Washington University in St. Louis
Department of Political Science

Pol Sci 583. Topics in QPM: Statistical Modeling

Spring 2013 Semester

Instructor
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Class Schedule
MW 9:30-11:00 AM
Seigle 111

Course Description

What is the probability that two states will go to war in a particular year? How likely is it that Justice Sotomayor will vote to grant *cert* in an abortion rights case? How strong is the relationship between issue preferences and voter behavior? Do domestic political institutions systematically affect currency markets?

The use of quantitative methods allows political scientists to answer these types of questions. This course is an introduction to the probability theory and inferential statistics. These two topics form the infrastructure on which all applied statistical work is based. To understand these more advanced methods, it is vital to have a background in these topics. Unfortunately, this means that we will read little applied research, and will devote most of our time to the abstract world of probability theory and the logic of statistical inference.

There is no formal prerequisite for this course, although familiarity with algebra, calculus, and elementary linear algebra is assumed. Experience at the level of Political Science 5052 (Mathematical Modeling in Political Science) suffices.

Requirements and Evaluation

The requirements for this course are simple—attend class and complete the assignments on time. This is a lecture-based course, which will proceed as quickly or slowly as is necessary. Since this is a graduate level course, it need not be said that class attendance is mandatory. Late assignments will not be accepted.

Each Wednesday of the course I will assign a graded homework assignment. These assignments will be due on the following Wednesday. Most exercises will come from the textbook, some with solutions provided in the back of the book. The assignments are due in class on Wednesday, and will

be returned the following Monday. These assignments will be graded by the Teaching Assistant. Students are encouraged to collaborate on these assignments, however each student must turn in their own written answers. Clarity of presentation and argument are of utmost importance when preparing these homeworks. There will be approximately twelve (12) homework assignments, of which the top ten (10) will count toward the final grade. Homeworks count for 30% of the final course grade.

In addition to the homework assignments there will be three examinations: two midterms, and a final. Each midterm will count for 20% of the final grade, and the final exam will count for 30% of the final grade. The midterms will be conducted during the scheduled class time, and the final will be conducted at the time scheduled by the Graduate School. *No incompletes will be assigned for any reason.* Failure to meet the requirements of the course will result in a failing grade.

Graduate student Keith Schnakenberg (`keschnak@wustl.edu`) is the Teaching Assistant for this course. He will grade all of the homework problem sets and exams, and work with me on course administration. Keith will hold office hours on Mondays and Tuesdays from 2:00-3:00 PM in Seigle 274. At various points in the semester I will ask Keith to lead our class session.

Readings

The primary textbook for the course is [hereafter DeGroot]:

> Morris H. DeGroot and Mark J. Schervish. 2012. *Probability and Statistics*, Fourth Edition. Boston: Addison-Wesley. ISBN: 0321500466.

This can be purchased at the bookstore, or at your favorite internet bookseller. DeGroot's book is a classic, and is used in many mathematics, economics, and statistics courses. This book was recently updated from the third edition. It is important to make sure you have the fourth edition to ensure we're all reading the same thing. Each student should carefully read the assigned sections of the text before class, and bring any questions to class.

After the second midterm we will be studying elementary Bayesian methods. We will use this text for that section of the course [hereafter Greenberg]:

> Edward Greenberg. 2012. *Introduction to Bayesian Econometrics*, Second Edition. New York: Cambridge University Press. ISBN: 1107015316.

Ed Greenberg is an emeritus faculty member our Economics Department and is a fantastic teacher. This book is an outstanding introduction to Bayesian methods. After working through this text you will be ready for a full-semester course on Bayesian methods and Markov chain Monte Carlo using more advanced texts such as those by Jeff Gill, Simon Jackman, or Andrew Gelman and his colleagues.

In addition to these two texts, I will draw some supplementary material from a good undergraduate statistics text [hereafter A&F]:

> Alan Agresti and Barbara Finlay. 2008. *Statistical Methods for the Social Sciences*, Fourth Edition. Upper Saddle River, NJ: Prentice Hall. ISBN: 0130272957.

