**PL SC 309: Quantitative Political Anlaysis**

MWF 3:35 – 4:25

Spring 2019

Huck 007

**Instructor**

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Office Hours: MWF 8:00-10:00 (and by appointment)

**Overview**

According to the course catalog, “This course introduces students to research design and quantitative analysis techniques used in political science. Students will learn how to construct theories and design studies, how to quantify concepts, and how to test theories using a variety of statistical techniques, including descriptive analysis, correlation, hypothesis testing, and regression analysis. The course will include classroom lectures and computer lab time to enable students to work hands-on with datasets. Basic math skills (algebra) are recommended.”

I will be more direct. This course provides an introduction to something called statistical modelling for pollitical questions. The first part of that, “statistical” means we assign numbers to phenomena that occur in the world. This is a politics class, so we might assign a number 0 for democrats, a 1 for republicans, and a 2 for independents. Most concepts can be expressed numerically (if they can be accurately measured is another entirely). The second part, “modelling” means we will develop a formula to combine those numbers we defined in the first place in order to answer the question of how likely something is to occur. That’s it.

To the consternation of the instructor, it is a difficult task to sell you on a course in statistics. So I will simply say that, regardless of your initial enthusiasm for the material, statistical models run your life and run the world. That is not an exaggeration. To a large extent they dictate what movies you watch, music you listen to, who your friends are, and who your romantic partners are. Politicians rely now almost exclusively on statistical models to tell them what ads to by, where to campaign, and what policies to promote. Governments build statistical models about everything from international trade and war to health care and social security. Considering how much of your life is dictated by these models, you owe it to yourself to better understand them.

**How to Succeed in the Course**

Succeeding in the course will be both quite easy and mildly painful. It will be quite easy because there are no major, high-stakes projects to complete. There are no tests and no term papers. Simultaneously, it will be mildly painful because it will require \*a little\* bit of effort frequently. There are weekly problem sets. There are weekly labs. The goal of problem sets are to have you recall information gained from the lectures and readings. The goal of labs is to connect the material learned in class and repeated through problem sets to different concepts. The syllabus is built in such a way that bad initial grades will not adversely impact your performance. If you consistently make an effort, even a small effort or one that doesn’t yield the right answer, you will do great. If you work only sporadically outside of class, don’t make an initial effort when the assignment is due, and wait until the very end to start, you will do poorly.

If anything is unclear in the course, or if you are having concerns about the material, please don’t hesitate to contact me by email or drop in during office hours.

**Required Materials**

Multiple readings and problems will be assigned from “Open Intro Statistics”, available freely at: <https://www.openintro.org/stat/textbook.php>

This course involves working with and analyzing data. Additionally, we will be learning statistical concepts that require calculations to apply. You will need access to a basic spreadsheet utility. Microsoft Excel is the most common, but any of the free alternatives, such as LibreOffice, will work just as well. If you have a Mac or Linux based operating system, I suggest using gnumeric. Calculations will be done using the free web app at [www.wolframalpha.com](http://www.wolframalpha.com/). Almost all data modern data analysis for politics (and other fields) is done using a programming language such as Python, MatLab or R. While learning a programming language is a very useful (and lucrative) skill, teaching it is beyond the ambit of this course. However, familiarizing yourself with one of these languages is not that difficult if you’re willing to put in the time. Please get in touch via email or office hours if you’d like additional help and resources to complete the assignments with one of these programming languages.

Supplementary materials will be occasionally assigned, and these will be distributed electronically. No textbooks are required for purchase. Materials will be distributed for download the week prior.

**A Note on Math**

You can’t have a course titled “Quantitative Political Analysis” and not rely heavily on mathematics. Please do not be intimidated. **Only basic high school algebra will be used in this course**. While the concepts we discuss can be much more rigorous, the goal of this course if for you to understand the intuition and operation of the different statistical techniques we cover, not the mathematical details. The vast majority of the work you will do in your assignments will be simple arithmetic.

