

PSC 404: Probability and Inference

Fall 2008

Lecture: M 2:00-3:15 (Morey 524), W 2:00-3:15 (Harkness 112)

Course website: <http://mail.rochester.edu/~mperess/pi2008.html>

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Overview: This course offers an introduction to probability and statistics for graduate students in political science.

Recommended Textbooks:

DeGroot, Morris H. and Mark J. Schervish (2002). *Probability and Statistics*.

Casella, George, and Roger L. Berger (2002). *Statistical Inference*.

Wackerly, Dennis D., William Mendenhall III, and Richard L. Scheaffer (2002).

Mathematical Statistics with Applications.

Note:

DeGroot and Schervish is most highly recommended, but choose the textbook you like best. If you choose Casella and Berger or Wackerly, Dennis, and Mendenhall, buy a used copy of an older edition (the current editions are absurdly expensive).

Other References:

Newbold, Carlson, and Thorne, *Statistics for Business and Economics*.

Provides better coverage of elementary statistics. I will distribute photocopies of a few chapters later in the semester.

Grading: Grading will be based on a midterm (33%), a final (33%), and six (plus or minus one) homework assignments (33%).

Syllabus: I plan on covering the following topics throughout the semester. The list may be contracted or expanded based on how long things are taking. Relevant sections in each textbook are indicated in parentheses.

Set Theory and Probability Theory

Topics: Set Theory, Probability Theory, Combinatorics, Conditional Probability, and Independence

Readings: DeGroot and Schervish (1.4-1.11, 2.1-2.3), Wackerly, Mendenhall, and Scheaffer (2.3-2.10), Casella and Berger (1.1-1.3)

Random Variables

Topics: Random Variables, Distribution Functions, Integration Tricks, and Density and Mass Functions

Readings: DeGroot and Schervish (3.1-3.3), Wackerly, Mendenhall, and Scheaffer (2.11, 3.1-3.2, 4.1-4.2), Casella and Berger (1.4-1.6)

Transformations and Expectations

Topics: Transformations, Expectations, and Characteristic Functions

Readings: DeGroot and Schervish (3.8, 4.1-4.5, 5.1-5.6, 5.9-5.10), Wackerly, Mendenhall, and Scheaffer (3.3-3.12, 4.3-4.9, 6.1-6.5), Casella and Berger (2.1-2.4, 3.1-3.3, 5.6)

Multiple Random Variables

Topics: Joint Distribution, Marginal Distributions, Conditional Distributions, Independence, Conditional Expectations, Covariance and Correlation, Multivariate Distributions, and Mixtures of Random Variables

Readings: DeGroot and Schervish (3.4-3.7, 3.9, 4.6-4.7, 5.11-5.12), Wackerly, Mendenhall, and Scheaffer (4.11, 5.1-5.12, 6.6), Casella and Berger (4.1-4.6)

Large Sample Theory

Topics: Convergence Concepts, Law of Large Numbers, and the Central Limit Theorem

Readings: DeGroot and Schervish (4.8, 5.7),¹ Wackerly, Mendenhall, and Scheaffer (4.10, 7.1-7.6), Casella and Berger (3.6, 5.1-5.2, 5.5)

Point Estimation (Part 1)

Topics: Properties of Point Estimator, the Derived Distributions, and Sampling Distributions

Readings: DeGroot and Schervish (6.9, 7.1-7.4, 7.6-7.8), Wackerly, Mendenhall, and Scheaffer (8.1-8.4, 9.1-9.4), Casella and Berger (5.3, 7.3)

Statistical Inference

Topics: Hypothesis Testing for Means, Proportions, Variances, Differences in Means, Differences in Proportions, and Differences in Variances

Readings: DeGroot and Schervish (7.5, 8.1-8.7, 8.9), Wackerly, Mendenhall, and Scheaffer (8.5-8.10, 10.1-10.10), Newbold, Carlson, and Thorne (8-11, 12.1)

Point Estimates (Part 2)

Topics: Maximum Likelihood, M-Estimators, Method of Moments, and Bayesian Estimators

Readings: DeGroot and Schervish, (6.1-6.6), Wackerly, Mendenhall, and Scheaffer (9.6-9.8), Casella and Berger (7.1-7.2).

Large Sample Theory for Point Estimation

Topics: Identification, Consistency, and Asymptotic Normality

Readings: Lecture Notes.²

Hypothesis Testing and Confidence Intervals

Topics: The Delta Method, the Wald Test, the Likelihood Ratio Test, Efficiency of Tests, and Confidence Intervals

Readings: Casella and Berger (8.1-8.3, 9.1-9.3), Wackerly, Mendenhall, and Scheaffer (10.11)

¹ DeGroot and Schervish provide poor coverage for these topics.

² Chapter 10 of Casella and Berger covers these topics, but it is unreadable.

Markov Chains

Topics: Markov Chains

Readings: DeGroot and Schervish (2.4)