Econ 506: Advanced Economic Statistics

Fall 2016
Rutgers University
Department of Economics

Instructor

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Class Meetings

Lecture: Tuesdays 11:30 am- 12:50pm, Scott Hall 205
Fridays 9:50am-11:10am, Scott Hall 115
Recitation: Wednesdays 9:50am-11:10am, Scott Hall 119

- The recitation session will largely be spent in answering questions about problem sets.

- Occasionally I will hold lecture during the recitation session (Wednesday mornings) due to short travels on the scheduled lecture days, which I will announce in advance.

Office Hour

Tuesdays 3:00 PM - 4:00 PM or by appointment.

Course Overview

This course is the first course in the core econometrics sequence. The main purpose is to introduce you to basic probability and statistical inference topics that you will find helpful as you pursue a graduate education in Economics. At the end of this course, you should be familiar with basic concepts in probability theory, commonly used univariate and multivariate distributions, different types of convergence and estimation methods.

Textbook

1. Bickel, P. and Doksum, K. (2006) *Mathematical Statistics, Basic Ideas and Selected Topics*, Vol. 1, Pearson (2nd Edition).

2. Casella, G. and Berger, R. (2001) *Statistical Inference*, Cengage Learning (2nd edition).

- Both books are excellent introduction to Mathematical Statistics, which I used when I was a first-year graduate student in the Department of Statistics at Northwestern University. Casella and Berger (2001) has more emphasis on Bayesian aspects and decision theories, while Bickel and Doksum (2006) is more about conventional mathematical statistics. You are encouraged to have either one of them.

- However, the books were written for graduate students in statistics, and it is impossible to cover all material in the texts. Therefore I will not follow the texts completely, and will try to provide more economic intuitions and examples. So it is important that students attend classes and follow my notes.

- Examples of economic applications (which are not covered in texts): Markowitz's modern portfolio theory, Testing Capital asset pricing models, Multiple choice models, Nonparametric instrumental variables.

Course Evaluation

The final grade will be determined by your performance in regular homework assignments, a mid-term exam and the final exam. The breakdown of weight given to each component is as follows:

Assignments: 30%
Mid-term exam: 30%
Final exam: 40%

- There will be 1-2 midterms, to be held at either the end of October (if one midterm), or the beginning of October and November (if two midterms). Dates will be announced at least two weeks ahead.

- Homework is usually due in a week.

- The exams will be in class, closed book. Students are allowed to bring a formula sheet.

Topics to be Covered

1. Review of Probability and Distribution Theories

    - Basic Set Theory
    - Random Variables
    - Expectation of a random variable
    - Joint, Marginal and Conditional Distributions
    - Transformations of random variables
    - Some common univariate and multivariate distributions
    - Some useful inequalities

2. Large Sample Theory for Independent Data

- Convergences in Probability and in Distribution
- Law of Large Numbers
- Central Limit Theorem

3. Some Mathematical Statistic Theories

   - Identification
   - Sufficiency and Completeness
   - Maximum Likelihood Estimations (MLE) and Efficiency
   - Computation: Newton-Raphson Iteration
   - Consistency of MLE
   - Quasi-Likelihood

4. Statistical Inference

   - Sampling
   - Hypothesis Testing
   - Confidence Sets
   - Duality between Testing and Confidence Sets
   - Large Sample Critical Values

5. Bayesian Approach and Decision Theories (if time permits)