**Coursework**

There are two types of assignments in this course.

*Labs (50% of grade)*

Every Friday will be devoted to an in-class lab, which you will work together on in small groups. **A lab report is due the following Monday at the beginning of class**, based on a rubric provided with the lab. If a student is absent on Friday, they are still responsible for completing the lab, without the benefit of working in a group or in-classroom help.

*Problem Sets (50% of grade)*

There will be weekly problem sets assigned on the Monday of every week (except the first week of class) and **due on Friday at the beginning of class**. You are free to use calculators or computer software to do the math. You will not be graded solely on whether or not you got the right answer, but whether or not you followed the right steps to complete the problem. Each problem set is graded according to an answer key. You may discuss or work through problems with others outside of class, but are responsible for turning in your own, unique work.

**Revision Policy**

If you are not satisfied with your grade on a particular assignment, you may revise it. **Your final grade for a particular assignment will be the average of the original and revised grades.** So if you received a 70 on the original submission, and submit a revised assignment that receives a 90, they would receive a final grade of 80. **Students are limited to two revisions per assignment.** Additionally, **only one revision can per turned in per week**. This counts both problem sets and lab reports. So if you submit a problem set for revision, you cannot submit another problem set or lab report for revision that same week. **Do not wait until the end of the semester to complete your revisions**.

**Late Policy**

**Assignments not turned in by the beginning of class on their respective due dates will be considered late.** Late assignments will be accepted, but are docked 10 percentage points for each day they are late.

**Attendance and Participation**

You are all adults and free to make your own decisions about how you spend your time. **Class attendance is not recorded**. However, it will be very beneficial. During lectures on Monday and Wednesday we will go over examples that directly parallel the questions in problem sets. Labs are designed in a way that most of the work can be completed in-class, with a group, on Friday. If you don’t attend class and still want a good grade, you will end up putting in more work on the assignments than you would have if you just went to class, got the examples, and got assistance with labs. But it’s your choice.

**Similarly, there is no dedicated class participation grade**. Occasionally, I will ask for examples or pose questions to the class. You should answer these questions. Participation will better help you learn the material, make class go by quicker, and avoid agonizing minutes of staring at the floor. It’s the polite thing to do. But there is no participation grade; again, it’s your choice.

**Electronic Submissions**

I will accept electronic submissions for lab reports and problem sets. They will not be accepted for think papers. **It is your responsibility to ensure that I receive the submission**. If you are experiencing technical difficulties or are just worried, **ask to confirm.** Again, it is your responsibility to ensure that I receive the submission. Hard copies are, of course, always accepted.

**Regarding Grades**

It is my responsibility to provide clear and consistent standards for which your assignments will be graded, and explain clearly when your work deviates from those standards. The syllabus is structured so will you have an opportunity to receive that feedback, correct your work, and improve your grade accordingly. **Grades will not be negotiated.** **Similarly, no extra credit or additional assignments will be assigned.** This is unfair to other students; it requires the application of different standards. I am more than happy to elaborate on the feedback you received and work with you to improve your assignment for revisions.

**Academic Dishonesty**

The Department of Political Science, along with the College of the Liberal Arts and the University, takes violations of academic dishonesty seriously. Observing basic honesty in one's work, words, ideas, and actions is a principle to which all members of the community are required to subscribe.

All course work by students is to be done on an individual basis unless an instructor clearly states that an alternative is acceptable. Any reference materials used in the preparation of any assignment must be explicitly cited. Students uncertain about proper citation are responsible for checking with their

instructor.

In an examination setting, unless the instructor gives explicit prior instructions to the contrary, whether the examination is in-class or take-home, violations of academic integrity shall consist but are not limited to any attempt to receive assistance from written or printed aids, or from any person or papers or electronic devices, or of any attempt to give assistance, whether the one so doing has completed his or her own work or not.

Lying to the instructor or purposely misleading any Penn State administrator shall also constitute a

violation of academic integrity.

