

POL SCI 200A: Probability and Inference for Social Science

Michelle Torres

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Contact Information

Instructor: Dr. Michelle Torres

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Office Hours: Thursday 11:00-12:30, or by appointment. You should sign up for office hours using [Calendly](#). The first day of classes we will determine whether this schedule works for the students. If for some reason you cannot attend the session in a given week, please contact me by e-mail to schedule a one-on-one.

Teaching Mentee: Graham Straus

Office: TBD

Email: gpstraus@gmail.com

Office Hours: During sections, or by appointment.

Grading session/Section: Fridays, 10:00-10:50am.

Course Overview and Objectives

Political science is the systematic study of politics. In order to achieve rigorous conclusions about political events, we need tools, techniques and methods to make statistical or quantitative insights into politics. This is called political methodology and it encompasses a wide variety of data types and approaches. In particular, this course focuses on the quantitative approach and the statistical core it implies.

Quantitative skills will make your research better, and this is basically because that research is judged on how convincing your inferences are. Statistics and evidence helps ensure and formalize credibility, not to mention that an overwhelming majority of top journal articles are quantitative.

The main objectives of this course is to provide you with the foundational baggage necessary to conduct, read and evaluate quantitative analysis. Understanding basic statistical concepts will help you to digest, analyze and even develop more sophisticated tools that are suitable for answering (or getting closer to answering!) the many wonderful questions I am sure you have, and that motivated you to come to graduate school.

The goals of this course include but are not limited to: translate political phenomena into mathematical notation, learn fundamental statistical concepts, explore and understand probability distributions and their properties, plot functions and interpret graphs, solve problems with logarithms, summations, products, solve problems in vector and matrix algebra, fully understand the concept of random variables, calculate expectations, variances, covariances, etc., and get an introduction to core concepts of inference and hypothesis testing.

Expect math and programming related content, and be ready to spend significant time working on problem sets. However, the course does not assume previous knowledge of the material, and is designed to cover fundamental concepts and basic topics, as long as you have an open mind and willingness to learn.

We will meet weekly on **Tuesdays and Thursdays, 9:30AM - 10:50AM** in Bunche 4357. You can find the details for the session in Canvas (BruinLearn).

Required Texts and Materials

- Jeff Gill. 2006. *Essential Mathematics for Political and Social Research*, Cambridge University Press: New York.
- Kosuke Imai. 2017. *Quantitative Social Science: An Introduction*. Princeton University Press.
- Blackwell, Matt. 2024. *A User's Guide to Statistical Inference and Regression*. Online at <https://mattblackwell.github.io/gov2002-book/>
- (OPTIONAL) Wooldridge, Jeffrey M. *Introductory Econometrics*. New York: South-Western. 5th edition. (earlier/later editions are fine)

You must purchase these through *Perusall*:

Course website(s)

Canvas/BruinLearn

We will use *Canvas* as a platform to interact with each other. I will upload the weekly problem sets in our course website, as well as extra material like practice exercises and slides. Announcements will be posted in Canvas as well as grades.

Perusall

Perusall is a platform to read and take notes. We will use it to annotate the assigned readings and have a discussion about them there. The main objective of Perusall is to provide you with a forum to ask and answer questions. Students can post questions about the material and the assignments

(with the exception of exams) and other students can (and should try to) reply. Students should also answer their own questions if they realized the answer later. Graham and I will also reply to questions on Perusall. Students should do their best to ask questions and provide answers in a concise manner and in a way that does not give away the complete answer to an exercise. If you e-mail Graham or me with a question that should be posted in Perusall, you will be asked to post it there.

To prepare for the lectures you should review the material covered in previous lectures and complete the reading assignments on Perusall. You can find the topics for each lecture in the schedule below.

Questions about the reading should be posted publicly in this platform, and students are encouraged to engage with those questions and continue the discussion. I will be able to see all of your comments and annotations. Using the online platform Perusall to ask and answer questions is strongly encouraged and it WILL contribute to your participation evaluation as well. You should purchase the two required textbooks through Perusall. Talk to me if for some reason you are facing difficulties to do this.

