POS 5698: Fundamentals for Political Science

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This course will introduce you to a set of mathematical tools that are fundamental to both statistics and formal theories of politics. I have two goals: [1] to persuade you that these tools are useful, and [2] to provide you with a foundation for future course work. It is important to note that we will be covering in one semester topics that are taught in mathematics and engineering programs over the course over 4 to 5 semesters. If you want to master the material that I introduce in this course, you will need to pursue that after this semester. But this course will provide you with a foundation for doing so.

When it comes to formal theory and statistics all political scientists need a minimum level of competency to be able to read and understand the work that people are doing in their field. That is why we require courses in statistics and formal theory. This course will introduce you to the mathematical tools you need to complete that course work. Some of you will decide to pursue the study of formal theory and/or statistics beyond a literacy level. This course will provide you with a foundation in math to be able to take additional course work that you will need to pursue such study.

Having covered the course objectives, let me turn to grading. You will be evaluated over three criteria:

(1) Class participation which will account for 40% of your final grade.
(2) Three midterm exams that will account for 45% of your final grade.
(3) A cumulative final exam that will account for 15% of your grade.

Class Participation

You are likely accustomed to math or statistics courses where the instructor lectures and you diligently take notes. This course is **not** structured that way. Instead, it has a hands-on focus. You will be required to arrive to class with completed assignments. Unlike in other courses you will not turn in your assignments prior to class so that I can grade them. Instead, you will bring them to class and I will call on individual students to work through a problem. That is, we will work through the problems in class. I will often call on a second student to explain whether or not the problem was worked correctly. I will also introduce some new problems in class that we will work on in small groups.

I urge you to bring questions with you. In fact, it is imperative that you ask questions in class. Some students are uncomfortable asking questions in class because it reveals ignorance or misunderstanding. The purpose of class is to eliminate ignorance and misunderstanding, and the reason we meet is to work on that together. We could simply have you do the

reading and then take tests. We could also meet so that you could take notes based on my lecturing. However, what we are doing is meeting to work together on problems and thereby have several people discuss the same issues. Sometimes when two different people explain the same thing in slightly different ways it clicks for someone who did not understand the first explanation. That will hopefully happen frequently. Further, requiring you to participate leads you to take ownership over the material in a way that does not happen if you are passively taking lecture notes. I believe that students learn material better under such circumstances.

After each class meeting I will assign each student a participation grade as follows:

A (excellent): The student participated strongly, making insightful comments that contributed to our collective understanding.
B+ (good): The student contributed meaningfully to the class discussion by asking good questions and/or exhibiting a grasp of the material s/he discussed.
B (satisfactory): The student participated, but discussion exhibited a poor grasp of the material.
C (poor): The student spoke, but did not address the assigned material.
F (unsatisfactory): The student did not speak in class.

I will only count the top 11 scores when calculating your participation grade (i.e., I will drop the three lowest scores).

Midterm Exams
There will be three midterm exams. You will have an hour to complete the exam. More specifically, we will spend the 1^{st} hour of class on the exam, take a break, and then meet for the remainder of time.

Each midterm counts for 15% of your course grade (together they count for 45%). I will make study sheets available the week prior to the exam. The dates are listed below in the course schedule.

Final Exam
The final exam is a cumulative, in class exam. The exam is scheduled for Thu 15 Dec from 10:00 - 12:00 am. Toward the end of the semester I will make available study sheets for the exam.

Grading Scale

	A 93-100	A- 90-92
B+ 88-89	B 83-87	B- 80-82
C+ 78-79	C 73-77	C- 70-72
D+ 68-69	D 63-67	D- 60-62
F 0-59		

Teaching Assistant

Jackie Rubin is the TA for all of the methods courses. She is going to shadow this course (i.e., do the reading, but not attend class) so that she will be able to help answer questions you may have. That said, she is not going to check your work or show you how to find the correct answer to the exercises. Instead, if you go to her for help she will offer hints and suggestions, or show you how to work a similar problem.

