Quantitative Political Methodology

Jeremy C. Pope
jpope@byu.edu & @JeremyCPOpe

WINTER 2013, POLITICAL SCIENCE 328, SECTIONS 1 - 6
Mondays, Wednesdays & Fridays 9:00 - 9:50 (B106 JFSB) and 10:00 - 10:50 (B062 JFSB)

“Measure with a model . . .”—Ivo Molenaar
“Everybody has a story.”—Robert Fogel
“Models are to be used but not to be believed.”—Henri Theil

Course Objectives

Quantitative Political Methods is required for all political science majors because statistical competence is increasingly important in the world (not to mention political science). For example, electoral campaigns are heavily reliant on polls that can only be thoroughly understood with a statistical background; public policy arguments—in all kinds of arenas—increasingly turn on statistical evidence; and cross-national comparisons and arguments over international affairs constantly rely on statistics. Every field of political science (from Political Philosophy to International Relations) requires some level of familiarity with the strengths and weaknesses of these tools, because in the modern world most any argument will be both attacked and defended via statistical methods (on some level). If you apply yourself, this course will give you the tools to both evaluate those arguments and begin to generate your own evidence and arguments. By the end of it you should be able to

- Analyze political and social behavior using statistical skills
- Learn how to read and interpret statistical evidence
- Produce your own rigorous statistical arguments, carefully and clearly explained

This course fulfills the university’s general education languages of learning requirement. As noted in that requirement’s Foundation Document, this course “prepares [students] to explain ‘the world in quantitative terms; to interpret numerical data; and to evaluate arguments that rely on quantitative information and approaches’ (Aims of a BYU Education). Students should be able to use the fundamental principles of and fluency in quantitative language as used in modern practical problem-solving situations.” As a General Education course, this class also fulfills University Core Learning Outcomes:

- Knowledge and Skill Development
- Sound Thinking and Problem Solving
- Life-long Learning

Finally this course also fulfills some department intellectual learning objectives: effective research, analysis, professional writing and critical thinking.

1Please see http://saas.byu.edu/classSchedule/policy/winter/univcore.php#10.
2Please see https://learningoutcomes.byu.edu and look for the political science links.
Office Hours and Consultations

Professor office hours are on Mondays and Wednesdays from 11:00 - 11:50 a.m., and by appointment.³

This course has several teaching assistants to help with review, course concepts, problem sets and anything related to the course. Each of them holds three regular office hours during the week. Of course, students, with sufficient notice, can make appointments with them outside of those hours.

Stetson Drolet
stetsonpd@gmail.com
office hours: Tuesday, 2:00 - 3:50 p.m. and Thursday 2:00 - 2:50 p.m.

Seongwook Jake Lee
swlee8723@gmail.com
office hours: Monday and Tuesday, 12:00 - 12:50 p.m. and Thursday 11:00 a.m. - 11:50 a.m.

Luke MacDonald
luke.macl@gmail.com
office hours: Monday, Tuesday and Wednesday, 4:00 - 4:50 p.m.

Ivanna Ortega
Ivanna.Ortega91@gmail.com
office hours: Monday & Wednesday 1:00 - 1:50 p.m. and Thursday 6:00 - 6:50 p.m.

Sydney Outzen
sydneyoutzen@gmail.com
office hours: Tuesday & Thursday 10:00 - 11:00 a.m. and Tuesday, 5:00 - 6:00 p.m.

Cindy West
cindywest343@gmail.com
office hours: Monday 5:00 - 5:50 p.m. and Wednesday 5:00 - 6:50 p.m.

All office hours are held in 173 Spencer W. Kimball Tower.

Prerequisites

The most significant prerequisite for this course is a commitment to work and study. This is not an easy course; there is a reason it is listed as a four credit hour class. Consultation with the BYU Undergraduate catalog reveals that the university expects an average student, receiving an average grade,⁴ to work approximately twelve hours a week in a four credit-hour course. Better grades obviously require proportionately more work.⁵

Students should plan to spend a substantial amount of time outside of class each week on reading and homework assignments. Please carefully consider your work and class schedule in light of this commitment.⁶ Falling behind in this course can be fatal,⁷ so you need to plan to be working very hard each week. No student should take this course without having previously completed PL SC 200.⁸ Previous experience with calculus at least at the level of MATH 112 or MATH 119 but not truly required. Lastly, it is useful for students to have already had a 300-level theory course (e.g., PL SC 300, 310, 350 or 370) but it is also not strictly required.

