IND E 508 Stochastic Processes
Syllabus

Course Information

- IND E 508 Stochastic Processes
- 3 Credits
- Spring 2026
- **Time: TTh 10:00-11:20am**
- **Location: IEB 205**
- Instructor: Dan Li, dli27@uw.edu
- Office Hour: By appointment

Course Content

Course overview: This course introduces stochastic-process models and analytical tools used to study uncertainty in engineering systems. The course begins with a concise review of probability concepts needed for stochastic-process analysis, then develops discrete-time stochastic models with emphasis on Markov chains and renewal processes. The course will also briefly cover continuous-time Markov chains and Poisson processes, depending on the progress.

Learning objectives: By the end of the course, students should be able to

- Formulate stochastic models for engineering systems evolving over time under uncertainty.
- Analyze discrete-time Markov chains, including transition behavior, communication structure, recurrence, transience, and limiting behavior.
- Characterize stationary and long-run behavior of stochastic systems.
- Analyze renewal processes and apply them to real-world problems.
- Communicate stochastic-model assumptions, derivations, and conclusions clearly and effectively.

Course materials: Lecture notes and supporting materials will be posted on Canvas. There is no single required textbook, but the following references are useful.

- Sidney I. Resnick. 1992. Adventures in Stochastic Processes. Birkhauser.
- Sheldon M. Ross. Introduction to Probability Models. Academic Press.
- Rick Durrett. Probability: Theory and Examples. Cambridge University Press.
- Additional instructor notes and selected reference materials distributed through Canvas.

- Prerequisite: E E 505 (Probability and Random Processes) or equivalent.

Grading

- Assignment weight/point distribution:

  Homework: 30%
  Midterm Exam: 30% (cumulative)
  Final Exam: 30% (cumulative)
  Participation: 10% (based on in-class activities)

- Credit scores (4.0 scale) will be given in 0.2 increments.
- Minimum credit scores: 4.0 for 95+, 3.8 for 90+, 3.6 for 85+, 3.4 for 80+

Tentative Course Schedule

Week	Class Topic
1	Probability theory: stochastic processes, convolution, and generating functions
2	Probability theory: branching processes, continuity theorem, and random walk
3	Discrete-time Markov chains: definitions, examples, and state space decomposition
4	Discrete-time Markov chains: first-step analysis, periodicity, and solidarity properties
5	Discrete-time Markov chains: absorption probabilities and additional state space structure
6	Discrete-time Markov chains: stationary distributions and limiting distributions
7	**Midterm Exam (May 12th)**; Renewal theory: convolution, Laplace transforms, and renewal functions
8	Renewal theory: renewal reward processes and renewal equations
9	Renewal theory: direct Riemann integrability, regenerative processes, and related applications
10	Optional topics: Poisson processes and continuous-time Markov chains
Final	**Final Exam (June 8th , 10:30AM-12:20PM, IEB 205)**

Course Policies

During Class

- The lecture notes and supporting materials will be made available before each class. However, the lecture notes may be updated after class; therefore, always check Canvas for the latest version.
- You are expected to participate actively in the class. Questions are highly encouraged.
- You have a responsibility to help create a classroom environment where all may learn. This means that you will treat other members of the class with courtesy.

AI Policy

- You are encouraged to use AI tools to support learning (e.g., understanding concepts, debugging, or exploring alternatives), but AI may not be used for homework and exam.

Assignments, Participation and Exam

- Homework assignments must be finished individually.
- You may discuss homework with your classmates, but your submission must be your own.
- Late assignment submissions are not accepted at any circumstances. Your lowest assignment grade will be dropped.
- Participation will be graded based on in-class activities, including pop-up quizzes (graded) and in-class examples (completion-based).
- The midterm exam will take place in class, on May 12th, from 10:00-11:20am. You may bring a single cheat sheet (letter size, double-sided) and a calculator.
- The final exam will take place in the final exam week, on June 8th from 10:30 am -12:20 pm. You may bring two cheat sheets (letter size, double-sided) and a calculator.

Religious Accommodations:

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)."

Accommodations & Access:

If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between the student, instructor, and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Academic Integrity:

Engineering is a profession demanding a high level of personal honesty, integrity and responsibility. Therefore, it is essential that engineering students, in fulfillment of their academic requirements and in preparation to enter the engineering profession, adhere to the College of Engineering Statement of Principles.

For the homework assignments, you are encouraged to discuss the problems with your classmates, but your submissions must clearly reflect your own, original work. For the exam, "collaboration" with your classmates is not allowed.

Any student in this course suspected of academic misconduct (e.g., cheating, plagiarism, or falsification) will be reported to the College of Engineering Dean's Office and the University's Office

of Community Standards and Student Conduct to initiate the student conduct process. *Any student found to have committed academic misconduct may receive a zero for their grade on the impacted academic work (e.g., assignments, exams, etc.), and academic consequences, with the possibility of expulsion.* If the student is found not responsible, the student will receive a grade based on the standard grading criteria for that assignment or exam.

Title IX:

UW, through numerous policies, prohibits sex- and gender-based violence and harassment, and we expect students, faculty, and staff to act professionally and respectfully in all work, learning, and research environments. For support, resources, and reporting options related to sex- and gender-based violence or harassment, visit UW Title IX's webpage (https://www.washington.edu/titleix/), specifically the Know Your Rights & Resources guide (https://www.washington.edu/titleix/files/2020/08/KYRR-guide-8-10-2020-LINKED.pdf).

If you choose to disclose information to me about sex- or gender-based violence or harassment, I will connect you (or the person who experienced the conduct) with resources and individuals who can best provide support and options. You can also access those resources directly:

- Confidential: Confidential advocates (https://www.washington.edu/sexualassault/support/advocacy/) will not share information with others unless given express permission by the person who has experienced the harm or when required by law.
- Private and/or anonymous: SafeCampus (https://www.washington.edu/safecampus/) provides consultation and support and can connect you with additional resources if you want them. You can contact SafeCampus anonymously or share limited information when you call.

Please note that some senior leaders and other specified employees have been identified as "Officials Required to Report." (https://www.washington.edu/titleix/title-ix-officials-required-to-report/) If an Official Required to Report learns of possible sex- or gender-based violence or harassment, they are required to call SafeCampus and report all the details they have in order to ensure that the person who experienced harm is offered support and reporting options (https://www.washington.edu/titleix/resources/).

Land Acknowledgement:

The University of Washington acknowledges the Coast Salish peoples of this land, the land which touches the shared waters of all tribes and bands within the Suquamish, Tulalip and Muckleshoot nations."