

COURSE DESCRIPTION
CS481/IE410 STOCHASTIC PROCESSES AND THEIR APPLICATIONS
Fall 2016 MW 3PM-3:50PM, MW 4PM-4:50PM 1310 DCL

Instructor: Sheldon H. Jacobson, Siebel Center 3224
Office Hours: Monday After class until 520PM
Teaching Assistants (TAs): Seibel Center 1123: Arash Khatibi (khatibi2), Ge Yu (geyu3), Hee Youn Kwon (hkwon14)
Office Hours: Khatibi (W, 11-1150), Yu (T, 1-150PM), Kwon (F, 10-1050).
Text: "Introduction to Probability Models" by Sheldon M. Ross (just about any edition)
Power Point Slides: Available at <http://compass2g.illinois.edu>

Course Objective: This course is an introduction to and survey of stochastic models, with applications to systems found in a variety of engineering and computer systems. Student should complete this course with the ability to identify problems that can be addressed using stochastic models, as well as to use such models to solve and gain insights into such problems.

Prerequisites: A working knowledge of any computer programming language (e.g., C, C++, C Sharp).
Introduction to Probability and Statistics, or equivalent (IE300: Analysis of Data)
Introduction to Operations Research, or equivalent (IE310: Operations Research)
NOTE: You must have the prerequisites (or equivalent, for graduate students) to take the course.
If you earned a B in any of these courses, you will need to thoroughly review the material in these courses, since all the material in these courses will be assumed to be known.
If you earned a C or lower in any of these courses, you may find this course extremely challenging.

IE Undergraduates: The ISE department has created IE370 or IE397 (Stochastic Processes and its Applications) that is a more basic version of this course. It will be offered in the upcoming spring semester and will satisfy the IE410 requirement for your program of study. The topics covered are similar; the primary difference is the level of depth covered.

General Topics: Review of Probability, Conditional Probability
Poisson Processes and the Exponential Distribution
Discrete Time Markov Chains, Continuous Time Markov Chains, and Birth and Death Processes

Grading: Assignments: Assignments are weighted 15%. Assignment questions for the entire semester are posted on COMPASS. Assignment problems will improve your understanding of the course material. You are encouraged to work on these assignment questions in small groups. Solutions to the assignments will be presented during problem sessions, or will be posted on COMPASS. To get credit for each chapter assignment, send an email message to ie410.cs481@gmail.com during the designated time periods (must be received between 3PM CT on the first day and ending at 259PM CT on the last day); late assignments cannot be accepted, under any circumstances and for any reason. The time windows are: 8/29-9/8 (Chapter 1), 9/10-9/17 (Chapter 2), 9/20-10/1 (Chapter 3), 10/13-24 (Chapter 4), 10/25-11/4 (Chapter 5), and 11/8-12/8 (Chapter 6) These dates may change, based on the flow of the lectures; any such changes will be posted on COMPASS. Otherwise, assume these date. To be fair to all the students in the class, there will be no exception to missing the cutoff date and time for assignment credit, under any circumstances. This includes health, family, or personal issues, forgetting to send the message, a power outage, a weather event, a national disaster (natural or man-made), or any other reason. Students do so at their own risk when waiting until the last minute to send their message.

Exams: There will be two exams (first exam will be 12 October). Your lower score will be weighted 37% and your higher score will be weighted 48%; no makeup exams are given. If you feel that you deserve additional credit on your exam, write an explanation where and why you deserve more points, how many additional points you deserve, and return the explanation, with your exam, to my or one of the TAs within 72 hours of when the exam is first handed back in class. Note that if you hand your exam back to be regraded, the entire exam will be regraded, including the questions that you specifically asked to be regraded. All exams are closed books/notes. If you miss an exam, for any reason (personal, family, scheduling, ...), this missed exam will be assigned a zero and weighted 37% towards your final grade.

Final Grades: Final grades are determined based on a curve (one for undergraduates, one for graduates). However, you must attain a final total score of 50% or above to receive a passing grade.

Classes Times: The classes will typically run for up to 100 minutes, twice per week. Problem sessions may be held after the regular lectures or as a stand-alone class during the regular lecture time.