To start using Perusall, create an account through their main website using your UCLA e-mail. You will find a link on Canvas (Navigation Menu that leads you to the Perusall class site)

Evaluation

Grading

- Problem sets: total of 30% (5% for presentations)
- Participation and attendance: 10%
- Readings: 15%
- Midterm Exam: 20%
- Final Exam: 25%

Problem Sets (30%)

Students will be asked to complete weekly homework assignments (unless otherwise noted). These assignments are intended to expand upon the lecture material and to help students develop the actual skills that are necessary to use and apply what they are learning to their own work. The problem sets should be properly submitted in PDFs coming from \LaTeX , or **R Markdown**, every Thursday before 8:00 p.m. Late assignments will not be accepted given that we might solve a few exercises from the problem set in class. Talk to Graham and me if you want or need more resources regarding \LaTeX . I strongly suggest working in Overleaf, and going over [this](#) tutorial to give you a general overview of this program. For each assignment, please submit to Canvas the compiled PDF file AND your R script. Assignments submitted in other formats will not be accepted.

The sets will be a mix of analytic problems, and programming in R. You know what style of working is better for you (lonely wolf vs. pack of wolves), but I want to strongly encourage you to 1) first attempt the problem sets on your own, and then 2) talk to your classmates to work out any potential challenge. Working in groups for these assignments has proven to be a very successful strategy (and a wonderful community bonding activity!). Make sure to reach step 2 before reaching out to Graham or me. Even when you work in groups, you **must** type **every single** character/digit of your homework, and **must** include your own computer code.

I may randomly select two students to present and explain the solution of an exercise from the assignment to the class. The students can select which exercise they prefer to present; however, the two student cannot present on the same exercise. The presentations will be factored into the grade for the assignments.

The day the assignment is due, Graham will hold a session in which you all will answer the exercises in the problem set. This section is a self-grading session. Come prepared, ready to participate and show your work.

Participation (10%)

Attendance is expected to be near perfect. If for some reason you cannot attend class, let me know in advance and please make sure to 1) read the assigned material whenever you can, and 2) catch up with what we covered in class (ask a friend for his/her notes, check slides, etc.)

Reading (15%)

Reading is a costly activity, I recognize, so I keep the reading materials to a minimum. Focus and read the readings carefully. I purposefully limited the list to **required readings** only, but if you are curious or want to know more about a given topic, contact me so I can give you more resources.

Because the number of assigned readings per class is not large, I expect a high level of engagement with the material: take notes, write down your impressions or confusions, talk with your classmates, bring examples from other classes, etc. Your participation is important not only to evaluate that engagement, but also to enrich the discussion and learning experience of your classmates. This means you must demonstrate a willingness to 1) answer questions I pose in class, 2) pose your own questions when you have them, and 3) engage in discussions we hold during class, in Canvas or in Perusall. In some classes you can be randomly selected to either a) ask a question about the readings for that class, or b) answer (to the best of your abilities) the question of another classmate. If you are shy, use this class as an opportunity to overcome it (you will need to be more outspoken and extrovert for certain aspects of both academic and non-academic jobs). And meanwhile, use Perusall or office hours to demonstrate that you are reading and mastering the material.

Midterm (20%)

There will be one midterm exam to take home. No make-up exam is allowed unless an unusual emergency arises and is documented. I will post the exam on the specified date below. You will

have one week to complete it. If I post the exam on October 23 at 6:05 p.m., you must submit your answers in Canvas BEFORE October 30 at 6:05 p.m. Late answers (even by a minute) will not be accepted. The exam should also be in PDF format generated from L^AT_EX, and should also include the relevant R code (Check R-Markdown if you want to be extra efficient). Students will not be allowed to use Canvas or Perusall to ask questions about the exam. If there are clarifying questions about it, e-mail them to me. I will then anonymize the questions and post them in Canvas with an answer. Sending a question does not guarantee an answer; it will depend on the type of question. Answers with no work will receive no credit.

Final Exam (25%)

There will be a final exam. No make-up exam is allowed unless an unusual emergency arises and is documented. The take-home final exam will have two parts: a theoretical one and a programming one. The deadline to submit it is December 12, before noon.

