Seminar in Research Design and Quantitative Techniques

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Objective

The purpose of this course is to introduce students to a range of basic statistical and data analytic techniques necessary to understand and conduct quantitative social science research. The development of such methodological skills has become increasingly important to social science. Social scientists are often asked to conduct quantitative research on their own, or at the very least, to be able to interpret, understand, and utilize research that employs quantitative methods. As such, you should not view this course as a "necessary evil," or an obscure requirement to fulfill your M.A. or Ph.D. requirements. Instead, it should be viewed as an integral part of your training as a social scientist, as the class will provide the requisite skills for practicing social science.

The topics in this course should not be considered exhaustive, and a thorough statistical background requires much more than will be covered in this class. This course provides the cornerstone to probability theory, as well as traditional (frequentist) methodology - i.e., the assumptions necessary to draw inferences about a population. The first portion of the class will focus on descriptive statistics, namely, how can we best describe a large dataset with only a few parameters. The second half of the course will examine how we can extrapolate, or infer, particular aspects of the population from a subsample of a population. More specifically, we will establish the foundations for inferential statistics. Finally, we will conclude with a brief section on probability theory and non-parametric techniques.

Several topics will be discussed in this course. First, we will discuss techniques common in univariate analysis - central tendencies, distributions, measures of variation and dispersion. We will then move to a more theoretical discussion of the philosophy of science, namely, hypothesis testing and operationalizing social constructs. Of primary interest in this section will be the estimation of population parameters (characteristics) based on information collected from random samples drawn from populations. Various techniques will be presented to compare samples, such as z-test, t-tests, the chi-squared statistic, and the F-test. In this section we will also explore the logic of experimental methods.

Next, we will transition to bivariate and multivariate statistical techniques. We will explore how to quantify relationships between two or more variables. Because social science often focuses upon the relationship between variables, special emphasis will be placed on establishing the direction and magnitude of relationships in populations and samples. At then end of the course, we will examine the basis of probability theory - specifically, sets, combinatorial methods, and Bayes' theorem. We will also explore several non-parametric statistical methods. Please note that I reserve the right to make modifications to the syllabus, as well as administer in-class exams and extra readings/homework assignments. All assignments, projects, and tests should be done independently, unless otherwise noted.

Two major points need to be emphasized about this course. First, one of the best ways to learn about statistical techniques is to practice them as much as possible. Statistics does not come "naturally" to everyone (perhaps anyone), but with practice you will become well-versed in the topics explored in this class. Only by going through the process of computing the answers to statistical problems, will you develop the skills necessary to understand and conduct empirical research. A second point is that this class should give you the ability to effectively evaluate research, perhaps even leading you to identify and discard myths pertaining to statistics. I am sure everyone has heard the phrase, "You can prove anything with statistics," or, "You can lie with statistics." Honest, ethical social scientists use statistics as objective way to explore our social world. Social scientists who are well-versed in statistical methods can very easily differentiate good statistical arguments from bad ones. If nothing else, my hope is to provide you with the tools necessary to make this important distinction.

The following text is required:

- David Knoke, George W. Borhnstedt, and Alisa Potter Mee. *Statistics for Social Data Analysis (4th Edition).* ISBN 0-87581-448-4.

- The University provides free software, *Moodle,* which I will rely upon in this class. Updates, additional readings, and other course material can be found here. I will also post grades here. Please check this site regularly for course information.

Optional readings

- Jeff Gill. 2006. *Essential Mathematics for Political and Social Research.*
- Timothy M. Hagle. 1995. *Basic Math for Social Scientists: Concepts (Series in Quantitative Applications for Social Scientists).* This is part of the Sage monograph series.
- William D. Berry and Stanley Feldman. 1985. *Multiple Regression in Practice. Series in Quantitative Applications for Social Scientists).* This is part of the Sage monograph series.
- Gary King. 1989. *Unifying Political Methodology: The Likelihood Theory of Statistical Inference.* Cambridge: New York.
- Morris H. DeGroot and Mark J. Schervish. 2002. *Probability and Statistics.* Addison-Wesley.

