

Fall 2001

Syllabus:

STATISTICS 210
Probability Theory and Statistical Inference I

Course Website: link from <http://www.fas.harvard.edu/~junliu>

Instructor: Jun Liu. Office: 711 Science Center; Phone: 495-1600

Reference books: Probability: Theory and Examples (2nd Ed)
Richard Durrett, Duxbury Press.
Probability and Random Processes (3rd Ed)
G.R. Grimmett and D.R. Stirzaker, Oxford Univ. Press.

Office hours: Tuesday 1:30-2:30, Wednesday 2-3, or by appointment.

Class meetings: TTh 11:30-1:00, SC-103b.

COURSE DESCRIPTION: Fundamental concepts on probability space, expectation, and independence are covered. Conditional probabilities and expectations are studied. Well-known random variables and distribution families are discussed. Characteristic functions and moment generating functions are introduced. Limiting theorems, including strong and weak laws of large number, central limit theorems, and large deviation theory, Poisson convergence, etc., are treated. Monte Carlo simulations are used throughout the course to illustrate important concepts. Other topics such as sampling distributions, elementary martingale theory, and ergodic theory will be touched upon if time allows.

COURSE REQUIREMENTS: Calculus, set theory and STAT 110 are prerequisites. There will be about 9 assignments, one midterm exam (tentatively scheduled on Nov. 6), and a take-home final exam. The weights are 30% for homework, 25% for the midterm, and 45% for the final. No late homeworks!!

In roughly chronological order, the following topics will be treated.

1. Introduction and history; basic concepts: sample space, events, conditional probability, independence; set theory and measure theory (2 classes)
2. Random variables, expectations, independence and inequalities. (2 class)
3. Discrete and continuous random variables: examples (2 classes)
4. Topics on multivariate normal distribution. (2 classes)
5. Laws of large numbers and other convergence theorems. (4 classes)
6. **Midterm examination.** (1 class)
7. Moments, moment generating functions, and characteristic functions. (1 class)
8. Central limit theorems via characteristic function. Poisson approximations. (5 classes)
9. Random walks and basic Markov chain theory (4 classes)
10. Martingales (2 classes)
11. Other topics. (1 class)