Re-grading policies

I do not encourage requests for re-grading. But if you want to ask for one, contact me directly. You will have to write a one-page memo justifying the request for re-grading. This justification should not only have solid arguments but also evidence and code supporting it. After receiving this memo, I will personally re-grade the problem set but you should know that I will do it from scratch so there is a risk that you will lose points in other sections different from those under review.

Class policies and etiquette

There is one core tenet of classroom etiquette that we must all agree upon for this course to be a success – respect. I will respect each and every one of you as an adult responsible for your own learning, and I look forward to the opportunity to work with you as a class and individual students. I ask for the same degree of respect in return, both for me and the other students in the classroom. This requires that we all agree to abide by the following considerations:

- Classroom discussion should be civilized and respectful to everyone and relevant to the topic we are discussing. Respect the questions that other classmates may have. This is a safe environment to ask questions and learn.
- Consider that every minute that you use in class to participate and share your ideas and opinions, is a minute you are taking from someone else. Thus, make sure your contributions are informed and appropriately motivated (e.g. you read the readings, thought carefully about an idea, you are not simply giving opinions but are contributing to the discussion with comments and ideas supported by evidence.)
- Attend all class sessions, arrive on time, and stay until the class is over. If you must miss class or arrive late/leave early, please notify me before class.

- You must bring your laptop each class so we can work on some exercises during the second half of it. I am expecting your FULL attention during the lecture part of the class. There is no need to be using a laptop during that period unless you have a question based on your e-notes about the reading. Bring pencil, paper and eraser, or a tablet and e-pen that allows for handwriting. This is important for some in-class exercises.
- Use email in a respectful manner. We are all peers but that does not mean we should talk to each other without professionalism and respect. And please, do not use email as a forum to discuss important course-related issues that should be addressed in person, or general questions that should actually be discussed in Canvas or Perusall.
- ChatGPT policy: generative models may be very helpful when debugging and creating code. They can also give useful answers that complement your learning experience in class. However, use them responsibly. Do not copy and paste code from there and be mindful when asking questions and understanding answers. I am trusting that you are here to learn and the best way to do so is to go over the problem sets and learn about your strengths and weaknesses. Using ChatGPT to complete *may* (or may not) give you a good grade but will not help you to fulfill the real objectives of the class.

Disability and Accommodations

If you are already registered with the Center for Accessible Education (CAE), please request your Letter of Accommodation in the Student Portal. If you are seeking registration with the CAE, please submit your request for accommodations via the CAE website. Students with disabilities requiring academic accommodations should submit their request for accommodations as soon as possible, as it may take up to two weeks to review the request. For more information, please visit the CAE website (www.cae.ucla.edu), visit the CAE at A255 Murphy Hall, or contact us by phone at (310) 825-1501.

Violence and Discrimination Resources

UCLA prohibits gender discrimination, sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced any of these, there are a variety of campus resources to assist you, including a confidential hotline where you can talk to someone 24/7: (310) 825-0768. Title IX is a federal civil rights law in the United States that was passed as part of the Education Amendments of 1972. Therefore international students have access to the same services at the Title IX office as non-international students. Please note that faculty and TAs are responsible employees, which means faculty, TAs, and other UC employees are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Coordinator a non-confidential resource should they become aware that you or any other student has experienced sexual violence or gender discrimination. Confidential Resources: You can make an appointment with a CARE Advocate (careprogram.ucla.edu) or call their 24/7 hotline: (888) 200-6665. CARE offers free and confidential services for students, staff and faculty impacted by sexual assault, relationship violence

and stalking. Counseling and Psychological Services (CAPS) (counseling.ucla.edu) also offers confidential crisis counseling and 24/7 support at (310) 825-0768. You can also receive confidential off-campus emergency medical services, advocacy, and counseling at the Rape Treatment Center UCLA Medical Center Santa Monica. Their 24/7 hotline is (424) 259-7208. Non-Confidential Reporting: You can report sexual violence or sexual harassment directly to the University's Title IX Office, 2255 Murphy Hall, titleix@conet.ucla.edu, (310) 206-3417. Reports to law enforcement can be made to UCPD at (310) 825-1491. Please note that any appointment you make with a Title IX representative is NOT confidential.

