

ISE 620: Advanced Topics in Applied Stochastic Processes (3.0 units)

**Contact Information**

Instructor: Sheldon Ross

Office: OHE 310J

Number: (213) 821-1377

Office Hours: Tu, Th.: tbd or by appointment

Email: smross@usc.edu

TA: Zhengyu Zhang

TA Email: zhan892@usc.edu

TA Office hours: Monday 10:00am - 12:00 pm OHE 340A

**Textbooks**

Stochastic Processes, second ed., Sheldon Ross, Wiley, 1996 (required)

Introduction to Probability Models, eleventh ed., Sheldon Ross, Academic Press, 2014 (recommended)

**Course Coverage** Conditional Expectation, Poisson Process, Renewal Process, Discrete time Markov Chains

**Course Material**

- Review of Conditional Expectation
- Exponential Distributions and Poisson processes
- Renewal Processes
  - Strong law, Wald's equation, and Elementary Renewal theorem
  - Renewal reward, Alternating renewal, and Regenerative processes
  - Limiting Distributions
    - Equilibrium Distribution
    - Blackwell's theorem
    - Key renewal theorem
- Discrete Time Markov Chains
  - State classifications and Chapman-Kolmogorov Equations

Limiting Distributions via renewal theory

The reversed chain and time reversibility

Semi-Markov processes

- Applications to Queueing, Inventory, Reliability, Analysis of algorithms, Graphs, Markov chain monte carlo methods and others.

**Course Objectives** To familiarize the students with the concepts and ideas of stochastic processes, so as to be able to utilize and analyze stochastic models and systems.

### **Course Outcomes**

- An understanding of, and facility in utilizing, conditional expectations
- Knowledge of exponential random variables and the Poisson process
- Utilizing renewal theory results
- Applying Markov chain models

### **Grades Based on**

20 percent: Homeworks

30 percent Midterm

50 percent: Final exam

### **Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to your course instructor (or TA) as early in the semester as possible. DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Website and contact information for DSP (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX)

**Statement on Academic Integrity** USC seeks to maintain an optimal learning environment. General Principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work

from misuse by others as well as to avoid using others work as ones own. All students are expected to understand and abide by these principles. Scampus, The Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://usc.edu/dept/publications/SCAMPUS/gov/> Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review should there be any suspicion of academic dishonesty.

### **Emergency Preparedness/Course Continuity in a Crisis**

In case of emergency, when travel to campus is difficult, if not impossible, USC executive leadership will announce a digital way for instructors to teach students in their residence halls or homes using a combination of the Blackboard LMS (Learning Management System), teleconferencing, and other technologies. Instructors should be prepared to assign students a Plan B project that can be completed at a distance.