PSC 404

Probability and Inference

Fall 2013
3:25-4:50 T/Th
Harkness 329

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PURPOSE

This course in mathematical statistics provides graduate students in Political Science with a solid foundation in probability and statistical inference. The focus of the course is on the empirical modeling of non-experimental data. While substantive political science will never be far from our minds, our primary goal is to acquire the tools necessary for success in the rest of the econometrics sequence. As such, this course serves as a prerequisite for the advanced Political Science graduate courses in statistical methods (PSC 405, 505, and 506).

PREREQUISITES

The math "boot camp" is the only course prerequisite, as familiarity with calculus is necessary to understand the material. Students who remain uncomfortable with differentiation and integration may want to consider sitting in on a calculus course offered elsewhere in the University.

COURSE REQUIREMENTS

Evaluation is based on homework assignments (10%), a midterm exam (40%), and a final exam (50%). In addition to office hours, the teaching assistant will hold a weekly recitation. Attendance is mandatory. The purpose of the recitation is to cover material not covered in lecture, to go over homework problems, and to review for exams. Students are responsible for material covered in lecture, recitation, and the required readings. A web page for this course is to be found at `http://www.rochester.edu/College/PSC/clarke/404/404.html`.

TEXT

The required texts for this course are:

DeGroot and Schervish. *Probability and Statistics.* 3rd ed.

COURSE SCHEDULE

Topic 0: Course Overview and Introduction to Empirical Modeling

Specifics: Course overview and business. Stochastic phenomena. Chance regularity. Characterizing data. Statistical models.

Topic 1: Introduction to Probability

Specifics: Set theory. Definition of probability. Combinatorics.

Reading: DS Ch. 1

Topic 2: Conditional Probability

Specifics: Definition. Independent events. Bayes' Theorem.

Reading: DS Ch. 2

Topic 3: Random Variables and Distributions

Specifics: Random variables. PDFs and CDFs. Functions of random variables.

Reading: DS Ch. 3

Topic 4: Expectation

Specifics: Expectation of a random variable. Variance. Covariance and correlation. The sample mean.

Reading: DS Ch. 4

Midterm. Covers topics 0-4.

Topic 5: Special Distributions

Specifics: Named distributions. Central limit theorem.

Reading: DS Ch. 5

Topic 6: Estimation

Specifics: Inference. MLE. Sufficient statistics. Improving an estimator.

Reading: DS Ch. 6

Topic 7: Sampling Distributions of Estimators

Specifics: Sampling distributions. χ^2 and t. Interval estimation. Fisher information.

Reading: DS Ch. 7

Topic 8: Testing Hypotheses

Specifics: Fisher v. Neyman-Pearson. Simple hypotheses. UMP tests. F-tests.

Reading: DS Ch. 8

Topic 9: Categorical Data and Nonparametric Methods

Specifics: Let's cross this bridge when we come to it.

Reading: DS Ch. 9

Topic 10: Simulation

Specifics: Who are we kidding?

Reading: DS Ch. 11

Final Exam. Cumulative with weight on second half.