

40.520 Stochastic Models

Spring 2026

Course Description

Knowledge of modeling uncertainty is key towards analyzing engineering, service, financial, and other systems. The aim of this course is to acquaint students with the **basic tools for modeling stochastic phenomena which vary over time**. The course does NOT require knowledge of measure theory, but knowledge of elementary probability, statistics and multivariate calculus will be assumed. The following topics will be covered (not necessarily in the order provided below).

- Probability Review
- Discrete Time Markov Chains
- Poisson Processes
- Continuous Time Markov Chain
- Martingale Theory
- Brownian Motion* (depending on progress)
- Queueing Systems (as examples)

Class Timings and Venue

Mondays and Tuesdays 14:00 – 16:00 @ Think Tank 22 (Building 2, level 3, Room 2.311).

For some weeks, we may also meet during Wednesdays or Fridays 14:00 – 16:00 to discuss solutions to problem sets and schedule make-up classes for those missed due to public holidays or conference travels.

Instructor

Xiaotang Yang

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Office: 1.602.10

Office hours: by appointment

Prerequisites

To attend this class, one is expected to be familiar with undergraduate probability (at the level of Chapters 1 - 4 of Bertsekas and Tsitsikilis' class notes available at [this link](#)) and calculus.

Grade Distribution

Students whose credit requirements are satisfied by taking this course will be evaluated on the basis of the following components:

- HW Assignments – 20%
- Midterm Exam – 35%
- Final Exam – 35%
- Class Participation – 10%

Auditing students will be evaluated based on assignment submissions and class participation.

Assignment

- 5 - 6 assignments (one for each topic)
- Assignments must be uploaded to eDimension in PDF format. No late assignments are accepted.
- You may use AI tools or collaborate with at most two classmates on assignments. But you **must provide your own solutions** and must also provide the names of your collaborators. Acknowledge any references beyond the course materials.
- **Effort over Accuracy.** Your grade is based more on your demonstrated problem-solving process than on the final answer.
 - **Show Your Work:** To receive credit, you must clearly explain your reasoning, steps, and attempts.
 - **Full Credit is Possible** for a thorough and logical attempt, even if the solution is incorrect or incomplete.

Exam

- Exams are held **in person**.
- Midterm exam is on the Tuesday on week 6 on class time.
- Final exam is scheduled following University arrangement.
- Maximum one make-up exam per term. To maintain academic equity, the makeup exam will be a distinct assessment, designed to be more comprehensive and rigorous than the original.

Participation.

To earn full credit for participation, students must contribute meaningfully in at least 10 class sessions during the semester.

Academic Honesty Policy Summary

Students are responsible for the integrity of their submitted work; copying and allowing others to copy is strictly prohibited. Working with others or using AI tools is allowed, provided that each student writes their own solutions and acknowledges collaborators and any external sources next to the relevant problems.

Texts and References

- Ross, S. (1996), Stochastic Processes, Second edition, Wiley.
- Harchol, M. (2013), Performance Modeling and Design of Computer Systems: Queueing Theory in Action, Cambridge University Press.
- Berestycki, N. and Sousi, P. Applied Probability, Lecture notes ([link](#)).