Chosen Names and Personal Pronouns

Everyone has the right to be addressed by the name and pronouns that correspond to their gender identity, including non-binary pronouns, for example: they/them/theirs, ze/zir/zirs, etc. Rosters do not always list all gender or pronouns so you may be asked to indicate the pronouns you use so that I don't make assumptions based on your name and/or appearance/self-presentation (you are not obligated to do so). If you use a chosen name, please let me know. Chosen names and pronouns are to be respected at all times in the classroom. Mistakes in addressing one another may happen, so I encourage an environment of openness to correction and learning. I will not however, tolerate repeated comments which disrespect or antagonize students who have indicated pronouns or a chosen name. Chosen name and personal pronouns may evolve over time, so if at any point during the semester you would like to be addressed differently, please let me know.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice.

Course Schedule

Week 1 (09/26-09/27): Introduction and Basics

Introduction and Basics

- Course details and logistics
- Goals of the course
- Notation
- Functions, logs and exponents

Section 1: 2024/09/27

Due 09/27: Problem set #0

Week 2 (10/01-10/04): Matrix Algebra Refresher

- Vectors and matrixes
- Operations
- Rank and Trace
- Determinants

Section 2: 2024/10/04

Readings: Gill, 3.1-3.5, 4.4-4.7

Due 10/03 before class: Problem set #1

Notes: Graham in charge of 10/01 Class

Week 3 (10/09-10/11): Probability theory I

- Basics of probability
- Counting rules
- Permutations and Combinations

Section 3: NO SESSION TODAY

Readings: Imai, 6.1

Due 10/10 before class: Problem set #2

Week 4 (10/15-10/18): Random Variables I

Random variables I

- Random variables
- Probability distributions
- Cumulative distribution functions
- Simulating from random variables

Section 4: 2024/10/18

Readings: Imai, 6.3; Gill, 8.3.1, 8.3.2, 8.3.6, 8.3.7, 8.3.10

Due 10/17 before class: Problem set #3

Week 5(10/22-10/25): Random Variables II

Random variables II

- Joint and conditional distributions
- Moments
- Covariance, correlation, and independence

Section 5: 2024/10/25

Readings: Imai, 6.2; Gill, 8.4-8.5

Due 10/24 before class: Problem set #4

Notes: MIDTERM POSTED

Week 6 (10/29-11/01): Sums, means, and limit theorems

- Distribution of the sample mean
- Useful inequalities
- Law of large numbers
- Central Limit Theorem

Section 6: 2024/11/01

Readings: Imai, 6.4-6.5

Due 10/30 at 10:00 a.m.: MIDTERM

Week 7 (11/05-11/08): Estimation and statistical inference

- Populations, samples, statistical models
- Point estimation
- Properties of estimators
- Confidence intervals

Section 7: 2024/11/08

Readings: Imai, 7.1, Blackwell 1.1-1.6

Due 11/07 before class: Problem set #5

Week 8 (11/12-11/15): Hypothesis testing

- Hypothesis testing
- Small sample testing and confidence intervals

Section 8: 2024/11/15

Readings: Imai, 7.2

Due 11/14 before class: Problem set #6

Week 9 (11/19-11/22): Regression and inference I

- Mechanics of Ordinary Least Squares
- Assumptions of the linear model
- Properties of least squares

Section 9: 2024/11/22

Readings: Imai, 7.3

Due 11/21: Problem set #7

Notes: 11/21 Class and Office hours cancelled

Week 10 (11/26-11/29): Regression and inference II

- Inference with regression
- Omitted variables and multicollinearity

Section 10: THANKSGIVING BREAK

Readings: Wooldridge, Ch. 1

Notes: 11/28 – THANKSGIVING BREAK

Week 11 (12/03-12/06): Regression and inference III and Wrap-up

- Matrix form of regression
- Mechanics of multiple linear regression
- Inference in a multiple linear regression model

*** Readings:** Blackwell, Chapter 6 *Section 11: 2024/12/06*

Readings:

Due 12/05 before class: Problem set #8 Notes: 12/05 FINAL EXAM POSTED

Final exam

Due 12/12 before noon (12:00 p.m.)