Political Science 1600

INTRODUCTION TO QUANTITATIVE RESEARCH METHODS

Paul Testa
Assistant Professor
paul_testa@brown.edu

First Draft: August 29, 2017
This Draft: January 27, 2022

Overview

General Information

Course Website https://pols1600.paultesta.org

Canvas https://canvas.brown.edu/courses/1085334

Zoom https://brown.zoom.us/j/97039852954

Where/When We meet Tuesdays and Thursdays from 1:00–2:20 pm in Smith-Buonanno Hall G13.

Office Hours Thursdays from **3:00-5:00 pm** via Zoom or in person at 111 Thayer St Room 339. If possible, please reserve a spot here

Course Summary

This class is an introduction to applied statistics as practiced in political science. It is computing intensive, and, as such, will enable students to execute basic quantitative analyses of social science data using the linear model with statistical inference arising from re-sampling and permutation based techniques as applied in the R statistical computing language R with RStudio. By the end of the course, a successful student will be able to find social science data online, download it, analyze it, and write about how the analyses bear on focused social science or policy questions.

Course Goals

More than anything I assume a willingness to engage with mathematics, data analysis, computer programming, and the practice of social science thinking and writing. I also assume you've taken at least one class in algebra at the level taught in most high schools in the United States and have used a personal computer to read and type email and other documents and have some experience with the Internet.

I also assume that you will read the syllabus and that you keep up to date on changes in the syllabus which will be announced in class. You should not expect a response to emails that ask a question already answered in the syllabus.

This is an experimental class so you should expect that the syllabus will change throughout the term. Make sure you have the syllabus with the latest date stamp. I will announce syllabus changes via the emails sent from Canvas.

Community Standards

All students and the instructor must be respectful of others in the classroom. If you ever feel that the classroom environment is discouraging your participation or problematic in any way, please contact me.

Accessibility

Brown University is committed to full inclusion of all students. Please inform me if you have a disability or other condition that might require accommodations or modification of any of these course procedures. You may speak with me after class or during office hours. For more information contact Student and Employee Accessibility Services at 401-863-9588 or SEAS@brown.edu.

Academic Integrity

Neither the University nor I tolerate cheating or plagiarism. The Brown Writing Center defines plagiarism as "appropriating another person's ideas or words (spoken or written) without attributing those word or ideas to their true source." The consequences for plagiarism are often severe, and can include suspension or expulsion. This course will follow the guidelines in the Academic Code for determining what is and isn't plagiarism:

> In preparing assignments a student often needs or is required to employ outside sources of information or opinion. All such sources should be listed in the bibliography. Citations and footnote references are required for all specific facts that are not common knowledge and about which there is not general agreement. New discoveries or debatable opinions must be credited to the source, with specific references to edition and page even when the student restates the matter in his or her own words. Word-for-word inclusion of any part of someone else's written or oral sentence, even if only a phrase or sentence, requires citation in quotation marks and use of the appropriate conventions for attribution. Citations should normally include author, title, edition, and page. (Quotations longer than one sentence are generally indented from the text of the essay, without quotation marks, and identified by author, title, edition, and page.) Paraphrasing or summarizing the contents of another's work is not dishonest if the source or sources are clearly identified (author, title, edition, and page), but such paraphrasing does not constitute independent work and may be rejected by the instructor. Students who have questions about accurate and proper citation methods are expected to consult reference guides as well as course instructors.

We will discuss specific information about your written work in class in more detail, but if you are unsure of how to properly cite material, please ask for clarification. If

you are having difficulty with writing or would like more information or assistance, consult the Writing Center, the Brown library and/or the Academic Code for more information.

Academic Accommodations

Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. As part of this process, please be in touch with Student Accessibility Services by calling 401-863-9588 or online

Diversity and Inclusion

This course is designed to support an inclusive learning environment where diverse perspectives are recognized, respected and seen as a source of strength. It is my intent to provide materials and activities that are respectful of various levels of diversity: mathematical background, previous computing skills, gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Toward that goal:

- If you have a name and/or set of pronouns that differ from those that appear in your official Brown records, please let me know!
- If there are things going on inside or outside of class that are affecting your performance in class, please don't hesitate to talk to me, provide anonymous feedback through our course survey, or contact one of Brown's Academic Deans.

