EC 730 Math for Economists: Probability Theory
Fall 1998

Professor Jushan Bai
Tuesday-Thursday 10:30 am, Campion Hall, Rm. 236
Office Hours: Tuesday 12:30-2:30pm and by appointment
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Course Objectives

This course is designed for first-year Economics Ph.D. students. Its primary objective is to provide the basic probability theory necessary for subsequent study of statistics and econometrics. No prior preparation in probability and statistics is required, but familiarity with basic algebra and calculus is assumed. This course is followed by Econometrics I in the spring semester, where the fundamentals of statistical theory are presented.

Required Text

DeGroot, M.H.: *Probability and Statistics,* Addison-Wesley, 1986.

The book is available in the Bookstore.

Alternative Textbooks

The material covered in the course can be found in a number of textbooks. Two of them are listed below:
Introduction to Probability Theory and Statistical Inference, by Harold, J. Larson, 1982.
An Introduction to Mathematical Statistics and its Applications, by Richard Larsen and Morris Marx, 1986.

Requirements and Grading

There will be weekly assignments. Late assignments will not be accepted as written answers will be passed out. It is essential to attempt all problems by yourself, even though you are allowed to work together on the assignments.

There will be one final exam held in class during the final exam week. In addition, a quiz will be given in class, Tuesday, November 10.

The course grade will be determined by the assignments (30%) and the final (70%). Your performance on the quiz will not be used for grade determination; its purpose is to see

your understanding of the material thus far, and more importantly, to identify areas for further improvement.

<div align="center">**Course Outline**</div>

Introduction to Probability

Interpretations of probability, experiments and events, sample space, set theory, union, intersection, complements, axioms of probability, counting methods, independence, conditional probability, Bayes Theory.

DeGroot, Chapter 1 and sections 2.1-2.2.
Larson, Chapters 1 and 2.
Larsen and Marx, Chapters 1 and 2.

Random variables and Distributions

Random variables, distribution functions, density functions, bivariate distributions, multivariate distributions, marginal distributions, conditional distributions, random variable transformations.

DeGroot, Chapter 3.
Larson, 3.1-3.2, 5.1-5.2
Larsen and Marx, 3.1–3.7

Expectations

Definition and properties of expectations, variance, moments, moment generating functions, mean, median, covariance, correlation, conditional expectation.

DeGroot, Chapter 4.
Larson, 3.3-3.4
Larsen and Marx 3.8-3.12

Special Distributions

Bernoulli trials, binomial, negative binomial, Poisson, normal, beta, gamma, multinomial, bivariate normal.

DeGroot, Chapter 5.
Larson, Chapter 4.
Larsen and Marx, Chapter 4.

Probability Inequalities

Markov inequality, Chebyshev inequality, Shwarz inequality, Jensen inequality.

DeGroot, 4.8
Larson, 5.5
Larsen and Marx, 3.13

Law of Large Numbers

Weak law of large numbers, strong law of large numbers.

DeGroot, 4.8
Larson, 5.5
Larsen and Marx 3.13.

Central Limit Theorem

DeGroot, 5.7
Larson, 5.6
Larsen and Marx, 4.3.