Her office hours are from 11:30 - 1:30 on Monday and 12:00 - 2:00 on Thursday. Her office is 550 Bellamy and she can be reached by email at: `jhr03@fsu.edu`.

Posting Grades
After the term is complete, grades will be posted using the last 6 digits of the student's ID #. If you would prefer that your grade not be posted, please notify me and I will remove it from the sheet that is posted.

Academic Honesty
With respect to academic honesty, FSU students are governed by an honor code and you are advised to familiarize yourself with this policy (see the Student Handbook which is available in paper or via the WWW). Cheating and plagiarism will not be tolerated: it will lead to a zero on the assignment, and will likely lead to dismissal from the program.

Accommodating Challenges
Students with challenges who require individualized testing or other accommodations should identify themselves to the instructor and express their needs during the first week of class. Where the challenge is not immediately apparent, verification will be required. The Department of Political Science is happy to do whatever it can to assure each student a full and rewarding participation in our courses.

Reading
There are no books to purchase for this course–the reading will largely be drawn from material that I am writing and will either be available online or in a standing file cabinet in the hallway outside my office door. Much of the material will become available the week prior to the class when it is assigned.

It is often useful to read more than one presentation of mathematics material–sometimes the way a second author phrases things makes it click. The material I am teaching is widely taught and, as such, is available via a number of web sites and thousands of text books. In fact, you may have an old textbook available from a previous course. I encourage you to avail yourself of a second (or third) presentation. In many of the chapters I am writing I explicitly list alternative sources of (typically more detailed) information. But you might search the web for either sites or text recommendations and identify another source to read in conjunction with the assigned material.

There are two books on math for the social sciences written by political scientists that you might consider:

- Hagle, Timothy M. 1995. *Basic Math for Social Scientists*, Newbury Park: Sage. It has two volumes: *Concepts* (QASS #108) and *Problems and Solutions* (QASS #109).
- Gill, Jeff. 2005. *Essential Mathematics for Political and Social Research*, Cambridge University Press, forthcoming. Galleys of Gill's book are available online at: `http://psfaculty.ucdavis.edu/jgill/papers/empsr.pdf.zip`.

Course Schedule

1 Some Basics to Get Us Started

WEEK 1 (29 Aug):

1.1 Deduction & Proof

Morrow, James D. 1994. "The Idea of a Mathematical Proof," in *Game Theory for Political Scientists*, Princeton UP, pp. 331-2.

Mayer, Albert R. 2002. "Proofs," available online at:
http://theory.lcs.mit.edu/classes/6.042/fall02/handouts/lectures/ln1.pdf

Anonymous. nd. "A Few Words About Proofs," available online at:
http://www.math.utah.edu/mathcircle/notes/proofs.pdf.

1.2 Variables, Arithmetic & Algebra Review, and Notation

Moore, Will H. 2004. "Preliminaries & Review," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

WEEK 2 (5 Sept):

Labor Day–class does not meet.

2 Relations and Functions

WEEK 3 (12 Sept):

Gardner, Martin. 1998. "What is a Function?" in S.P. Thompson *Calculus Made Easy*, New York: St. Martin's Press, pp. 10-17.

Moore, Will H. 2004. "Relations & Functions," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

3 Probability

WEEK 4 (19 Sept):

Moore, Will H. 2004. "Probabilities," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

4 Distributions

WEEK 5 (26 Sept):

Moore, Will H. 2004. "An Introduction to (Discrete) Distributions," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

WEEK 6 (3 Oct):

Moore, Will H. 2004. "Continuous Distributions," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

5 Calculus

WEEK 7 (10 Oct):

Midterm #1, 1:30 - 2:30.

5.1 Limits

Moore, Will H. 2004. "Limits of Functions & Sequences," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

5.2 Differences & Derivatives

WEEK 8 (17 Oct):

Gill, Jeff. 2004. "Understanding Rates, Changes and Derivatives," in *Essential Mathematics for Social and Political Research*, Cambridge UP, pp. 99-104.

S.P. Thompson & M. Gardner. 1998. *Calculus Made Easy*, New York: St. Martin's Press, pp. 30-58, 103-10.

