Empirical Methods I
POLS 509

Spring 2021
Zoom: https://emory.zoom.us/j/93759177569
Hours: Mondays and Wednesdays 9:40-11:00

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Description

Empirical Methods I is an introduction to statistics for political science PhD students. The first half of this course will review the foundations of probability theory and covers properties of random variables, asymptotic approximations, methods for developing and evaluating statistical estimators, and hypothesis testing. The second half of this course will develop the linear regression model with a focus on its assumptions, statistical properties, inference, and diagnostics.

Learning goals

The main goal of this course is for students to familiarize themselves with and to learn to apply the main concepts of mathematical statistics and linear regression analysis. An additional goal of this course is for students to improve their statistical computing skills through problem sets and exams that contain applications of the course's theoretical concepts to data.

Course structure

This course is online and will have Zoom synchronous sessions twice per week (see meeting ID and hours above). Presentation slides and recordings will be uploaded to Canvas after each session.

Prerequisites

- Mathematical Tools for Political Scientists (POLS 508)

Grading

- 10% Participation
- 5% In-class quizzes
- 20% 2 In-class midterms (10% each)
- 25% Take home final

- 40% Problem sets

All problem sets and exams will be given a score from 1 to 100 and a letter grade. The final course and assignment grades will be given according to the following scale:

Grade	Score
A	$(95, 100]$
A-	$(75, 95]$
B+	$(70, 75]$
B	$(65, 70]$
B-	$(60, 65]$
C+	$[0, 60]$

Unlike exams and problems sets, in-class quizzes will receive a minimum score of 60 points. A correct answer will receive a score of 100 points; an answer that is conceptually correct but has a small mistake – for example, a mathematical derivation error – will receive a score of 90 points; an answer that has a conceptual problem will receive a score of 70 points. The participation grade will be assessed at the end of the semester and will have a minimum score of 60 points.

Course logistics and requirements

- Participation: During lecture, I will ask simple questions based on the discussion. I prefer students answer on a voluntary basis, but I reserve the right to call on individual students.
- In-class quizzes: These are 5 to 10 minute quizzes that test a basic concept from the assigned readings.
- You are encouraged to discuss problem sets with your classmates. However, each student must turn in their own work. Problem sets are also open-book and open-note.
- When taking the midterm exam or in-class quizzes, you are not allowed to discuss the exam's content with anyone and should not consult books, notes, or any other materials. I am required to report any violations of this policy to the Honor Council.
- Midterm exams will take place during synchronous sessions. You should prepare your web-cams in advance and make sure that they work properly. Please also have at least one backup alternative (another laptop with full battery and camera, if possible, or a mobile phone). You should also plan to be in a place where the internet connection will not fail. Throughout the exam, students will be recorded and are expected to remain in the frame. At the end of the exam, You will take a clear picture of your answers as well as your scrap paper and upload them to Canvas.
- You are not required to turn in your assignments in Latex format.
- If you do not type your answers, you must write neatly and take good quality pictures of your handwritten answers once you finish an exam or problem set using a document scanning app on your phone. Adobe Scan and Scanbot are good options, but you are free to choose any

other scanning app that you prefer. There will be a penalty of 10 points if it is difficult for me (or the grader) to read a student's handwriting. If a student repeatedly loses points in this way, I will ask them to type all future assignments in Latex.

- The penalty for unexcused late homework is 20 points per day.

Additional Assistance

Elisha Cohen (elisha.ann.cohen@emory.edu) will be the TA for the class. She will answer questions regarding the problem sets and will hold regular office hours Thursdays from 11:00am to 12:00pm.

