PLAD 7100—Political Research with Quantitative Methods (Statistics Component)
Fall 2025

Tuesday & Thursday, 9:30am–10:45am

296 Gibson Hall

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> "Inductive logic is unlike deductive or symbolic logic. In deductive reasoning, when you have true premises and a valid argument, the conclusion must be true too. Valid deductive arguments do not take risks. Inductive logic takes risks. You can have true premises, a good argument, but a false conclusion. Inductive logic uses probability to analyse that kind of risky argument."
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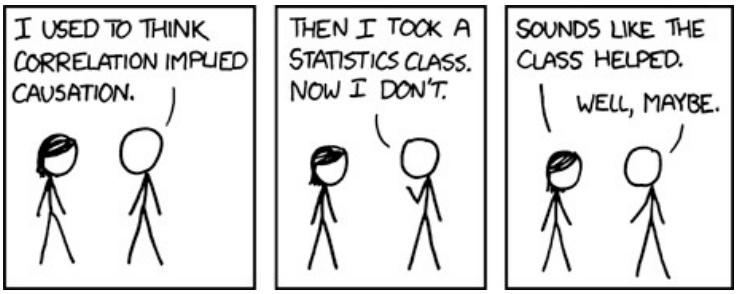
> — Ian Hacking. 2001. *An Introduction to Probability and Inductive Logic*, xi.



http://xkcd.com/552/

PLAD7100 includes two semi-autonomous components: statistics and math. The statistics component of this course will introduce you to some basic theory and methods for conducting quantitative analyses in political science, with a focus on statistics and data analysis. The mathematics component will introduce you to the mathematical background that will be used (to some extent) in this course and that will be assumed in future quantitative methodology courses. The primary goals are to give you tools to begin applying quantitative methods in your own work, to prepare you for further coursework, and to situate statistics within the broader endeavor of data analysis (and that within the broader endeavor of social science research).

The statistics component begins at the beginning with basic probability theory, then develops the tools for statistical analysis and inference, and concludes with an introduction to OLS regression. I include a moderate amount of statistical theory and develop the mathematics underlying statistical techniques because I believe strongly that being able to "read math" is critical to the smart application of statistical techniques. As the course proceeds we will shift emphasis toward applications and data analysis.

There are no prerequisites for the course. Both the statistics and math components are required.

This document describes the statistics component; see also the separate math component syllabus.

Course Format and Requirements
The course requirements include reading, in-person meetings, more-or-less weekly homework assignments, occasional asynchronous video lessons, and midterm and final exams.

Our in-person meetings include a good bit of interactive lecture, plus some individual and small group problem-solving. I record the lectures and make them available online so you can review the material as you work on homework and prepare for exams.

To learn statistics you must **practice**, and so I assign homework that you submit plus periodic supplemental (self-graded) at-home problems. The early assignments consist of "paper-and-pencil" exercises to help solidify your understanding of basic concepts and procedures; the later assignments will ask you to conduct analysis of real political science data that I provide. I encourage group work on homework assignments, although each student should write up and turn in their own set of answers.

The exams will be completed asynchronously (at home) with a (generous) time limit. They are closed book, except that you are allowed one page of notes (8½ by 11, front only) for the midterm, and two pages of notes for the final.

Because the material in this course is cumulative, and the in-class work is critical to your learning, it is vital that you attend class consistently and stay current on the reading and homework. I do not recommend auditing, though I don't forbid it. If you audit the course, I strongly encourage you to attend consistently and to complete the reading and homework assignments.

Software
The statistical software we will use is Stata (http://www.stata.com). Stata is available on the Politics lab computers in Gibson 196, and also through the "Remote Apps" system, a virtual computer lab that you can connect to; see https://in.virginia.edu/remote-apps.

You do not need to purchase (or rent) your own copy of Stata, though you may find it helpful. If you do want a license, it is available for Windows, Mac, and Unix/Linux platforms with a student discount; see https://www.stata.com/order/new/edu/gradplans/student-pricing/. Stata comes in three "flavors": BE (Basic Edition), SE (Standard Edition), or MP (Multi-processor), with increasing capabilities (and price). The least expensive (BE) will be sufficient to analyze the data sets for this class and for all or most work you will do in graduate school. As you will see on the site, there are options to rent Stata for 6 months ($48 for BE) or a year ($94 for BE), or purchase a copy that is valid forever ($225). If you plan to purchase a perpetual license, there are discounts for group orders, so you may want to coordinate with each other and reach out to sales@stata.com. Final note: the current version of Stata is 17, although version 18 (or even 17, 16, or 15) should meet your needs for this course (and most else you might need).

Readings
There are several books for this course. All but the Acock book are available electronically through the UVa Library, and used copies are available online. I recommend getting a hard copy—especially of the Wonnacott and Wonnacott book—if you can. That said, I have posted PDFs of Wonnacott & Wonnacott on Canvas.