Moore, Will H. 2004. "The Derivative I," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

5.3 Extrema, Partial Derivatives & Comparative Statics

WEEK 9 (24 Oct):

S.P. Thompson & M. Gardner. 1998. *Calculus Made Easy*, New York: St. Martin's Press, pp. 116-24, 132-35, 184-89.

DeAnda, Lee. nd. "Max and Min's," available online at:
http://www.clas.ucsb.edu/staff/lee/Max%20and%20Min's.htm

DeAnda, Lee. nd. "Inflection Points," available online at:
http://www.clas.ucsb.edu/staff/lee/Inflection%20Points.htm

Moore, Will H. 2004. "The Derivative II," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

5.4 The Integral & Differential Equations

WEEK 10 (31 Oct):

S.P. Thompson & M. Gardner. 1998. *Calculus Made Easy*, New York: St. Martin's Press, pp. 191-206, 210-18.

Moore, Will H. 2004. "The Integral," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

Gill, Jeff. 2004. *Essential Mathematics for Social and Political Research*, sections 3.4-3.5, Cambridge UP, pp. 116-121.

DeAnda, Lee. nd. "What is a Differential Equation?" available online at:
http://www.clas.ucsb.edu/staff/lee/Intro%20to%20diff%20eqn.htm

6 Matrix Algebra

WEEK 11 (7 Nov): Operations, Determinants & Inverses

Midterm #2, 1:30 - 2:30.

Kaw, Arthur K. 2002. "Vectors," in *Introduction to Matrix Algebra*, available online at:
`http://numericalmethods.eng.usf.edu/matrixalgebrabook/downloadma/matrixalgebra.pdf`,
pp. 20-33.

Gujarati, Damodar N. 1995. "Rudiments of Matrix Algebra," in *Basic Econometrics*, Third ed., New York: McGraw Hill, pp. 791-802.

Hagle, Timothy M. 1995. "Matrix Algebra," in *Basic Math for Social Scientists: Concepts*, Newbury Park: Sage, pp. 71-86.

WEEK 12 (14 Nov): Cramer's Rule, Systems of Equations & Roots

Hagle, Timothy M. 1995. "Matrix Algebra," in *Basic Math for Social Scientists: Concepts*, Newbury Park: Sage, pp. 86-91.

Moore, Will H. 2004. "Fun With Matrices," will become available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/

Moler, Cleve. 2002. "The World s Largest Matrix Computation,"
http://www.mathworks.com/company/newsletters/news_notes/clevescorner/oct02_cleve.html

7 Optimization

WEEK 13 (21 Nov):

Moore, Will H. 2004. "Optimization," available online at:
http://garnet.acns.fsu.edu/∼whmoore/fundamentals/.

Hagle, Timothy M. 1995. "Matrix Algebra," in *Basic Math for Social Scientists: Concepts*, Newbury Park: Sage, pp. 50-56, 91-93.

8 Constrained Optimization

WEEK 14 (28 Nov):

Hagle, Timothy M. 1995. "Constrained Optimization," and "Multivariate Extrema and Matrix Algebra," in *Basic Math for Social Scientists: Concepts*, Newbury Park: Sage, pp. 56-58, 93-95.

Read problem 4.2.6 of Hagle from *Problems & Solutions* (1995:56), and problem 6.6.3 (pp. 93-4).

8.1 Dynamic Models

WEEK 15 (5 Dec):

Midterm #3, 1:30 - 2:30.

Mondak, Jeffrey J & Shannon Ishiyama Smithey. 1997. "The Dynamics of Public Support for the Supreme Court," *Journal of Politics*, 59:1114-1142. (Search Ejournals from FSU Library)

Optional: Huckfeldt, R. Robert, C.W. Kohfeld & Thomas Likens. 1982. *Dynamic Modeling*, Beverly Hills: Sage, pp. 61-85.[1]

[1] I am making this available to give you a flavor of differential modelling if you are interested. You are not expected to read it and won't be tested on it.

FINAL EXAM (Thu 15 Dec)

10:00 - 12:00 am in 113 Bellamy