Course Structure and Policies

Class

This course meets two times a week for 80 minutes on Tuesdays and Thursdays. Tuesday's class will be devoted to lecture, demonstration and review. Recorded versions of these lectures will be provided on Canvas after class. Thursday's class will focus on applications of these concepts through brief labs where you'll work with real data from a variety of sources. I assume that you will come to class having done each week's assigned readings and reviewed material from the previous week's lectures and labs. Slides and labs are available on Canvas and `https://pols1600.paultesta.org`

Attendance

You may miss two classes without it having any effect on the attendance portion of your grade. After two absences, each additional absence (without a written note from the University) will reduce your final grade by 1 percent.

Readings

There is one required textbooks for the course (**Estimated cost: ∼$42.00**):

Imai, K. (2017). *Quantitative Social Science: An Introduction*. Princeton, NJ: Princeton University Press

The primary textbook on which the course is structured. Most chapters are spread over multiple weeks. You should read this text with your laptop and R Studio open. Execute the code in the main text and ideally try to complete the assignments and

exercises at the end of the chapter.[1]

Additional readings will be listed below and available to download on Canvas.

Labs

The bulk of the work and learning you'll do in the course comes in the form of **weekly labs** in which you'll explore a given data set or paper using R. You'll be given an R Markdown document that will guide you through a set of exercises to teach concepts covered in the lectures and reading. You'll code in `R` and summaries of your findings in R Markdown. You will compile your document to produce an html document which you will **submit on Canvas by the end of each class.**

All work in this class **MUST BE SUBMITTED ONLINE VIA CANVAS.**

You will work in groups on these labs. One member of your group will submit a lab. One question from the lab will be randomly selected for grading.

Tutorials

In addition to weekly labs, you will also work through **weekly tutorials** made available to you through the 'qsslearnr' package. These tutorials provide you with an opportunity to practice your programming and review concepts from the text and lecture. After completing each tutorial, you will download your progress report and upload this file to Canvas by midnight on Friday each week a tutorial is assigned. If you upload a report by Friday, you receive a grade of 100% on that Tutorial. If you upload a report after Friday, you receive a grade of 50%. If you do not upload a report, you receive a grade of 0%. There are 11 total tutorials for the course. Your lowest grade on the Tutorials will be dropped.

These Tutorials are for your personal benefit. You may collaborate with peers, but you must submit your own file.

Assignments

In addition to weekly labs, you will complete periodic group assignments developing an original research presentation applying skills you have learned in this class to a topic of your choosing. All assignments are due the Friday after the class with which they are associated.

The timeline of assignments for your final paper is as follows:

- **Week 3: Research Topics**
- **Week 6: Identifying Datasets**
- **Week 8: Data Explorations**
- **Week 11: Draft of Research Presentation**
- **Week 12: Research Presentations**
- **Week 13: Final Paper**

[1] Seriously. Working carefully through these examples will be incredibly helpful and rewarding. If you're taking the time to read this footnote, send me picture of a cute animal and I'll add 1 point of extra credit to your final paper grade. See, your hard work is already paying off.

Assignments must be submitted on time to Canvas. No late work will be accepted without prior approval of the instructor or a note from the University.

Grades

Your final grade for this course will be calculated as follows:

- **5% Class attendance**
- **10% Class involvement and participation**
- **10% Tutorials**
- **30% Labs**
- **20% Assignments not including the final Paper**
- **25% Final Project**

Labs, assignments excluding the final presentation, will be graded graded out of 100 roughly on a ✓+ (100, completed on time, acceptable), ✓(85, completed on time, passable), ✓- (0 not submitted on time, unacceptable). The lowest three lab grades will be dropped from your final lab grade. Tutorials are graded on pass (submitted on time = 100%) - fail (not submitted =0) based submitting your progress report from the tutorial by Friday each week. If you submit a Tutorial after the week it's do, you will receive partial credit (50%). Your final presentations will be graded on 100-point scales with rubrics provided beforehand.

