POLITSC 7551: Quantitative Analysis I
The Ohio State University, Autumn 2016

Instructor: Jan H. Pierskalla
Time and Location: Tue/Thu 10-11:20pm, Derby Hall 150
Time and Location of Lab Session: Fri 9-10am, Derby Hall 150
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Web: http://janpierskalla.wordpress.com/
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Teaching Assistant: Caitlin Clary (`clary.69@osu.edu`)
TA Office Hours: Wed 3:30-4:30pm, Derby Hall 2012

Overview and Objectives

Political Science 7551 is an introduction to probability and statistics targeted toward Political Science PhD students. A primary purpose of the course is to build a strong foundation for regression and generalized linear models, which will be studied in great depth in Political Science 7552. To accomplish this goal, we will study the basics of probability theory, properties of random variables, asymptotic approximations, methods for developing and evaluating statistical estimators, and hypothesis testing. In addition, the course will provide a hands-on introduction to statistical computing.

The course will be taught as a combination of lectures by the instructor and practical exercises at the computer during lab sessions.

Requirements

- Weekly Problem Sets (60%): There will be a total of 13 weekly problem sets. The problem sets typically consist of a set of theoretical and conceptual questions and a hands-on data analysis portion. Each problem set is meant to familiarize the student with essential concepts of that week. Students are encouraged to work on the problem sets in small groups, i.e. you should discuss possible answers and solution approaches with your fellow students. It is good practice to first try to develop answers on your own and then meet in a group setting to discuss potential difficulties. While group discussion and work is explicitly encouraged, you are required to write and hand in your own computer code and final write-up of the answers. DO NOT simply copy computer code or answers from your classmates. Write-ups have to be provided in a well-formatted, electronic format (e.g. LaTeX). Computer code used for any data analysis has to be submitted as a supplement to the write-up. I will not accept any late homework assignments. The write-up and code have to be submitted on Thursdays before class in the following week. To accommodate your busy schedules, I will drop your two lowest homework scores when calculating your final grades.
- In-class Midterm Exam (Oct 13) (15%): The midterm will test the material covered in the first part of the class. The exam will be a mixture of a multiple choice and short-answer questions. The exam will take during normal class time and is closed-book.

- Take-home final (due December 15) (25%): The take-home final will be made available to students via Canvas on December 6th. The exam will be very similar to prior problem sets, but cover material from the whole semester. For the final exam student are allowed to consult all their course notes and the textbooks, but have to complete the exam without the help of other students or other sources. Write-ups and computer code are due on December 13th at 11:59pm.
- Attendance Policy: We will meet twice a week during the semester. You can expect me to be prepared, give the lecture and answer questions. When you come to class, please also be prepared. I will not require attendance, but class is a resource to *you*. The classroom is a great place to exchange ideas, meet your classmates, and ask questions. Regular attendance is also encouraged because lectures and practical sessions are tightly linked to weekly assignments, the midterm and final. If you do not attend regularly, it will be difficult to pass the class.
- Summary of most important dates:
  - Oct 11: Midterm
  - Dec 6: Take-home final made available
  - Dec 13: Take-home final due

Classroom Policy

The classroom is one of the most important places to learn, engage, develop ideas, and communicate. We should all aim to establish an environment that enhances the academic experience. You will frequently make use of computers in this course. Please be respectful of your instructors and peers by using your computers only for class-related purposes. Please also make sure to put your phone away before class starts and not take it out during class. There are some general basic principles we should embrace: 1. Use electronic devices respectfully. 2. Arrive on time.

Communication

The classroom is the best place to raise questions, which are relevant for everybody in the class. Questions not directly relevant to all students, are ideally raised at the end of class. The office hours should be dedicated to discuss more in-depth questions and your assignments. In fact, within the first 4 weeks I encourage everybody to come to my office hours at least once. Emails are a last resort! Think twice before sending an email (Subject header should always include the course number and your full name). On weekdays you can expect that I reply to your emails, within 24 hours. Be prepared to remind me, should my attention slip. I will not respond to emails over the weekend (except in urgent cases).

