

OPRE 6330, Applied Probability and Stochastic Processes—Fall 2004

Tuesdays, 7:00pm–9:45pm
Room: SOM 2.803

Instructor:

Shun-Chen Niu
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Texts:

The required text is: *Introduction to Probability Models*, by Sheldon M. Ross, 8th Edition. Academic Press, 2003.

In addition, I also recommend: *Stochastic Processes*, by Sheldon M. Ross, 2nd Edition. John Wiley & Sons, 1996.

Prerequisites:

Calculus and Analytic Geometry; or consent of the instructor.

Course Description:

The first part of the course covers basic concepts and methods from probability theory. Students are expected to gain a working knowledge in probability. In the second part of the course, we will cover a number of important classes of stochastic processes that are useful in the modeling of complex systems. These include Poisson and renewal processes, discrete and continuous-time Markov chains, and semi-Markov processes.

Grading Scheme:

Homework: 20%
Midterm: 40% (October 12)
Final: 40% (November 30)

Course TA:

Abdullah Suzek
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Office Hours: TBA
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Course Outline:

1. Introduction to Probability

- (a) Sample Space and Events
 - (b) Definition of Probability and Conditional Probability
 - (c) Independence
2. Random Variables
- (a) Definition and Types of Random Variables
 - (b) A Survey of Important Discrete Random Variables
 - (c) A Survey of Important Continuous Random Variables
 - (d) Expectation
 - (e) Basic Limit Theorems
3. Conditional Probability and Conditional Expectation
- (a) The Conditional Distribution of a Random Variable
 - (b) Various Uses of Conditional Expectations
4. The Exponential Distribution and the Poisson Process
- (a) Definition and Basic Properties of the Exponential Distribution
 - (b) Various Definitions of the Poisson Process and Its Relation to the Exponential Distribution
 - (c) Conditional Arrival Times of a Poisson Process and Other Properties
 - (d) Nonhomogeneous and Compound Poisson Processes
5. Continuous-Time Markov Chains
- (a) Definition and Basic Properties
 - (b) Kolmogorov Differential Equations
 - (c) Steady-State Results
6. Renewal Theory
- (a) Definition and Basic Properties
 - (b) Renewal-Type Equations
 - (c) Limiting Results and Some Applications
 - (d) Regenerative Processes — A Generalization
7. Markov Chains
- (a) Definition, Basic Properties, and Classification of States
 - (b) Connection to Renewal Theory
 - (c) Limiting Results
 - (d) Semi-Markov Processes (or Markov-Renewal Processes) — A Generalization