Incomplete Work Assignments not turned in will be counted as zero in the calculation of the final grade.

Computers in class Please bring your laptops if you have them. We will install R and RStudio together. If you do not own a laptop, you can still work in a group of other people who have laptops and will be able to complete the in-class worksheets without a problem. In fact, it is ideal if each group of 2-4 people works with one laptop and then shares the work among themselves. Of course, feel free to work on your own outside of class.

Time

This course meets 27 times over 13 weeks in the semester. Each class is 80 minutes long so you should expect to spend approximately 36 hours total in class; approximately 3 hours per week reading the textbook and reviewing material (39 hours total); approximately 11 hours on tutorials each week, approximately 15 hours on assignments for the final paper; approximately 20 hours researching, writing, and revising your final presentation; and at least .5 hours meeting with me in person to discuss your work (Estimated Total Time: 118.5 hours)

Schedule

The general outline of topics for the course is as follows. The data and topics for some labs may change.

In general, you will

- Do the week's assigned reading before class on Tuesday
- Submit your labs in class on Thursday
- Upload your weekly QSS Tutorial problem by midnight, Friday.

Week 0 — January 27, 2022— Introduction and Course Overview [Remote]

Thursday **January 27, 2022—Lecture:** What am I getting myself into? Course overview

Read: Imai (2017) Chapter 1 (if you have the textbook)

Do: Download and install R and R Studio following the steps outlined in Getting started with R

Week 1. Describing Data in R

Read: Imai (2017) Finish Chapter 1 Imai (2017) Chapter 3 pp. 75-97

Tuesday **February 1, 2022—Lecture:** How do we describe the world around us?

Thursday **February 3, 2022—Lab:** Levels of measurement; Measures of central tendency and dispersion; Loading and manipulating data in R

Friday **February 4, 2022—Tutorials:** QSS Tutorial 0: Introduction to R; QSS Tutorial 1: Measurement 1

Week 2. Visualizing Data in R

Read: Imai (2017) Chapter 3 pp. 97-122 R 4 Data Science Chapter 3 Data Visualization: https://r4ds.had.co.nz/data-visualisation.html

Tuesday **February 8, 2022—Lecture:** How can we visualize data to help us understand the world around us?

Thursday **February 10, 2022—Lab:** Visualizing distributions and relationships with ggplot

Friday **February 11, 2022—Tutorial:** QSS Tutorial 2: Measurement 2

Week 3. Causation I - Experimental Studies

Read: Imai (2017) Chapter 2 pp. 32-54

Broockman and Kalla (2016) skim for understanding of basic question, data and design

Tuesday **February 15, 2022—Lecture:** Making Causal Claims in Experimental Studies: How do we know if X causes Y?

Thursday **February 17, 2022—Lab:** Estimating causal effects with experimental data

Friday **February 18, 2022—Tutorial:** QSS Tutorial 3: Causation 1

Week 4. Causation II - Observational Studies

Read: Imai (2017) Chapter 2 pp. 54-74

Ferwerda and Miller (2014) skim for understanding of basic question, data and design

Tuesday **February 22, 2022—NO CLASS:**

Thursday **February 24, 2022—Lab:** Making Causal Claims in Observational Studies: How do we know if X causes Y without randomly assigning X? (Exploration of Ferwerda and Miller (2014))

Friday **February 25, 2022—Tutorial:** QSS Tutorial 4: Causation 2

Assignment 1 **DUE: 5 pm on Sunday, February 27, 2022. Submit proposed research topics on Canvas**

Week 5. Prediction I

Read: Imai (2017) Chapter 4 pp. 123-165

Tuesday **March 1, 2022—Lecture:** How do we make predictions?

Thursday **March 3, 2022—Lab** Simple linear regression. OLS as a linear approximation to the conditional mean function.