Required

Abelson, Robert P. 1995. *Statistics as Principled Argument*. Hillsdale, NJ: L. Erlbaum Associates. ISBN 0805805281

Achen, Christopher H. 1982. *Interpreting and Using Regression*. Thousand Oaks, CA: Sage. ISBN 0803919158 (Available electronically through the UVA library.)

Wonnacott, Thomas H. and Ronald J. Wonnacott. 1990. *Introductory Statistics for Business and Economics*. Fourth Edition. New York: John Wiley & Sons. ISBN 978-0471615170. Very inexpensive used copies are available; e.g.: https://www.amazon.com/gp/offer-listing/047161517X/ref=dp_olp_used?ie=UTF8&condition=used

Optional

Acock, Alan C. 2018. *A Gentle Introduction to Stata*. Rev. 6th ed. College Station, Texas: Stata Press. ISBN 978-1-59718-269-0.

In addition, we will read substantial portions of the following book, which is unfortunately out of print. I will make available copies of the relevant sections.

Kelejian, Harry H. and Wallace E. Oates. 1989. *Introduction to Econometrics: Principles and Applications.* Third Edition. New York: Harper and Row.

Copies of assigned articles and other readings will be available online.

Note: There is a set of references to *Stata Journal* articles, most written by Nicholas Cox, that explain some tips, tricks, and useful techniques for managing data, creating analysis graphs, and presenting model results. These are all supplementary.

Homework

Homework assignments will generally be posted to Canvas on Wednesday or Thursday and will be due on Friday at noon a week later (that is, eight or nine days after posting). You may not use AI in any form while completing the homework.

You will submit homework through Canvas as a PDF file. For many homework problems you will want to hand-write your work and your answers. Here are some tips on converting your hand-written homework to PDF:

- Write on only one side of the paper to avoid bleed-through.
- Use a smartphone document scanning app to convert the hand-written pages to PDF, rather than simply taking pictures with your camera. These apps do a great job of automatically detecting the edges of the paper, transforming the image to a true rectangle, increasing contrast, and more.
- If you don't already have a scanning app you like, you might consider Adobe Scan. It is free (though you have to create or use a free Adobe Cloud account), is highly recommended by the NYTimes Wirecutter, and is available for Android and iOS.
- Please make sure the result is legible. If needed, play with the app's filters to improve readability. With the Adobe app I've had luck with the "light text" and "original color" filters.

Course Schedule and Outline

August 26: Welcome & introduction to the course

August 28 & September 2: Descriptive statistics

Wonnacott & Wonnacott, skim chapter 1, read sections 2-1, 2-2, 2-3, 2-5 & 2-6

Optional: Kranzler, John H. 2017. "Overcoming Math Anxiety." In *Statistics for the Terrified*. 6th ed. New York: Rowman & Littlefield, chapter 1

September 4 & 9: Probability

Wonnacott & Wonnacott, chapter 3

September 11: In-class probability problems

September 16, 18, & 23: Discrete probability distributions

Wonnacott & Wonnacott, sections 4-1 through 4-3

September 25 & 30: Continuous probability distributions and covariance

Wonnacott & Wonnacott, sections 4-4 through 4-6; chapter 5

October 2 & 7: Sampling, point estimation, and statistical inference

Wonnacott & Wonnacott, chapters 6-7

Abelson, chapter 1

Acock, chapters 1-3

October 9: Confidence intervals

Wonnacott & Wonnacott, sections 8-1 and 8-2

October 14: No class (UVa fall break)

October 15–17: Midterm exam

You may spend *four hours* on the final between 8am Friday, 12/12 and midnight Tuesday, 12/16.

October 21 & 23: Significance testing

Wonnacott & Wonnacott, chapter 9

Abelson, chapter 2

Acock, chapters 4, 7

Cohen, Jacob. 1994. "The Earth is Round (p<.05)" *American Psychologist* 49(12):997-1003. Available from Canvas.

October 28: Proportions & differences of means

Wonnacott & Wonnacott, sections 8-3 through 8-5

October 30: Data analysis, graphical analysis, and visual presentation

Wonnacott & Wonnacott, section 2-7

Abelson, chapters 3, 4

Kastellec, Jonathan P., and Eduardo L. Leoni. 2007. "Using Graphs Instead of Tables in Political Science." *Perspectives on Politics* 5(4), **pages 755-763**.

Schwabish, Jonathan A. 2014. "An Economist's Guide to Visualizing Data." *Journal of Economic Perspectives* 28 (1):209-34.

Acock, chapters 5, 6

Optional supplementary readings

Epstein, Lee, Andrew D. Martin, and Matthew M. Schneider. 2006. "On the Effective Communication of the Results of Empirical Studies, Part I." *Vanderbilt Law Review* 59(6):1811-71.

Epstein, Lee, Andrew D. Martin, and Christina L. Boyd. 2007. "On the Effective Communication of the Results of Empirical Studies, Part II." *Vanderbilt Law Review* 60(3), **pages 801-31**.

