "Existing Directory" » "New Project"
    - "Browse" to find "SSS class" folder you just saved
    - Then click on Create Project
3. Save the following files in "SSS class/lectures/lecture1"

- lecture1.1.qmd
- lecture1.1.pdf
- lecture1.2.qmd
- lecture1.2.Pdf
- lecture1.2.R

Next,you follow these steps

- you can add any additional sub-folders you want to the "SSS class" folder
  - e.g., "syllabus", "resources"
- You can add any additional files you want to the sub-directory folders you unzipped
  - e.g., in "SSS class/lectures/lecture1" you might add an additional document of notes you took