Graduate students (4 credits) versus undergraduate students (3 credits): Graduate student will have additional questions on their exams.

BONUS POINTS: There may be classes during the semester for which you will receive bonus points added to your final grade. You must be in attendance to receive this bonus; to be fair to all the students in the class, no excuses, under any circumstances, can be accepted. There will also be other classes and opportunities to earn bonus points, which will be announced on the designated class days during the lecture. You must be present to earn such points; no excuses, under any circumstances, can be accepted.

COURSE DESCRIPTION
CS481/IE410 STOCHASTIC PROCESSES AND THEIR APPLICATIONS
Fall 2016 MW 3PM-3:50PM, MW 4PM-4:50PM 1310 DCL

Class Participation: Participating in class discussions, asking questions, and answering questions posed during lectures are all important parts of the learning process. Learning is a two-way exchange of information. I will frequently ask questions during the lectures, so it is in your best interest to come to class prepared. I also have been known to give out bonus points when questions are asked or answered in class.

Class Attendance: You are not required to attend lectures. Experience has shown that students who attend class also perform better in the course. Also, announcements for exam dates, changes in assignment due dates, and all other course information will only be made in class or during office hours. You are responsible for obtaining all such information.

Cell Phones: As a courtesy to others, please put your cell phone in silence mode off during all classes. Also, cell phones should not be brought to exams, to limit disruptions that affect other students.

General Comments:

- My lectures may not always match the book and its presentation. There are a number of concepts covered in the book that I will not cover, and vice versa. Therefore, although you are not required to attend the lectures (i.e., no attendance is taken), it is in your best interest to attend, since you will be responsible for all the material covered in the lectures.
- If you are having problems with the course, come and discuss the situation with me as soon as possible. It is typically very difficult to find a solution in mid-November, while feasible plans of attack can be identified in mid-September.
- The work you hand in on your exams will be your own.
- A review session will be held before each exam, which will provide an overview of the material that you will be tested on, as well as give you an opportunity to see the types of questions you can expect on the exam.
- The best way to prepare for exams is to work a large number of problems, including the problems assigned for your assignments, and to understand the material being presented in the lectures (in particular, listen to what I emphasize). I encourage you to work extra problems in the book that I have not assigned, since the only way to truly understand the material is by working problems. Working only the problems assigned will not be sufficient for you to gain an understanding of the material presented in the course.
- If the pace of a lecture is too fast / slow, let me know. I am not always aware of it, no matter how obvious it may be to you.
- Probability is an area where you may understand the course material well, yet not be able to solve problems very easily. Solving problems requires a great deal of practice. Your assignments provide you with some of this practice. However, you should also attempt to solve problems not assigned. Working problems out of any probability/stochastic processes book in the library is encouraged. Use my / the teaching assistants' office hours to get help with those problems that you have difficulty.
- Any students with special needs or circumstances should feel free to meet with me during office hours.
- Safety is everyone's concern. Please visit <http://police.illinois.edu/emergencyplanning/general/>
- Some of the material presented will be rather abstract. However, most of it also has real practical value. If I forget to mention it, ask where or how the material can be applied.

TOPICS TO BE COVERED

Course Outline: Chapters 1-6 of text (in whole or part)

Introduction to Probability (2 weeks)

Sample Spaces, Events, Probability and Conditional Probability
Independence and Bayes Formula

Random Variables (2 weeks)

Discrete and Continuous, Expectation and Variance
Jointly Distributed Random Variables
Moment Generating Functions, Limit Theorems

Conditional Probability and Conditional Expectation (1 week)

Discrete and Continuous
Computing Expectations and Probabilities by Conditioning

Discrete Time Markov Chains (2.5 weeks)

Introduction and Definitions
Chapman Kolmogorov Equations
Classification of States and Limiting Probabilities
Branching Processes and Markov Decision Processes

The Exponential Distribution and Poisson Processes (2.5 weeks)

Exponential Distribution
Poisson Processes and Generalizations of Poisson Processes

Continuous Time Markov Chains (3 weeks)

Introduction and Definitions
Birth and Death Processes, Queueing models, Chapman Kolmogorov Differential Equations, Limiting Probabilities