

# POL 213: Quantitative Analysis in Political Science II

Thursday, 12:10–3:00 PM

Kerr Hall 593

CRN 53499

<https://canvas.ucdavis.edu/courses/892125>

**vers. 29 March 2024**

## Instructor:

Lauren Peritz [lperitz@ucdavis.edu](mailto:lperitz@ucdavis.edu)

Office hours: Tuesdays 1:00PM - 3:00PM in Kerr 680 and online

OH link: Zoom, passcode: marmot

## Teaching assistant:

Lily (Yu-Shiuan) Huang [yslhuang@ucdavis.edu](mailto:yslhuang@ucdavis.edu)

Discussion session: TBD

Office hours: Wednesdays 1:00PM - 3:00PM in Kerr 675

## Course description:

This course builds on the material learned in POL 211 and 212. In 211, you learned the basics of data analysis in the social sciences including measures of central tendencies and dispersion, graphical summaries of variables, probability distributions, confidence intervals, *t*-tests, and hypothesis testing. In 212 you expanded your understanding of the linear regression model—the workhorse of statistical inference in the social sciences. You covered the basic assumptions of the linear model, methods for transforming data, estimation and interpretation of the classical linear model, derivations of the estimators of interest, and diagnostics of results and/or potential fixes for violations of assumptions. In POL 213, we will derive the linear model, examine multivariate regression, and extend our discussion of estimation, interpretation, diagnostics, and model selection. We will motivate the use of maximum likelihood estimation by showing when and why linear regression is unsuitable for categorical dependent variables. Finally, this course will cover several types of MLE models to establish a foundation for future learning. Like the rest of the political science first year sequence, this course will use the statistical programming language R.

## Required texts:

1. Gelman, Andrew, Jennifer Hill, and Aki Vehtari. 2021. *Regression and Other Stories*. New York: Cambridge University Press. Available online.
2. Fox, John. 2016. *Applied Regression Analysis and Generalized Linear Models*, third edition. Thousand Oaks, CA: Sage. Comprehensive treatment of regression models (see also Fox and Weisberg's *An R Companion to Applied Regression*.)

**Recommended texts:** I recommend reading a diverse set of textbooks, lectures, and presentations on all topics methodological: probability, statistics, computing, modeling, problem solving and algorithmic design, the process and nature of scientific inquiry, etc. These topics require steady effort to master. The more time you spend with them, the better you will understand the theory and concepts and the greater facility you will have applying them in creative ways to your own substantive research interests.

1. Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. New York: Cambridge University Press. Excellent discussion of motivations for, derivations and implementation of multilevel models, widely applicable to social science.
2. James, Gareth, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2013. *An Introduction to Statistical Learning with Applications in R*. New York: Springer. If you're looking for a light, user-friendly introduction to machine learning methods (and a discussion of how regression analysis fits into this world), this is the book for you.
3. Monogan, James E. III. 2015. *Political Analysis Using R* London: Springer. (Available electronically from the UC Davis library's website.) A political-science focused discussion of statistical fundamentals with R applications.
4. Christopher R. Bilder and Thomas M. Loughin. 2015. *Analysis of Categorical Data with R*. Boca Raton: Chapman and Hall/CRC. New to me, but comes highly recommended. It looks like a great reference for models of categorical data beyond what can be covered in POL213.
5. King, Gary. 1998, *Unifying Political Methodology*, Ann Arbor: University of Michigan Press. Useful reference for maximum likelihood estimation. Recommended for those interested in methodology subfield.

### Grade components:

Problem Sets (three)	60%
Midterm Exam (in class, May 16)	15%
Final Exam (take home, June 10)	25%

### POL 213 Policies:

**Problem Sets:** Three problem sets will be given throughout the quarter. Your homework should be prepared in  $\text{\LaTeX}$  or **Markdown** and formatted neatly. Submit your write-up and R code (where applicable) via **Canvas**. Each problem set is worth 20% of your grade. We will accept late problem sets after the due date with a penalty as follows: 1:00-24:00 hours late = 1 letter grade penalty, 24:01-48:00 hours late = 2 letter grade penalty, etc.