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with

examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct `http://studentlife.osu.edu/csc/`.

Disability

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. You are also welcome to register with Student Life Disability Services to establish reasonable accommodations. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: `slds@osu.edu`; 614-292-3307; `slds.osu.edu`; 098 Baker Hall, 113 W. 12th Avenue.

Beyond class activities

OSU has many interesting talks and seminars that pertain to the topics of the class. I will make you aware of interesting events as they come up. I will notify you on the specific dates as they are published.

Course materials

We will use two fairly new textbooks as our main reference texts:

- S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014
- J. Monogan. *Political Analysis Using R*. Springer, 2015

The book by Sean Gailmard can be purchased as a hardcopy or ebook from any of your favorite vendors. The book by Jamie Monogan is brand new. The publisher has made an electronic and marked copy available for our class. You can download the copy via Canvas. You can also access a free online copy via SpringerLink through OSU's library.

Other useful textbooks you may want to consult for this class are:

- M. DeGroot and M. Schervish. *Probability and Statistics*. Addison-Wesley, 2012
- G. Casella and Roger Berger. *Statistical Inference*. Duxbury Press, 2001
- A. Agresti and B. Finlay. *Statistical Methods for the Social Sciences*. Pearson, 4th edition, 2008
- P. Kellstedt and G. Whitten. *The Fundamentals of Political Science Research*. Cambridge University Press, 2013
- D. Freedman, R. Pisani, and R. Purves. *Statistics*. Norton, 2007
- J. M. Wooldridge. *Introductory Econometrics: A Modern Approach*. Cengage Learning, 5th edition, 2012

Statistical software

We will use the open source and free statistical software **R** in our course: http://www.r-project.org/. You might want to consider Microsoft R Open https://mran.revolutionanalytics.com/open/. This is a version of R that automatically leverages multiple cores.

I recommend that you also install the free RStudio interface (`http://www.rstudio.com/`), which makes working with **R** a little easier.

The first problem set will walk you through the process of installing **R** / R Open and RStudio on your own computer/laptop.

This is a useful guide to using **R** that will come in handy throughout the semester:

- SimpleR – Using R for Introductory Statistics.

There are plenty of other free resources for **R** to be found on the internet. Google will get you very far in many instances. I want to recommend in particular the new R package swirl. This is an add-on to R that contains a number of self-guided lessons that show you how to do basic data and regression analysis in R. This package is a great complement to our own exercises.

LaTeX

I recommend highly that you familiarize yourself with the LaTeX typesetting environment. It will make it much easier to produce nicely formatted homework assignments and research papers. Jamie Monogan provides a nice introduction:
`http://spia.uga.edu/faculty_pages/monogan/latex.php`

Course Outline

Week 1: Aug 23 Introduction and Overview, Aug 25 Descriptive Statistics I

Introduction to the class, general requirements, and logistics.

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 1-2)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 1-2)
  - Optional: Brody et al., "Map-making and myth-making in Broad Street: the London cholera epidemic, 1854" (`http://www.uio.no/studier/emner/matnat/ifi/INF5761/v12/undervisningsmateriale/map_making_myth_making.pdf`)
- Assignments:
  - Download PS-1 from Carmen, due on Thursday Sep 1.

Week 2 (Aug 30/ Sept 1): Descriptive Statistics II

NO CLASS ON THURSDAY

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 2)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 3-4)
- Assignments:
  - Download PS-2 from Carmen, due on Thursday Sep 8.

Week 3 (Sep 6/8): DGPs and Probability I

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 3-4.2)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 11.2, 11.3)
  - Optional: Beber and Scacco, "The Devil Is in the Digits" (`http://www.nyu.edu/projects/beber/files/Beber_Scacco_The_Devil_Is_in_the_Digits.pdf`)
- Assignments:
  - Download PS-3 from Carmen, due on Thursday Sep 15.

