

Lessons Learned from Teaching Programming in R

Remote and In Person

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University of California Riverside

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University of California Riverside at a Glance

- ▶ Hispanic Serving Institution
- ▶ 101 Undergraduate Statistics Majors
- ▶ 166 Undergraduate Data Science Majors
- ▶ 51.8% First Generation College Student
- ▶ 45.6% Pell Grant Recipients

Introducing R to Undergraduate Students

- ▶ **STAT 010: *Introduction to Statistics I***
 - ▶ Equivalent to AP Statistics
 - ▶ Utilizes R in lectures, labs, prerecorded videos
- ▶ **STAT 011: *Introduction to Statistics II***
 - ▶ Linear regression, analysis of variance, and simple experimental designs
 - ▶ Utilizes R in lectures, labs, prerecorded videos
- ▶ **STAT 107: *Introduction to Statistical Computing With R***
 - ▶ Data management, statistical analysis and graphics, functions and packages, simple programming, and reproducible work
 - ▶ Primarily for STATS and DS majors

Enrollment

STAT 010

- ▶ 1800 per year
 - ▶ Aim to offer 1 in-person and 1 online section per quarter
 - ▶ 250 per section (100 per in summer)
- ▶ In-person enrollment limited by lab availability

STAT 107

- ▶ 130 per year
 - ▶ 56 per section (25 per in summer)
- ▶ Virtual, Hybrid, In-Person

- ▶ R
 - ▶ TA guided labs
 - ▶ Many student's also use R instead of tables (e.g. Normal, t , ...)
 - ▶ Primary goal is early **exposure**
 - ▶ Using *OpenIntro Statistics* labs
 - ▶ Group assignments

STAT 010 Topic Videos

Testing for goodness of fit using chi-square

- Could use a table to find $P(X^2 > 5.89)$, but it's easier to use R.

```
p.value <- pchisq(5.89, df=3, lower.tail = FALSE)
p.value
```

```
## [1] 0.1170863
```

- Since the p-value is greater than 0.05, we fail to reject the null hypothesis. That is, we fail to find strong evidence there is racial bias in juror selection.



08:55 / 09:22

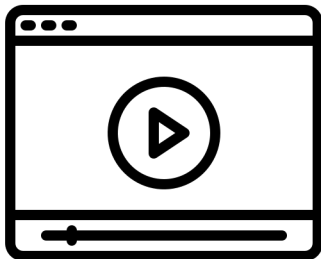


STAT 107

- ▶ Primary goal is to gain skills for future classes
- ▶ Projects
 - ▶ Similar to notes
 - ▶ Challenge problems
 - ▶ “Creative”
- ▶ Lab assignments

Use of Videos

- ▶ FAQ, Troubleshooting, Main Concepts
- ▶ Solutions
- ▶ Syllabus
- ▶ Instructor Absences



Assignments

- ▶ Virtual Submissions
- ▶ Response Survey
- ▶ Designated questions that can be discussed with classmates
- ▶ Rmarkdown

Assignments

```
1 ---
2 title: "Untitled"
3 author: "Rebecca Kurtz-Garcia"
4 date: "January 6, 2023"
5 output: html_document
6 ---
7
8 ```{r setup, include=FALSE}
9 knitr::opts_chunk$set(echo = TRUE)
10 ```
11
12 ## R Markdown
13
14 This is an R Markdown document. Markdown is a simple
15 formatting syntax for authoring HTML, PDF, and MS Word
16 documents. For more details on using R Markdown see
17 <http://rmarkdown.rstudio.com>.
18
19 When you click the Knit button a document will be
20 generated that includes both content as well as the output
21 of any embedded R code chunks within the document. You can
22 embed an R code chunk like this:
23
24 ```{r cars}
25 summary(cars)
26 ```
27
28 ## Including Plots
```

Untitled

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R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

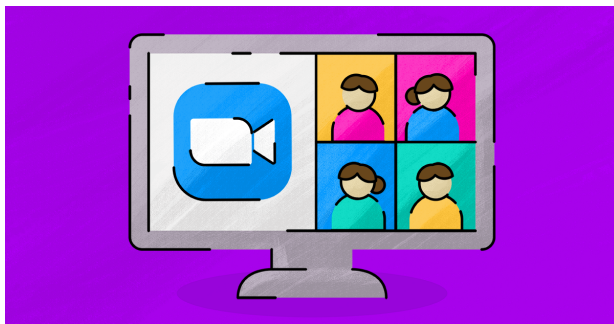
When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)
```

```
##      speed      dist
##  Min.   : 4.0   Min.   : 2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
```

Office Hours

- ▶ Virtual or Hybrid format
- ▶ Study breakout rooms



Interaction Tools

- ▶ Surveys, discrete check ins
- ▶ Discussing problems with classmates
- ▶ Piazza, Discord, Slack



Post To ☒ Entire Class ☐ Individual Student(s) / Instructor(s)

Select Folder(s)

hw1 hw2 hw3 hw4 hw5 hw6 hw7 exam logistics other discussion1 discussion2
discussion3 discussion4 discussion5 discussion6 discussion7 discussion8 discussion9
discussion10

[Manage and reorder folders](#)

Summary

What is wrong with my vector?

Details

☐ Rich text editor ☐ Plain text editor ☒ Markdown editor

☒ preview

I am not sure why my vector returns an ****error**** message

""

`v <- (1,2, 3)`

""

I am not sure why my vector returns an **error** message

```
v <- (1,2, 3)
```

Use `$$latex formula$$` for LaTeX.

Participation

- ▶ Balance of in-person and virtual opportunities
 - ▶ Piazza activity
 - ▶ Instructor Piazza daily-ish question
 - ▶ Office hours participation
 - ▶ In-class participation
 - ▶ Attendance
- ▶ Peer evaluation (group assignments)

Introducing R to Graduate Students

Graduate Programming/Statistics Bootcamp

- ▶ Always virtual
- ▶ Computing in R for research
- ▶ Specifically designed for incoming underserved students
- ▶ Open to all graduate students after initial enrollment period

STAT 206: *Statistical Computing*

- ▶ STAT students usually take this their 1st quarter on campus
- ▶ Popular with external graduate students
- ▶ Elective for online engineering MS program

Virtual Learning, R, and DEI

- ▶ Virtual/in-person classroom expectations
- ▶ Choices to make
 - ▶ Open Access vs Traditional Textbooks
 - ▶ Digital vs Physical Submissions
 - ▶ Streaming (and study) spaces
 - ▶ Flexibility vs Structure

Pandemic Impacts

- ▶ Virtual skills are becoming standard
- ▶ Available computers
- ▶ “People that are students” rather than “students that are people” mentality

Considerations Going Forward

- ▶ Dominate clear stream of information
- ▶ Curating resources
- ▶ Facilitating interaction

Challenges Going Forward

- ▶ Integrated platforms (Piazza, Gradescope, Canvas, Google Forms, Github)
- ▶ Changing Technology
- ▶ Grading
- ▶ In-person evaluation

Thank You!

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