I am also asking that you purchase a copy of *Stata* (Version 9, 10, or 11 is fine). This can be purchased at a significantly discounted student rate on *Tigerware.* Students may purchase a year license, Stata Intercooled, or the more expensive Stata Special Edition. You should avoid the Stata Student Edition. There are far too many restrictions and you will not be able to work through all the required assignments. While initially expensive, *Stata* is perhaps the most widely used and flexible statistical package in the social and basic sciences. Also, subsequent statistics classes in this department will require or encourage you to purchase *Stata.* We will periodically hold *Stata* workshops throughout the semester, and you should feel free to bring your laptops to class if you would like to work through examples.

There will be several *Stata* labs held throughout the semester. If you have a laptop, or access to a laptop, you should bring it to these labs. All the syntax we use will be made available on Moodle, as well as *Stata* screenshots and detailed instructions. It is your responsibility to attend these labs. While I am more than willing to provide instruction and guidance, I will not go through the lab material multiple times. If you miss the lab material, it is your responsibility to learn the material, either on your own or with the help of your classmates. You should direct technical questions to the TA assigned to this course, Cassie Black. Cassie will help you get data into Stata and troubleshoot issues regarding installation and analysis.

My Teaching Policy

Some students enter this course thinking it is far removed from what they will do in their professional careers. After all, why does a theorist need to know how to conduct an experiment or run a correlational analysis? In reality, this course is essential to your development as an ethical and knowledgeable social scientist. Understanding the foundations

of statistics is a skill that is important in evaluating the trustworthiness and credibility of existing social science research. My job is to work with you to develop the skills necessary for you to critically and objectively evaluate scientific information.

Throughout the semester I will reiterate this, but I am always available should you have any comments or concerns about the class. In addition to my office hours, I practice an "open door" policy. If my door is open, feel free to stop by. If I am not in, email me and I will get back to you in a timely manner. The concepts in this class may be difficult to grasp. It is your job to work hard this semester. It is my job to facilitate your learning of the material.

Procedures

1. Students must read all assignments in the text and readings available on Moodle and emailed to the course. There will be several in class exercises to illustrate research techniques. Quizzes on readings and notes may be administered at the professor's discretion.

2. Cell phones must be set to silent. For your safety, I will bring my phone to every class, which I have subscribed to the LSU emergency text message service.

3. Students should always bring a calculator to course. The calculator should handle square roots and exponents. PLEASE BRING THIS TO EVERY CLASS!

4. Students should always come to class fully prepared and ready to learn.

5. All the assignments & projects MUST be submitted at the beginning of the class. NO LATE WORK WILL BE ACCEPTED.

6. Class attendance is extremely critical for this course. You are expected to come to every class. If you miss a class without providing a valid excuse in writing, your grade may be lowered. (*E-mail notification will not be accepted as a valid excuse for an absence.)

7. An in-class quiz may be given when THREE or more students miss a class.

8. Come to class with assignments completed and reading material covered. Textbook reading assignments are listed in the syllabus. Thus, I will assume that you have read the assigned materials before the class and expect you to actively participate in class discussion.

9. If you have a disability which may require accommodation, you should immediately contact the Office of Services of Students with Disabilities to officially document the needed accommodation. You should immediately contact the *Office of Disability Service* to officially document the needed accommodation. You can find more information at http://appl003.lsu.edu/slas/ods.nsf/index

10. It is your responsibility to complete all works assigned in this course (e.g., tests, assignments) in full observation of the Academic Honor Code. Cheating, plagiarism or any form of academic dishonesty will be unacceptable. University policies regarding academic honesty will be strictly enforced. If you have any questions about academic dishonesty, please speak either with me or with someone in the *Office of the Dean of Students*. You can also learn more about it at http://appl003.lsu.edu/slas/dos.nsf/$Content/Code+of+Conduct?OpenDocument#5.1 or https://paws002.lsu.edu

11. If a student engages in any form of academic dishonesty this will be reported to the Dean of Students. All assignments will be due at the beginning of the class period on the established due date. Depending on where we are in the class, I may decide to alter a due date. Any changes will be announced in class. Makeup exams or assignments will be allowed only in the case of university excused absences. Documentation must be provided.

Grades

Grades will be determined by the following components:

- Midterm Exam (100 points)
- Final Exam (100 points)
- Problem Sets and Assignments 5x20 points=(100 points)
- Final Report (100 points)

90%-100%	A
80%-89%	B
70%-79%	C
60%-69%	D
59% and below	F

Homework assignments comprise a large part of your grade. In order to effectively comprehend and conduct quantitative research, it is important that you spend a fair amount

of time outside of the classroom studying the material. It is extremely important that you keep up to date with the readings and homework. For this reason, I will not accept any late assignment, except under the extraordinary circumstances.