**Midterm Exam:** There will be a midterm exam held in class on May 16. This exam is worth 15% of your grade.

**Final Exam:** There will be a take home final exam due on Monday, June 10 at 11:59PM. This exam is worth 25% of your grade. Your final exam should be prepared in  $\text{\LaTeX}$  or Markdown and formatted neatly. Submit your write-up and any applicable code via Canvas.

**Course materials:** Course materials (including slides, R code, and assignments) will be available on the class Canvas page. Please buy or download the assigned textbooks as they will serve as crucial reference material in this class and throughout your graduate studies.

**Adjustments:** This syllabus is subject to change. Any changes will be announced as soon as possible and individual needs will be accommodated to the greatest extent possible, subject to university policy and instructor discretion.

**Academic honesty:** I strictly adhere to the UC Davis Code of Academic Conduct (<http://sja.ucdavis.edu/cac.html>). I will report any suspected misconduct to Student Judicial Affairs.

**Disabilities:** UC Davis is committed to educational equity in the academic setting, and in serving a diverse student body. I encourage all students who are interested in learning more about the Student Disability Center (SDC) to contact them directly at [sdcc@ucdavis.edu](mailto:sdcc@ucdavis.edu), [sdcc@ucdavis.edu](mailto:sdcc@ucdavis.edu), or 530.752.3184. If you are a student who requires academic accommodations, please submit your SDC Letter of Accommodation to me as soon as possible, ideally within the first two weeks of this course.

**Political Methodology Subfield:** Students interested in taking the comprehensive exam in methodology should approach this class with the aim of developing a deeper mathematical understanding. Some lectures will present material that entails calculus and linear algebra. All students are expected to follow and familiarize themselves with this material. Methodology track students should go further: they need to understand the mathematical mechanics, derivations of estimators, and why the statistical tools work as they do. “Challenge” problems will be included in the homework assignments. Methodology track students must complete these problems in addition to the usual assignment.

**Grading system:**

$\geq 97$	A+	87 - 89	B+	77 - 79	C+	67 - 69	D+	$< 60$	F
93 - 96	A	83 - 86	B	73 - 76	C	63 - 66	D		
90 - 92	A-	80 - 82	B-	70 - 72	C-	60 - 62	D-		

## Schedule:

This schedule is subject to change.

- **April 4: Introduction & the Linear Regression Model**

*Reading:*

Gelman, Hill and Vehtari 2021 (GHV), Chapters 6 and 7.

Fox 2016, Chapter 5.

- **April 11: OLS and Matrix Algebra I**

*Reading:*

Fox Chapters 6 and 9.1 through 9.3.

- **PROBLEM SET #1 DUE FRIDAY APRIL 12 AT 11:59PM**

- **April 18: OLS and Matrix Algebra II**

*Reading:*

Fox Chapter 9.4 and 9.5.

GHV Chapter 10.

\* Recommended: Fox Chapter 10.

- **April 25: Model Diagnostics and Assessment**

*Reading:*

GHV Chapter 11.

Fox Chapters 11 and 12.

- **PROBLEM SET #2 DUE FRIDAY APRIL 26 AT 11:59PM**

- **May 2: Collinearity and Variable Transformations**

*Reading:*

GHV Chapter 12.

Fox Chapter 13.

- **May 9: Binary Dependent Variables and Logit/Probit Models**

*Reading:*

GHV Chapter 13.

Fox Chapter 14.

- **May 16: Midterm Exam**

*The midterm exam is in class, closed book and closed note.*

- **May 23: Generalized Linear Models (GLM) I**

*Readings:*

GHV Chapters 14 and 15.

Fox Chapter 15.

Gelman and Hill 2007, Chapter 6 (on Canvas).

- **PROBLEM SET #3 DUE FRIDAY MAY 24 AT 11:59PM**

- **May 30: GLM II**

*Reading:*

[Finish readings from prior week.]

\* Recommended: King, Gary. 1998. *Unifying Political Methodology*, Ann Arbor: University of Michigan Press. Chapters 1 - 4.

- **June 6: Working with Panel Data**

*Reading:*

Gelman and Hill 2007, Chapters 11–12 (on Canvas).

Clark, Tom S., and Drew A. Linzer. 2015. “Should I Use Fixed or Random Effects?” *Political Science Research and Methods* 3(2): 399–408. doi: 10.1017/psrm.2014.32.

- **TAKE-HOME FINAL EXAM DUE MONDAY, JUNE 10 AT 11:59PM**