Healey, Christopher G., and J. T. Enns. 2012. "Attention and Visual Memory in Visualization and Computer Graphics." *Visualization and Computer Graphics, IEEE Transactions on* 18 (7):1170-88.

Murnane, Richard J. and John B. Willett. "Reducing Observed Bias by the Method of Stratification." In *Methods Matter: Improving Causal Inference in Educational and Social Science Research,* 286-304

November 4: No class (election day)

November 6: Bivariate data analysis and χ^2 (chi-squared)

Wonnacott & Wonnacott, chapter 17

November 11: The bivariate OLS regression model

Wonnacott & Wonnacott, chapter 11 and 12-1, 12-2

Achen, pages 1-37

Kelejian & Oates, pages 1-9

Acock, chapter 8

November 13: Bivariate OLS estimation

Wonnacott & Wonnacott, 12-3 through 12-5

Achen, pages 37-51

Kelejian & Oates, pages 25-33, 43-86, 89-104 & 123-131

Abelson, chapter 5

November 18: OLS interpretation and inference

November 20: OLS topics: prediction, R^2, ANOVA, and more

Wonnacott & Wonnacott, section 10-1

Acock, chapter 9

November 25: Catch up, review, more problems

November 27: No class (Thanksgiving break)

December 2 & 4: Multiple regression

Wonnacott & Wonnacott, chapter 13

Kelejian & Oates, chapter 4 (134-161) and 200-202

Acock, chapter 10

Kastellec, Jonathan P., and Eduardo L. Leoni. 2007. "Using Graphs Instead of Tables in Political Science." *Perspectives on Politics* 5(4), **pages 763-768**.

Epstein, Lee, Andrew D. Martin, and Christina L. Boyd. 2007. "On the Effective Communication of the Results of Empirical Studies, Part II." *Vanderbilt Law Review* 60(3), **pages 831-46**.

Abelson, chapter 6–9

December 9: Catch up, review, and what's next?

December 12–16: Final Exam

You may spend up to six hours on the final between 8am Friday, 12/12 and midnight Tuesday, 12/16.

Stata Journal Articles of Interest

Tables of estimation results

Gallup, John Luke. 2012. "A New System for Formatting Estimation Tables." *Stata Journal* 12(1):3-28.

Cox, Nicholas J. 2012. "Speaking Stata: Output to Order." *Stata Journal* 12(1):147-158.

Newson, Roger B. 2012. "From Resultssets to Resultstables in Stata." *Stata Journal* 12(2):191-213.

In addition, see my handout, "Producing Presentation-Quality Tables and Figures for Regression Models," which describes my own command, mktab, as well as a few other options.

Data management and tabulation

Cox, Nicholas J. 2011. "Speaking Stata: Compared With ..." *Stata Journal* 11(2):305-314.

Baum, Christopher F. and Nicholas J. Cox. 2007. "Stata Tip 45: Getting Those Data Into Shape." *Stata Journal* 7(2):268-271. http://www.stata-journal.com/sjpdf.html?articlenum=dm0031

Cox, Nicholas J. 2003. "Speaking Stata: Problems with tables, Part I" *Stata Journal* 3(3):309-324. http://www.stata-journal.com/sjpdf.html?articlenum=pr0010

Graphing

Cox, Nicholas J. 2010. "Speaking Stata: Graphing Subsets" *Stata Journal* 10(4):670-681.

Cox, Nicholas J. 2010. "Speaking Stata: The statsby Strategy" *Stata Journal* 10(1):143-151.

Buis, Maarten L. and Martin Weiss. 2009. "Stata Tip 81: A Table of Graphs." *Stata Journal* 9(4):643-647.

Cox, Nicholas J. 2009. "Speaking Stata: Paired, Parallel, or Profile Plots for Changes, Correlations, and Other Comparisons." *Stata Journal* 9(4):621-639.

Cox, Nicholas J. 2008. "Speaking Stata: Between Tables and Graphs." *Stata Journal* 8(2):269-289. http://www.stata-journal.com/sjpdf.html?articlenum=gr0034

Cox, Nicholas J. 2008. "Stata tip 27: Classifying data points on scatter plots." *Stata Journal* 5(4):604-606. http://www.stata-journal.com/sjpdf.html?articlenum=gr0023

Cox, Nicholas J. 2008. "Speaking Stata: Graphing Categorical and Compositional Data." *Stata Journal* 4(2):190-215. http://www.stata-journal.com/sjpdf.html?articlenum=gr0004

Model Interpretation

Williams, Richard. 2012. "Using the margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects." *Stata Journal* 12(2):308-331.

Jann, Ben. 2013. "Plotting regression coefficients and other estimates in Stata." University of Bern Social Sciences Working Papers Nr. 1. Available from http://ideas.repec.org/p/bss/wpaper/1.html