---

³I strongly encourage you to take advantage of these hours.
⁴For reference, the median grade in this class is virtually always a B.
⁵Obviously this varies somewhat by the student. Some of you will require far less time to earn an equal grade. Others will require even more time than the average student. That is the nature of a distribution.
⁶Almost no one working more than twenty hours a week should consider taking this class. I know some of you will do so anyway. I just want to warn you in advance, that you will almost certainly get a grade lower than the one you think you deserve.
⁷Metaphorically speaking, of course.
⁸Concurrent enrollment is not acceptable: there will be no exceptions.
Course Texts

This course follows two textbooks. Stock and Watson (2011) provides the core of the reading and is the main focus of the reading. Several problems will be drawn from this text. Weisberg (2005) provides a more technical treatment of the main issues. This text assumes a knowledge of matrix algebra (not assumed in the course overall) and requires much more work to understand. However it is, in some respects, the superior textbook and will repay attention. Some problems will be drawn from this text as well.

Other readings will be referenced in class and links or documents posted on the course site.

Course Outline

Course Introduction & probability (January 7 - 11)

What sorts of social science questions are amenable to quantitative investigation? How do we make causal arguments? What is a distribution and how does it relate to answering these questions (Stock and Watson, 2011, chapters 1 & 2)? These lectures will also cover types of data available for investigation and some data summary techniques.

Agresti and Finlay (2007, sections 2.1 - 2.3 & 3.1 - 3.4) provides some additional information about sampling, variable measurement and data description. The files will be posted online early in the first week of class.

Probability, continued (January 14 - 18)

What is the Normal Distribution? The Chi-Squared Distribution? The Student $t$ and the $F$ Distribution? How is random sampling important? What can be done without a random sample? Finally, what is the Central Limit Theorem? Supplemental readings will also be posted online this week (Agresti and Finlay, 2007, sections 4.1 - 4.6).

Estimation and Hypothesis Tests (January 23 - 25)

How do we make inferences about the population? What is the form of a hypothesis test or a confidence interval for that estimate? How do we compare different populations? Which distributions are we using in these comparisons? And what does it mean to say that data is correlated (Stock and Watson, 2011, chapter three)?

Simple Linear Regression (January 28 - February 1)

What is the linear regression model? How do we interpret the coefficients and measures of fit? What assumptions are necessary to fit a least squares model (Stock and Watson, 2011, chapter four)?

Linear Regression and Inference (February 4 - 8)

How do hypothesis tests and confidence intervals work for a simple linear regression model? How do we interpret binary predictors? What is heteroskedasticity and why is it important? What is the Gauss-Markov Theorem (Stock and Watson, 2011, chapter five)? These lectures will also cover small sample-size prediction and some graphical presentation of models.

---

9 Weisberg (2005, sections 2.8 - 2.9) provides additional information on the subject.
10 Weisberg (2005, sections 2.1 - 2.5) provides additional information on the subject.
11 Weisberg (2005, sections 2.6 - 2.9 and chapter eight) provides additional information on the subject.
Multiple Regression (February 11 - 15)

What can bias our model? Why is it important (typically) to have multiple regressors? What additional assumptions are we making? And what possible problems are likely to crop up in this type of model (Stock and Watson, 2011, chapter six)?\(^\text{12}\)

Multiple Regression and Inference (February 19 - 22)

How do hypothesis tests and confidence intervals work in a multiple regression context? How do we test joint hypotheses? These lectures will also begin taking up the vital topic of model specification: how do we select variables to include in the model (Stock and Watson, 2011, chapter seven)?\(^\text{13}\)

Midterm Examination (February 23 - March 1)

There will be both a portion in the testing center (available on February XXXX) and a portion that is to be done out of class over approximately this period. The final copy of the take-home portion will be due on Friday, March 1 at 6:00 p.m., under Prof. Pope’s door.