Other policies

- For this course's Zoom sessions, students should turn their cameras on.
- You are expected to attend all sessions. I understand this semester is unlike any other, and I plan to be flexible to account for unforeseen circumstances. If you have to miss a class, please notify me and send me proper written justification (medical or otherwise) within a week after the missed class.
- It is one of my goals to provide an inclusive learning environment. The Department of Accessibility Services (DAS) works with students who have disabilities to provide reasonable accommodations. It is the student's responsibility to request accommodations by registering with the DAS (http://accessibility.emory.edu/students/). Accommodations cannot be retroactively applied. Students need to contact DAS and inform me as early as possible in the semester to discuss their implementation plan. For additional information about accessibility and accommodations, please contact the Department of Accessibility Services at (404) 727-9877 or accessibility@emory.edu..
- The honor code is in effect throughout the semester. You should familiarize themselves with the honor code, which can be found at this link:
http://catalog.college.emory.edu/academic/policies-regulations/honor-code.html
- This course's sessions on Zoom will be recorded for students in the class to refer back to the lectures and for enrolled students who are unable to attend live. The recordings and other materials posted on Canvas are for the sole purpose of educating the students enrolled in this course. The release of such information (including, but not limited to, directly sharing, screen capturing, or recording content) is prohibited. Doing so without my permission will be considered an Honor Code violation and may also be a copyright violation. Students who participate with their camera and mic engaged or utilize a profile image are agreeing to have their video, image, and voices recorded. If students are unwilling to consent to have their profile image, video, or audio recorded and posted on canvas, they must keep their camera off, not use a profile image, and use the "chat" feature to communicate during class.

Instructor responsibilities

Your success in this class is important to me. These are some of the actions I will take to help you master the material of this course:

- I will carefully prepare each of the lectures, exams, and assignments, in a way that enhances your understanding of the core concepts of statistics. This involves the selection of most applications from political science, a clear correspondence between what is covered in class and what is included in exams and assignments, and lectures that follow the material included in the assigned textbook.
- I will be available during office hours online to answer any question (see personal meeting ID above). If my office hours are not compatible with your schedule, I will do my best to accommodate particular circumstances. Part of my job is to answer and clarify any question regarding the material that you might have. Interruptions and questions during synchronous sessions are more than welcome (just raise your hand).
- If you need to communicate with me outside of regular class hours, please send me an email (see my email address above). I respond to emails in less than 48 hours (most likely within a day).
- I am committed to give you information about your performance in the course in a timely manner. I usually take one week after you have turned in an exam or a problem set to grade it. If I am taking longer, please remind me about this commitment.
- I will provide you with answer keys for each problem set and exam. This will help you identify past mistakes and gaps in your understanding. If you have questions about the answer keys, do not hesitate to ask me.

Readings

This course has one required textbook:

- John A. Rice. 2007. *Mathematical Statistics and Data Analysis*, 3rd edition. Pacific Grove, Calif.: Duxbury. ISBN: 978-0534399429

If you want an alternative take on the material from the first part of the course, I recommend the following books:

- Dennis Wackerly, William Mendenhall, and Richard L. Scheaffer. 2002. *Mathematical Statistics with Applications*, 6th ed. Pacific Grove, Calif.: Duxbury.
- George Casella and Roger L. Berger. 2001. *Statistical Inference*, 2nd edition. Pacific Grove, Calif.: Duxbury.

I also suggest you acquire a comprehensive econometrics textbook for the second part of the course. You will most likely need one of these throughout your graduate careers. My two suggestions are:

- A. Colin Cameron and Pravin K. Trivedi. 2005. *Microeconometrics: Methods and Applications*, New York: Cambridge University Press. ISBN: 978-0521848053

- William H. Greene. 2011. *Econometric Analysis (7th Edition)*, New York: Pearson. ISBN: 978-0131395381

Tentative Outline

- Week 1: Probability theory review (class notes)
- Week 2: Joint distributions (Ch 3.1-3.6 and 4.3 and 4.4 of Rice)
- Week 3: Weak Law of Large Numbers, Central Limit Theorem (Ch. 5 of Rice)
- Week 4: Important distributions and Survey Sampling (Ch. 6 and 7.1-7.3 of Rice)
- Week 5: Midterm 1 (Feb 22)
- Week 5: Method of Moments (Ch. 8.1-8.4 of Rice)
- Week 6: Maximum Likelihood Estimation (Ch. 8.5 of Rice)
- Week 7: Bayesian Inference (Ch. 8.6 of Rice)
- Week 8: Hypothesis Testing, Type 1 and Type 2 Errors, Null vs. Alternative, Statistical Significance and p-Values (Ch. 9 of Rice)
- Week 9: Confidence Intervals and Goodness of Fit (Ch. 9 of Rice)
- Week 10: Midterm 2 (March 29)
- Week 10: Ordinary Least Squares setup, assumptions, and finite sample results (Ch. 14 of Rice)
- Week 11: Asymptotic properties of OLS and hypothesis testing
- Week 12: Violations of OLS assumptions and solutions
- Week 13: Limited dependent variables and model selection