Friday **March 4, 2022—Tutorial:** QSS Tutorial 5: Prediction 1

Week 6. Prediction II

Read: Imai (2017) Chapter 4 pp. 165-188

Tuesday **March 8, 2022—Lecture:** How do we make predictions adjusting for potentially confounding factors?

Thursday **March 10, 2022—Lab:** Multiple regression. What it means to "control for education" or hold "age constant".

Friday **March 11, 2022—Tutorial:** QSS Tutorial 6: Prediction 2

Assignment 2 **DUE: 5 pm on Sunday, March 13, 2022. Submit discussion of potential data sources to Canvas**

Week 7. Prediction III

Read: Review Imai (2017) Chapter 4

Tuesday **March 15, 2022—Lecture** How do we evaluate our models predictions?

Thursday **March 17, 2022—Lab:** Measures of model fit; Obtaining predicted values; Dangers of over-fitting and under-fitting

Week 8. Probability I

Read: Imai (2017) Chapter 6 pp. 242-277

Levendusky (2009) Skim Chapter 3

Tuesday **March 22, 2022—Lecture:** What is probability and how do we use it?

Thursday **March 24, 2022—Lab**: Axioms of probability; Discrete and continuous probability distributions; Expectations, variance, and moments

Friday **March 25, 2022—Tutorial:** QSS Tutorial 7: Probability 1

Assignment 3 **DUE: 5 pm on Sunday, March 27, 2022. Submit Data Explorations on Canvas**

Spring Break

Week 9. Probability II

Read: Imai (2017) Chapter 6 pp. 277-313

Tuesday **April 5, 2022—Lecture:** What is probability and how do we use it?

Thursday **April 7, 2022—Lab:** Conditional probability; Bayes Rule; The Law of Large Numbers and The Central Limit Theorem; More fun with partisanship in the NES

Friday **April 8, 2022—Tutorial:** QSS Tutorial 8: Probability 2

Week 10. Uncertainty I

Read: Imai (2017) Chapter 7 pp. 314-342

Tuesday **April 12, 2022—Lecture:** How do we quantify uncertainty?

Thursday **April 14, 2022—Lab** Asymptotic and simulation based approaches to sampling distributions, standard errors, and confidence intervals.

Friday **April 15, 2022—Tutorial:** QSS Tutorial 9: Uncertainty 1

Week 11. Uncertainty II

Read: Imai (2017) Chapter 7 pp. 342-396

Tuesday **April 19, 2022—Lecture:** How do we quantify uncertainty?

Thursday **April 21, 2022—Lab** Asymptotic and permutation based approaches to hypothesis test and p-values

Friday **April 22, 2022—Tutorial:** QSS Tutorial 10: Uncertainty 2

Assignment 4 **DUE: 5 pm on Sunday, April 24, 2022. Submit draft of final project to Canvas**

Week 12. Workshops

Tuesday **April 26, 2022—Workshop:** Course Review and Final Project Workshop

Thursday **April 28, 2022—Workshop:** Course Review and Final Project Workshop

Assignment 5 **DUE: 5 pm on Sunday, May 1, 2022. Upload Project Presentations To Canvas**

Week 13. Workshops

Tuesday **May 3, 2022—Presentations:** Class Presentations

Thursday **May 5, 2022—Presentations:** Class Presentations

Final Project **DUE: 5 pm on Sunday, May 8, 2022. Upload Final Project To Canvas**

References

Broockman, D. and Kalla, J. (2016). Durably reducing transphobia: A field experiment on door-to-door canvassing. *Science (New York, N.Y.)*, 352(6282):220–4.

Ferwerda, J. and Miller, N. L. (2014). Political Devolution and Resistance to Foreign Rule: A Natural Experiment. *American Political Science Review*, 108(03):642–660.

Imai, K. (2017). *Quantitative Social Science: An Introduction*. Princeton, NJ: Princeton University Press.

Levendusky, M. (2009). *The partisan sort: how liberals became Democrats and conservatives became Republicans*. University of Chicago Press.