The final project involves writing a research report. You can choose the topic, but you must be able to provide me with the data you use in this report. Thus, if you or your advisor has proprietary data which I cannot access, you cannot use this. I must be able to verify that you did all the necessary calculations honestly and accurately, which requires me being able to access any data you use. Your final report should be roughly 20 pages in length and include all the required sections of an American Psychological Association (APA) style or American Journal of Political Science (AJPS) style report: Title page, abstract, introduction, methods, results, discussion/conclusion, references, tables, figures, and appendix. Please follow APA or AJPS style for this report.

There will be an in-class midterm and comprehensive, final exam. Both exams will be open book/open notes.

In-class projects will be conducted throughout the semester and students will be asked complete these. Some of these projects might be made up outside of class if you have an excused absence, but others cannot be given outside of class. You need not prepare for these projects, but you should have paper, pens, and calculators available every class.

Daily Schedule

Please read all assigned readings prior to the listed meeting times. Please note that the course schedule is subject to change at my discretion. You are responsible for announced changes.

August 23: Introduction to the Course

- Knoke et al., Chapter 1.

August 30: Univariate Statistics and an Introduction to Stata

- Knoke et al., Chapter 2.

September 6: Labor Day, No Class

September 13: Distributions and Sample Estimation of Population Parameters

◆ Knoke et al., Chapter 3.

Stata Lab: Introduction to Basic Stata Syntax (Importing data, describing variables, and recoding variables)

Problem Set 1 (Chapters 2 and 3). Under "General Problems" answer #2, 6, and 10 on pp. 65-66. Then answer #1, 5, 7, and 10 on pp. 106-107. This will be due on September 21.

September 20: Analysis of Variance

◆ Knoke et al., Chapter 4.

Stata Lab: Variance Decomposition (ANOVA)

You must hand in a half to one page summary of the data you will be using for the final project. It should include where you will get the data, what variables you will analyze, and any other relevant information*

September 27: Quantifying Bivariate Relationships

◆ Knoke et al., Chapter 5.

Problem Set 2 (Chapters 4 and 6). Under "General Problems" answer #1, 4, and 9 on pp. 136-137. Then answer #1 and 3 on p. 201. This will be due on October 5.

October 4: Bivariate Relationships in Stata and Midterm Review

◆ Knoke et al., Chapter 6.

Stata Lab: Introduction to Bivariate Relationships (Creating Scales, Correlation, and Contingency Tables)

October 11: MIDTERM EXAM.

The exam will be open book. You may use your textbook and notes. The exam will be done individually. You will have the entire course period to complete the exam.

October 18: Introduction to Multivariate Methods

◆ Knoke et al., Chapter 7.

Problem Set 3. Generate a research question, hypothesis, and propose a way to test this hypothesis. Find a dataset to explore this hypothesis. Explain what variables you will examine and what methods you will use. Please see me for comments or suggestions. This will be due on November 2.

October 25: Ordinary Least Squares and Multiple Regression

◆ Knoke et al., Chapter 8 (pp. 235-253).

November 1: Multiple Regression in Practice using Stata

- Knoke et al., Chapter 8 (pp. 253-285).

Stata Lab: Multivariate Relationships (Multiple Regression using OLS)

November 8: Introduction to Probability Theory

- John E. Freund, *Probability Theory and Applications.* (pp. 1-85). Available on Moodle.

Problem Set 4. Complete the Stata problem set posted on Moodle. This will be due on November 23.

November 15: Probability Theory and Bayes' Theorem, Continued

- John E. Freund, *Probability Theory and Applications.* (pp. 1-85). Available on Moodle.

Problem Set 5. Complete the probability theory homework posted on Moodle. This will be due on November 30.

November 22: Non-Parametric Statistical Methods

- Wackerly et al. 2002. *Mathematical Statistics with Applications,* Chapter 15: Nonparametric Statistics. Available on Moodle.
- Knoke et al., Chapter 6.

Stata Lab: Non-Parametric Statistics in Stata

November 29: Semester Wrap Up and Final Exam Study Session.

December 6: 8-10PM