The instructor will provide photocopies of the assigned sections from A&F. Some students may wish to purchase this text as a supplement to DeGroot, and as an introduction to some elementary methods. For your information, this text is not available in the bookstore, but it can be purchased online.

The reading load for this course is trivial, perhaps ten or twenty pages a class. However, the work load will be high. It is important to carefully read and understand every result in the text *before the class meeting.* This requires full attention when reading the text. The problem sets will also consume a substantial amount of time. Later in the semester you will likely need to use statistical software to complete some of the assignments. I expect that you will use the R Language (`http://www.r-project.org`) for your assignments.

To provide a forum for communication outside of class, not only between instructor and student, but also between students, I have established an email mailing list. It is necessary for each of you to sign up for the list, and I encourage you to contribute to it. Oftentimes if you have a question about the text or lecture many of your colleagues will as well. It is best to use the listserve as a forum to pose the questions you have, and to answer the questions that are posed. Of course you can ask the instructor these questions, but the common good will be served by using the mailing list. I will provide instructions on how to use the list during our first class meeting. Keith and I may choose to forward our answers to email questions to the list.

Tentative Course and Topics Schedule

The following is a tentative schedule for the course. Hopefully we will cover all of this material. We will go as fast, or as slow, as needed. To wit, I have not assigned firm dates for each topic. The following, though, is the order we will cover the material. Note that each topic may take more than (or less than) one class session, so you should read a topic or two ahead.

Before our first class session please make sure you have read and mastered the material in DeGroot Chapters 1 (all) and 2 (Sections 2.1-2.3), and Greenberg Chapters 1 and 2. I will take questions about this material in our January 16 meeting.

Due to some unavoidable travel commitments I already know of some class meetings that I will need to reschedule. We will not hold class on: January 28, February 13, March 25, and March 27. *Please hold these dates on your calendar as my travel schedule may change, and if it works with our progress through the material, I may hold an exam during one of those class periods.* At this point I plan to hold make-up class sessions on: Friday, January 25, 9:30 AM; Friday, February 1, 9:30 AM; Friday, February 15, 9:30 AM; and Friday, April 5, 9:30 AM.

Dates	Topic	Reading
(_____).	Random Variables and Distributions I	DeGroot 3.1-3.3
(_____).	Random Variables and Distributions II	DeGroot 3.4
(_____).	Random Variables and Distributions III	DeGroot 3.5-3.7
(_____).	Random Variables and Distributions IV	DeGroot 3.8-3.9
(_____).	Expectation I	DeGroot 4.1-4.2
(_____).	Expectation II	DeGroot 4.3-4.5
(_____).	Expectation III	DeGroot 4.6-4.7
(_____).	**Midterm Exam I**	
(_____).	Special Distributions I	DeGroot 5.1-5.2, 5.4
(_____).	Special Distributions II	DeGroot 5.6, A&F 4.3
(_____).	Special Distributions III	DeGroot 5.7-5.8, 5.10
(_____).	Central Limit Theorem	DeGroot 6.1-6.3
(_____).	Sampling Distributions I	DeGroot 7.1, 8.1-8.2
(_____).	Sampling Distributions of II	DeGroot 8.3-8.4, A&F 4.4-4.5
(_____).	Confidence Intervals	DeGroot 8.5, 8.7, A&F 5.1-5.3
(_____).	Hypothesis Testing I	DeGroot 9.1-9.2, A&F 6.1-6.4
(_____).	Hypothesis Testing II	DeGroot 9.4-9.5, A&F 6.5-6.7
(_____).	Hypothesis Testing III	DeGroot 9.6, A&F 7.1-7.4
(_____).	Hypothesis Testing IV	DeGroot 9.7, 9.9
(_____).	**Midterm Exam II**	
(_____).	Posterior Distributions and Bayesian Inference I	Greenberg 3.1
(_____).	Posterior Distributions and Bayesian Inference II	Greenberg 3.2
(_____).	Priors I	Greenberg 4.1-4.2
(_____).	Priors II	Greenberg 4.3-4.9
(_____).	Simulation I	Greenberg 5.1-5.3
(_____).	Simulation II	Greenberg 5.4-5.6
(_____).	Linear Regression	Greenberg 8.1
(_____).	**Final Exam**	