Nonlinear Models (March 4 - 8)

What about nonlinear relationships? What about situations where regressors interact (Stock and Watson, 2011, chapter eight)?\(^\text{14}\)

Internal and External Validity (March 11 - 15)

How do we assess internal and external validity? Can we deal with those threats? How do we adjust our interpretations accordingly (Stock and Watson, 2011, chapter nine)?\(^\text{15}\)

Panel Data (March 18 - 22)

What is “panel data” and why is it important? What are fixed effects? Finally, what specific assumptions are necessary to make inferences from this type of model (Stock and Watson, 2011, chapter ten)?

Binary Dependent Variables (March 25 - 29)

What do we do with binary data? What is a probit model and how does it work (Stock and Watson, 2011, chapter eleven)?\(^\text{16}\)

Review and Introduction to Advanced Topics (April 1 - 5)

How can regressions be used to analyze experiments? Can it say something more concrete about causality (Stock and Watson, 2011, chapters twelve and thirteen)?

---

\(^\text{12}\)Weisberg (2005, chapter three) provides additional information on the subject.

\(^\text{13}\)Weisberg (2005, chapter four) provides additional information on the subject.

\(^\text{14}\)Weisberg (2005, chapters five through seven) provide a much more focused and deep study of all of these topics (that does go further than the course material). The treatment is excellent and though some of the notation is difficult the chapters will repay a close reading.

\(^\text{15}\)Weisberg (2005, chapter ten) provides additional details on variable selection algorithms. Chapter eight of this text is also a useful review at this time.

\(^\text{16}\)Weisberg (2005, chapter twelve) provides and introduction to logit models (or logistic regression).
Examination Period (April 8 - 15)

There will be no lectures or labs held in this period so that students may work on their final examinations. The portion of the exam to be completed out of class is due on Monday, April 15 in class.

Concluding Thoughts (April 15)

This lecture will provide some concluding discussion of the final examination along with some final lessons and comments on statistical models.

Grade Policy

This course is graded on a curve. This does not mean a set number of A’s, B’s and C’s. It simply means that I will look for the natural breaks between students and assign grades accordingly. You may have heard professors describe this process in the past. In this course, you will learn exactly what it means for a distribution of grades to be distinguishable from a particular value. But you should not worry too much about grades. Good marks accompany learning, which is the far more important goal.

At the end of the course I will use two methods for analyzing the distribution of points

1. I look at the complete point total for the course.

2. I drop the midterm examination and double the point total on the final examination.

The reasoning behind this is simple. Sometimes students take a while to “get” this course material. I find that some students need time to absorb the course concepts and techniques. For such students, it seems best to give them a chance to prove what they have learned at the end, without undue focus on their previous mistakes. Please do not take this system as license to avoid problem sets. A student who does not complete the required work will find it difficult—if not impossible—to do well in the course. It is true that some students simply need more time to understand the material. But no student is able to master this material without diligence and practice.

There are three major components to the course assessment (listed in the table below): weekly assignments, a midterm and a final:

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Assignments</td>
<td>200</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>75</td>
</tr>
<tr>
<td>Final Exam</td>
<td>125</td>
</tr>
</tbody>
</table>

Each of the course assessment components are discussed below.

Weekly Assignments

Assignments are typically due each Friday morning in class. There are no exceptions, except for circumstances truly outside of your control. However, if you complete assignment 0 your lowest assignment score is replaced with twenty points in your overall homework total (see the homework schedule below). But, do not use this exception lightly. If you have used this up before the middle of February you will have a long two months without any security. I strongly recommend that all students do every problem set, even if the score is one that will eventually be dropped from your overall grade. To give you plenty of time, each homework

---

17 This means things like illnesses, alien abductions, Turkish prison sentences, etc. It does not mean family trips, job interviews, or other matters. If you are going to be absent or miss some class it is best to communicate with Prof. Pope as early as possible.
assignment will be posted on Blackboard at least one week before it is due. There is simply no way to master this material without practice. The weekly assignments are the most important part of this course.