In cases of any violation of academic integrity it is the policy of the Department of Political Science to

follow procedures established by the College of the Liberal Arts. More information on academic

integrity and procedures followed for violation can be found at: [**http://www.la.psu.edu/current-students/student-services/academic-integrity/academic-integrity**](http://www.la.psu.edu/current-students/student-services/academic-integrity/academic-integrity)

**Note to Students with Disabilities**

Penn State welcomes students with disabilities into the University’s educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources Web site provides contact information for every Penn State campus. For further information, please visit the Student Disability Resources Web site.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation. If the documentation supports your request for reasonable accommodations, your campus’s disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

**Counseling and Psychological Services**

Many students at Penn State face personal challenges or have psychological needs that may interfere with interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients’ cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

Counseling and Psychological Services at University Park (CAPS): 814-863-0395

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400

Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

**Educational Equity and Reporting Bias Incidents**

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias webpage. You may also contact one of the following offices:

University Police Services, University Park: 814-863-1111

Multicultural Resource Center, Diversity Advocate for Students: 814-865-1773

Office of the Vice Provost for Educational Equity: 814-865-5906

Office of the Vice President for Student Affairs: 814-865-0909

Affirmative Action Office: 814-863-0471

Call 911 in cases where physical injury has occurred or is imminent.

STUDENT CARE & ADVOCACY OFFICE. College presents a number of challenges for students, and Penn State maintains an office of Student Care & Advocacy that can point you in the right direction if you are facing any of the following issues:

* Death of an immediate family member
* Food insecurity
* Family crisis
* Housing insecurity
* Mental health concern
* Medical emergency and/or hospitalization
* Self-injurious behavior
* Local natural disaster
* Academic distress
* Unexpected events or challenges

If you have questions, concerns, or need more information, please do not hesitate to contact that office byphone at 814-863-2020 or by email at StudentCare@psu.edu. They encourage you to call or e-mail ahead.

**Course outline**

**Week 1: What Is Data?**

* Types of data
* Representing data
* Data-generating process

**Week 2: Probability Spaces**

* Sample space
* Sigma notation
* Algebra of events

**Week 3: Descriptive Statistics**

* Centrality
* Spread
* Histograms and PMFs

**Week 4: Cumulative Distributions**

* Percentiles and rank
* CDFs and their application

**Week 5: Continuous Distributions**

* Small sample sizes
* Resampling
* Probability Density Functions

**Week 6: Commonly Used Distributions**

* Uniform distribution
* Binomial distribution
* Exponetial distribution

**Week 7: Repeated Sampling**

* Many draws from a large population
* Repeated large draws
* Repeated small draws

**Week 8: Central Limit Theorem**

* Which distribution to use?
* The uses of the normal distribution
* Properties of the normal

**Week 9: Hypothesis Testing I (Non-parametric)**

* Bootstrap
* Rank-sum test
* Permutation test

**Week 10: Hypothesis Testing II (The Cheap Way)**

* Point estimates
* Confidence Intervals
* T-test

**Week 10: Estimation**

* Distributions of guesses
* Hypothesis space
* Error

**Week 11: Correlation**

* Distance from the mean
* Z-scores
* Covariance

**Week 12: Loss**

* Which is the least wrong answer?
* Bias and variance tradeoff
* Evaluating statistical models

**Week 11: Least Squares**

* Geometry review
* Fitting a perfect line
* Best linear approximation

**Week 12: Linear Regression**

* The parameters of a line
* Calculating least squares fit
* Evaluating line fit

**Week 13: Generalized Linear Models I**

* Binary outcomes
* Linear Probability Model
* Logistic Distribution

**Week 14: Generalized Linear Models II**

* Link functions
* Processes as distributions
* Error in GLMs

**Week 15: The Dangers of a Scientific Approach to Social Problems**

* Data-generating processes revisited
* The consequences of loss functions
* Statistical malpractice