

EC 707 Advanced Statistics for Economists
Boston University
Department of Economics
Fall 2007

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Office hours: M 5-6:30pm, W 9-10:30am
Lecture: MW 3:30-5pm; CAS B25B

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Office hours: T 3:30-5:00pm
Section: T 2pm-3:30pm; CAS B27
M 10:30am-12pm; CAS 324

Course Objectives

This course is an intermediate level probability and statistics course with a focus on the theoretical foundations of statistical inference. The primary objective is to provide an introduction to mathematical statistics necessary for the subsequent study of econometrics and economic theory. Univariate and multivariate models are covered, and matrix algebra is used extensively. A brief review of the most important results in matrix algebra is provided at the beginning of the course. The linear Gaussian model is covered in detail. At the end of the course an introduction to asymptotic theory is provided. The course does not cover measure theoretic probability, but some terminology from measure theory is introduced.

Prerequisites

No prior preparation in probability and statistics is required, but familiarity with algebra and calculus is assumed. There are no formal prerequisites.

Required Text

Casella, G., and R. Berger (2002), *Statistical Inference*, Duxbury Press, Second Edition, (CB). This book is available at Barnes&Noble at Boston University.

Goldberger, A. (1991), *A Course in Econometrics*, Harvard University Press, (G). I will use this reference for the parts on linear regression. The lectures will try to be self-contained, so you do not need to buy this textbook.

Kuersteiner, G. (2005), "Lecture Notes on Matrix Algebra," mimeo, Boston University, (K05). These notes will be distributed by the TA in the discussion section.

Kuersteiner, G. (2004), "Asymptotic Theory," mimeo, Boston University, (K04). These notes will be distributed by the instructor in class.

Additional References

DeGroot, M., and M. Schervish (2002), *Probability and Statistics*, Addison Wesley, Third Edition. This textbook does not fully cover all the topics of the course, but provides more examples and is probably more accessible than CB.

Requirements and Grading

There will be weekly assignments, one midterm and one final. The course grade will be determined by the midterm (30%) and the final (45%), with the weekly problem sets making up the rest. Problem Set due dates will be announced in class. You are encouraged to work in groups on homework but each student has to turn in his/her own copy. Identical assignments will not be accepted. There will be no makeup exams and no late homework will be accepted. Homework that is handed in late will receive a zero grade. Exceptions: illness confirmed by a medical certificate from a physician. The midterm and final exams are closed book. No collaboration or outside help is allowed in either of the exams.

Lectures and Discussion Sections

It is expected that students attend all lectures and the weekly discussion section. Please check the web site of the course http://courseinfo.bu.edu/courses/07fallgrsec707_a1/ for class announcements. The two different times for the section correspond to the two halves of the semester (Tuesdays for the first half and Mondays for the second half).

Office hours

Students are encouraged to take advantage of the instructor's office hours to clarify material covered in class and other matters related to the course. If you are unable to meet during regular office hours you should set up an appointment by email.

The best way to contact me outside office hours is by email, which I read daily. However, please be aware that I cannot reply to questions that require lengthy answers about the material covered in the course. If you have such questions, please come to my office and I will be happy to help you.

The TA will also hold weekly office hours to answer questions relative to the problem sets and the grading of the assignments. If you are unable to meet during regular office hours you should set up an appointment by email.

Exam Schedule

The mid-term exam will be held in class, Monday October 22 during regular class time. The final exam will be held in the final exam week on Tuesday December 18 from 12:30pm to 2:30pm.

Course Outline

The course covers the following topics. Required reading in the text book by Casella and Berger (CB) is listed below for each topic. In addition to reading the textbook, attendance of lectures is essential.

Review of Matrix Algebra, K05

Part I - Elements of Probability

1. Set Theory, CB 1.1
2. Definition of Probability, CB 1.2
3. Conditional Probability and Independence, CB 1.3
4. Random Variables, Distribution Functions, and Density and Mass Functions, CB 1.4 - 1.6
5. Expectations and Moment Generating Functions, CB 2.2 - 2.4, 2.6
6. Special Distributions, CB 3.1 - 3.3
7. Multivariate Distributions, CB 4.1, 4.2, 4.5
8. Best Linear Predictor, G 5
9. Transformations and Mixtures, CB 2.1, 4.3, 4.4, 4.6
10. Multivariate Normal and Transformations, CB 5.3
11. Inequalities, CB 4.7

Part II - Elements of Statistical Inference

1. Random Samples and Statistics, CB 5.1, 5.2, 5.5
2. Sample Mean and Sample Variance, CB 5.2, 5.3
3. Other sampling schemes

Part III - Statistical Inference

1. Point Estimation, CB 6.3, 7.1 - 7.4 (without 7.2.3)
2. Linear Regression, G 13.1, 14.1, 14.2, 16.4, 25, 15
3. Hypothesis Testing and Interval Estimation, CB 8 (without 8.2.2), CB 9 (without 9.2.4)

Part IV - Asymptotic Theory, CB 5.5 and K04

1. Modes of convergence
2. Continuous Mapping Theorem
3. Stochastic Orders of Magnitude
4. Laws of Large Numbers
5. Central Limit Theorems
6. Delta Method