POL 502: Mathematics for Political Science

Fall 2005

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Logistics

Lectures: Mondays 10–11:20 a.m. in 008 Robertson; Thursdays 3–4:20 p.m. in Firestone B6N
Precepts: TBA.

Course Mailing List

Send questions about lectures and problem sets to POL502_F2005@Princeton.Edu Samir also has office hours and precepts where he can answer any questions about problem sets.

Catalog Description

This course presents basic mathematical concepts that are essential for formal and quantitative analysis in political science research. It prepares students for advanced courses offered in the department (e.g., POL 571–573, 575–576). The topics include calculus, linear algebra, and probability theory. Some applications to political science will be introduced. There is no prerequisite. The course is aimed for *both* students with little exposure to mathematics and those who have taken some courses but wish to gain a more solid foundation.

Why Math for Political Science?

In the last 20 years, political science research has come to increasingly rely on quantitative and formal methods. Having a solid foundation in the underlying mathematical concepts will help you do better research in these areas. You will find the mathematical skills and intuition you gain from this course useful to understand and conduct applied research in the discipline.

Outline of the Course

I plan to cover the following topics in the order that they are listed below. Since we are political scientists and not mathematicians, I assume no prior knowledge. The teaching principle I follow

is that we proceed as fast as possible given that *everyone* in the class is understanding the materials. Never hesitate to ask questions during the class! Weekly sections should also provide us the opportunity to make sure that everyone is keeping up with the course. You are especially encouraged to form groups and study together for problem sets and exams.

1. Foundations (Abott ch. 1; Simon and Blume ch. A1): Sets, Functions, Real Numbers, Countable and Uncountable Sets (if time permits).

2. Sequences (Abott ch. 2; Simon and Blume ch. 12 and 29): Limits of Sequences, Cauchy Sequences, Subsequences and Monotone Sequences, Convergence of Infinite Series (if time permits).

3. Limits of Functions and Continuity (Abott ch. 4; Simon and Blume ch. 12 and 13): Limits of Functions, Continuous Functions, Continuity on Compact Sets, Properties of Continuous Functions.

4. Derivatives and Integrals (Abott ch. 5 and 7; Simon and Blume ch. 2, 4, 14, and A4).

5. Linear Algebra (Kolman; Simon and Blume ch. 8, 9, 11, and 23): Vectors and Matrices, Systems of Linear Equations, Eigenvalues and Eigenvectors.

6. Probability (DeGroot and Schervish; Simon and Blume ch. A5): Random Variables, Probability Distributions, Conditional Probability, Expectation, Convergence of Random Variables, Law of Large Numbers, Central Limit Theorem.

Course Requirements

Problem sets (approximately weekly), 30%.
Mid-term exam (scheduled on Thursday, Oct 20), 30%.
Final exam (scheduled on January 19), 40%.

Textbooks

Although the lectures are based on selections from the following textbooks, they are not required for purchase. On the exams and problem sets, you will only be held accountable for the materials that are covered in the lectures.

Real analysis: Abbott, S. (2000). *Understanding Analysis*, Springer.

Probability: DeGroot, M. H. and Schervish, M. J. (2002). *Probability and Statistics*, Addison-Wesley.

Linear Algebra: Kolman, B. (1996). *Elementary Linear Algebra*, 6th Edition, Prentice Hall.

General: Simon, C. P. and Blume, L. (1994). *Mathematics for Economists*, W.W. Norton.