Week 4 (Sep 13/15): DGPs and Probability II

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 4.2-4.7)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 11.2, 11.3)
- Assignments:
  - Download PS-4 from Carmen, due on Thursday Sep 22.

Week 5 (Sep 20/22): Expectation and Moments

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 5)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 10.1-10.2)
- Assignments:
  - Download PS-5 from Carmen, due on Thursday Sept 29.

Week 6 (Sept 27 / Sept 29): Probability and Models

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 6)
  - J. Monogan. *Political Analysis Using R*. Springer, 2015 (Ch. 11.1)
- Assignments:
  - Download PS-6 from Carmen, due on Thursday Oct 6.

Week 7 (Oct 4/6): Sampling Distributions

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 7)
  - J. Monogan. *Political Analysis Using R*. Springer, 2015 (Ch. 11.1)
- Assignments:
  - Download PS-7 from Carmen, due on Thursday Oct 20.

Week 8 (Oct 11/13): MIDTERM

On Tuesday we will have our in-class midterm. NO CLASS ON THURSDAY.

Week 9 (Oct 18/20): Hypothesis Testing I

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 8)
  - J. Monogan. *Political Analysis Using R*. Springer, 2015 (Ch. 5)
- Assignments:
  - Download PS-8 from Carmen, due on Thursday Oct 27.

Week 10 (Oct 25/27): Hypothesis Testing II

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 8)
  - J. Monogan. *Political Analysis Using R*. Springer, 2015 (Ch. 5)
  - Check out: `http://www.economist.com/blogs/graphicdetail/2015/07/daily-chart-other-place`
  - *Economist* article (`http://tiny.cc/5fcq5w`) and video (`http://www.youtube.com/watch?v=TosyACdsh-g`) on problems with false positives and negatives in scientific research
- Assignments:
  - Download PS-9 from Carmen, due on Thursday Nov 3.

Week 11 (Nov 1/3): Estimation I

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 9)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 6)
- Assignments:
  - Download PS-10 from Carmen, due on Thursday Nov 10.

Week 12 (Nov 8/10): Estimation II

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 9)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 6)
- Assignments:
  - Download PS-11 from Carmen, due on Thursday Nov 17.

Week 13 (Nov 15/17): Estimation III

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 9)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 10.3, 11.5, 11.7)
- Assignments:
  - Download PS-12 from Carmen, due on Tuesday Dec 1.

Week 14 (Nov 22/24): THANKSGIVING BREAK

No required class attendance. Optional review session on Tuesday.

Week 15 (Nov 29/ Dec 1): Causality

- Core readings:
  - S. Gailmard. *Statistical Modeling and Inference for Social Science.* Analytical Methods for Social Research. Cambridge University Press, 2014 (Ch. 10)
  - J. Monogan. *Political Analysis Using R.* Springer, 2015 (Ch. 8.3)
- Assignments:
  - Download PS-13 from Carmen, due on Tuesday Dec 6.

Week 16 (Dec 6): Final Wrap-up

We will do a big picture review and talk about future classes.

- Core readings:
  - -
- Assignments:
  - Final take-home exam will be posted on Dec 6, submissions are due on Dec 13.

References

[1] A. Agresti and B. Finlay. *Statistical Methods for the Social Sciences*. Pearson, 4th edition, 2008.

[2] G. Casella and Roger Berger. *Statistical Inference*. Duxbury Press, 2001.

[3] M. DeGroot and M. Schervish. *Probability and Statistics*. Addison-Wesley, 2012.

[4] D. Freedman, R. Pisani, and R. Purves. *Statistics*. Norton, 2007.

[5] S. Gailmard. *Statistical Modeling and Inference for Social Science*. Analytical Methods for Social Research. Cambridge University Press, 2014.

[6] P. Kellstedt and G. Whitten. *The Fundamentals of Political Science Research*. Cambridge University Press, 2013.

[7] J. Monogan. *Political Analysis Using R*. Springer, 2015.

[8] J. M. Wooldridge. *Introductory Econometrics: A Modern Approach*. Cengage Learning, 5th edition, 2012.