

BUSI 573: Stochastic Models in Operations Management

Jones Graduate School of Business, Rice University
Spring 2026 Syllabus

Course Information

Instructor: Prof. Süleyman Kerimov, kerimov@rice.edu. McNair Hall 244

Office Hours: By appointment

Meeting Times: 4:30pm-7:30pm

Course Website: Canvas

Course Description

This course introduces students to stochastic models of manufacturing and service enterprises, for which uncertainty is a key aspect of performance. It focuses on the workflow optimization for operational competitiveness, capacity and revenue management, as well as the operations of online platforms, which play an increasingly important role in delivering services to customers.

Course Materials

There is no required textbook. I will pass out hard copies of book chapters and research papers when necessary. Some books that I will use throughout the semester are:

- Leonard Kleinrock. Queueing Systems. Vol. 1. Wiley, 1975.
- Sean Meyn and Richard Tweedie. Markov Chains and Stochastic Stability. 2nd ed. Cambridge University Press, 2009.
- Philippe Robert. Stochastic Networks and Queues. Vol. 52. Springer Science & Business Media, 2013.
- David A. Levin and Yuval Peres. Markov Chains and Mixing Times. Vol. 107. American Mathematical Soc., 2017.
- Sheldon M. Ross and Erol A. Peköz. A Second Course in Probability. Cambridge University Press, 2023.

Grading

- **Homework assignments (60%):** There will be 6 homework assignments, which will be posted on the course website. I will not accept any late submissions. Other than the course material, you cannot use other sources such as the internet (see Rice University Honor Code below). You can discuss homework problems with your fellows, but all the work and your submission must be individual.
- **Final (40%):** The final exam will be a 24 hour take-home exam.

Course Policies

- Students are expected to attend all classes and actively participate in class discussion. In case of absence, students are required to report the instructor in advance. Students are also expected to read the assigned papers throughout the semester.
- Any regrading request must be made within three days after grades are posted. Your request must include a detailed note about the objection. You should be aware that the entire assessment will be regraded.
- All submitted work must include the signed Honor Code pledge (see Rice University Honor Code below).
- Please be courteous and be in class promptly. Use of electronic devices (call, text, etc.) is not allowed in class. If you are using an electronic device (e.g., a tablet) to take notes, please let me know.

Academic Accommodations for Disability

If you have a documented disability or other condition that may affect academic performance, you should:

- Make sure this documentation is on file with the Disability Resource Center (Allen Center, Room 111, adarice@rice.edu, x5841) to determine the accommodations you need.
- Notify the instructor at the beginning of the term so we can discuss your accommodation needs.

Mental Health Statement

The wellbeing and mental health of students is important; if you are having trouble completing your coursework, please reach out to the Wellbeing and Counseling Center. Rice University provides cost-free mental health services through the Wellbeing and Counseling Center (<https://wellbeing.rice.edu>) to help you manage personal challenges that threaten your personal or academic well-being. If you believe you are experiencing unusual amounts of stress, sadness, or anxiety, the Student Wellbeing Office or the Rice Counseling Center may be able to assist you. The Wellbeing and Counseling Center is located in the Gibbs Wellness Center and can be reached at 713-348-3311 (available 24/7).

Honor Code

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

All submitted work must include the signed Honor Code pledge: "On my honor, I have neither given nor received any unauthorized aid on this (assignment, exam, etc.)."

Course Topics

The following (tentative) list includes the course topics that we will cover.

- Lecture 1: Limit theorems
Probability spaces, convergence theorems, law of large numbers
- Lecture 2: Stein's method (HW1 out)
Couplings, Poisson approximation, Stein's method for distributions
- Lecture 3: Martingales
Conditional expectation, stopping times, martingale convergence theorem
- Lecture 4: Probability inequalities (HW1 due, HW2 out)
Bounds on expectations and tail probabilities
- Lecture 5: Markov chains
Classification of states, limiting probabilities, time reversibility
- Lecture 6: Renewal and regenerative processes (HW2 due, HW3 out)
Limit theorems of renewal theory, renewal reward processes, the inspection paradox
- Lecture 7: Queueing theory I
Poisson process, exponential models
- Lecture 8: Queueing theory II (HW3 due, HW4 out)
Variations of $M/G/1$, multiserver queues
- Lecture 9: Foster-Lyapunov techniques
Lyapunov functions, bounding stationary expectations
- Lecture 10: Dynamic matching (HW4 due, HW5 out)
Matching queues, dynamic control
- Lecture 11: Online resource allocation
Secretary problems, prophet inequalities
- Lecture 12: Revenue management (HW5 due, HW6 out)
Capacity control, customer choice models
- Lecture 13: Mean field theory
Density dependent Markov chains, Kurtz's theorem, the supermarket model
- Lecture 14: Market design (HW6 due)
Bayesian equilibrium, auctions