Though you may work in groups (indeed I think this is best), all homework assignments should be your own work. Students sometimes want to know where to draw the line on this issue. Groups should work together to discuss the assignment and help each other generate .do files\textsuperscript{18} to create computer output. But the actual submission should be the student’s own work. Tables and figures will obviously be slightly different.\textsuperscript{19} The language used to describe the output will be slightly different. If this is not true (i.e., assignments are written up in exactly the same way) then students have clearly stepped over the line and may expect to fail at least that assignment and possibly the course.

Submitted assignments should be clearly and carefully written. This class is not PL SC 200 and we will not grade to exactly the same standard that they do. However, we expect citations that are clear and formatting that is sensible. All homework assignments must be typed and turned in with a cover sheet to facilitate blind grading. Beyond these preliminaries we have high expectations for grammar and style. Getting the correct answer is not enough. Part of each assignment is learning how to explain the concepts to a lay audience. If it helps, imagine you are writing to your sainted aunt Edna. Though spry for age 91, Edna has never had a statistics class and needs clear explanations. Do not simply submit computer output. Carefully select the most important information and place it into clear tables and figures that answer each part of the question.

\textbf{Exams}

The midterm exam will have two components. Part 1 will be completed outside of class and will require computing and written analysis. Part 2 of the midterm will be given in the testing center. This portion of the test will require analytical skill but no computing. Though students may work in groups on homework assignments, on the midterm (and the final) you are not allowed to work in groups. Assume that any violation of this policy will result in a failing grade in the course. The final exam will similarly be given in two parts and the same rule applies: everything must be your own work.

\textbf{Academic Integrity}

Academic honesty is at the heart of academic life and the honor code at this university. Some students who would never think of a violation of the Word of Wisdom will not hesitate to cheat on an exam or plagiarize a paper. See the section of the BYU homepage devoted to the honor code for details on the academic honesty policy. Assume that clear cases of dishonesty will result in a failing grade in the course.

\textbf{Disabilities}

Brigham Young University and its faculty are committed to providing a learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability that may impair your ability to complete this course successfully, you are responsible for making your needs known to us and seeking available assistance from the university in a timely manner. In addition to notifying us, you must contact the University Accessibility Center (UAC) at 422-7065, 1520 WSC. The UAC reviews requests for reasonable academic accommodations for all students who have qualified documented disabilities, and any accommodations for this class must be coordinated with the UAC office. See \url{http://uac.byu.edu/} for more information.

\textsuperscript{18}You will shortly learn what this term means.

\textsuperscript{19}This is because you will \textit{never} simply submit computer output or the work will be severely penalized.
Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU’s policy against discrimination and sexual harassment extends not only to employees of the university but to students as well. If you encounter sexual harassment or discrimination, please talk to a faculty member; contact the Equal Employment Office in D-282 ASB or by telephone at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

Incompletes:

This course adheres to University policy on “incompletes,” which is that an incomplete (I) is given only when circumstances beyond the student’s control make it impossible to complete the required work within the prescribed time. Arrangements must be made between the professor and the student prior to the end of the semester. The “I” is never given when a student is failing or has failed the course.

Important Dates

| Homework 0 | January 11 |
| Homework 1 | January 18 |
| Add/drop deadline | January 18 |
| Martin Luther King, Jr. Holiday | January 21 |
| Homework 2 | January 25 |
| Homework 3 | February 1 |
| Homework 4 | February 8 |
| Homework 5 | February 15 |
| President’s Day Holiday | February 18 |
| Monday instruction on a Tuesday | February 19 |
| Homework 6 | February 22 |
| Midterm examination (part 1) begins | February 23 |
| Midterm examination (part 2) | February 26 - 27 |
| Midterm examination (part 1) deadline | March 1 |
| Homework 7 | March 15 |
| Homework 8 | March 22 |
| Withdrawal Deadline | March 19 |
| Homework 9 | March 29 |
| Homework 10 | April 5 |
| Discontinuance deadline | April 2 |
| Final examination (part 1) period begins | April 8 |
| Final examination (part 1) deadline | April 15 |
| Last day of instruction | April 15 |
| Final examination (part 2) | April 20 |

Please see: [http://www.byu.edu/hr/directory/equal-employment-opportunity](http://www.byu.edu/hr/directory/equal-employment-opportunity) for many more details.
References


Last updated: January 9, 2013

TBD