Syllabus: Introduction to Probability Modeling,  
36-410 (Spring 2016)

1 Course Overview

Stochastic processes are ways of quantifying the dynamic relationships of sequences of random events. Stochastic models play an important role in elucidating many areas of the natural, managerial, and engineering sciences. They can be used to analyze the variability inherent in biological and medical processes, to deal with uncertainties affecting managerial decisions, and with the complexities of psychological and social interactions, and to provide new perspectives, methodology, models and intuition to aid in other mathematical and statistical studies.

This course is intended as an introduction to stochastic models for students familiar with elementary probability. Our aim is to bridge the gap between a first course in mathematical probability and an intermediate level course in stochastic processes.

2 Learning Objectives

• To introduce the standard concepts and methods of stochastic modeling.

• To illustrate the rich diversity of applications of stochastic processes.

• To provide exercises in the application of simple stochastic analysis to appropriate problems.

Students will develop a higher level of mathematical formality than is usually required in introductory probability and statistics courses. Emphasis will be placed on clear, rigorous arguments in homework and exam solutions.

3 Course mechanics

1. Course information: Course information will be posted on Blackboard, as well as on the course webpage. www.stat.cmu.edu/~siva/410/main.html

2. Prerequisites: 21-325 or 36-217 or 36-225 or 36-625


4. Lectures: Tuesdays and Thursdays, 12:00 to 1:20, Location: BH A53.

5. Instructor: Siva Balakrishnan, siva@stat.cmu.edu, Office: BH 132K.

6. Instructor Office Hour: Thursdays 1:30 - 2:30 PM, Location BH 132K.

7. TAs: YJ Choe: yjchoe@cmu.edu, Jining Qin: jiningq@stat.cmu.edu
8. **TA Office Hours:** Jining: Friday 2:30 - 3:30 PM, Location BH 132M. YJ: Monday 3 - 4 PM, Location BH 132M.

9. **Homework:** There will be roughly ten homework assignments, due on Tuesdays in lecture. If you do not turn in the assignment before lecture, you **must** turn it in electronically, i.e. you must send us (both TAs and me) a pdf file via Blackboard.

Assignments submitted electronically before 10:00 AM on the day after the due date will be accepted without penalty. Assignments turned in after 10:00 AM the day after the due date, but before 10:00 AM two days after the due date will incur a 20% penalty. Solutions will be posted at this time, and hence there will be no further extensions. Assignments and solutions will be posted on Blackboard, and on the website. The assignments will be posted at least a week before the due date.

You are allowed, and even encouraged, to discuss the assignments with other students in the course, but the work that you hand in must be your own. This means that each student must perform all of the work and write up the results independently.

For questions where the assignment states that partial credit is not possible, you only need provide the correct answer to receive full credit. For all other questions (where partial credit is possible), your writeup of the homework should show fully how you arrived at your final answer. When you are writing up an answer you should ask yourself: “If I had made a small error in the derivation/calculation, could the grader identify that error, and still recognize that I understand the approach to solving the problem?” If your answer to that question is “No,” then you are not providing sufficient detail.

Each homework assignment will receive equal weight. The homework assignment on which you have the lowest percentage score will be dropped. This policy exists to handle extreme circumstances which might make it difficult to submit every assignment on time. Please staple your assignment if you are handing it in before lecture.

10. **Exams:** There will be two exams during the semester, and then a cumulative final exam. Check the course calendar for the dates. The final exam could be as early as May 2 and as late as May 10. Please do not schedule travel until the date of the exam is finalized.

11. **Mid-semester Grades:** Mid-semester grades will be based on the first midterm (60%) and the first six homework assignments (40%). Letter grades will be assigned based on the usual scale: 90% and up is an A, 80% to 90% is a B, etc. At the risk of stating the obvious, receiving a mid-semester grade of “A” is no assurance of a final grade of “A.”

12. **Final Letter Grades:** The final grades will be 60% based on your exam scores, 40% on your homework scores. Letter grades will be assigned based on the usual scale: 90% and up is an A, 80% to 90% is a B, etc. I might adjust this scale in your favor if needed.

13. **Academic Integrity:** The course will be run in strict adherence to Carnegie Mellon’s policies on cheating/plagiarism (see https://www.cmu.edu/academic-integrity/cheating/index.html).

14. **Physically Disabled and Learning Disabled Students:** The Office of Equal Opportunity Services provides support services for both physically disabled and learning disabled students. For individualized academic adjustment based on a documented
disability, contact Equal Opportunity Services at eos@andrew.cmu.edu or (412) 268-2012. Also, please come and talk to me early on in the semester.

15. **Calendar:** A course calendar will be maintained. The dates of the exams and the due dates for the homeworks will not change. Otherwise, this calendar should be viewed as a rough guide showing the order in which I plan to cover material; the exact distribution of time over these topics will almost certainly change.

16. **MATLAB:** We will use MATLAB to perform some calculations and simulations during the course. It is especially useful for working with the matrices associated with Markov chains.

    Some of the later assignments will involve coding. We will assume that you are at least somewhat familiar with one of Python, R or MATLAB. If not, please email/talk to me early on in the semester. You can download a copy of MATLAB for your Mac or PC https://www.cmu.edu/computing/software/all/matlab/index.html, or you can find it on any computer in the clusters on campus.

17. **Discussion Board:** We will utilize the discussion board feature on Blackboard in order to answer questions. Blackboard allows you to “subscribe” to a discussion forum. If you do so, you will receive an email each time a post is made to the forum. Do not post solutions to HW questions on the forum.

    If you send me a question on the homework via email, I may post it to the discussion forum if I think it will be of use to the entire course. In general, we would prefer if you posted directly to the appropriate forum.

18. **Returning Graded Work:** If you sign and return the waiver below, you can pick up your homework from an envelope that will be passed at the start of each lecture. If you do not sign the waiver, you can pick up your homework from me during office hours.

19. **Other Policies:**

    • I assume that you read your Andrew email at least once a day. I will send a test email in the first week of the semester. Please let me know immediately if you do not receive it.

    • I assume that you check your homework scores on Blackboard regularly. Please do not come the last week of classes and tell me that we have lost every one your assignments. (It happens every semester.)

    • We will be helpful (in-person, via email or on the discussion board) with questions on homework. Still, you should not expect responses to questions such as “How do you do question 1 on the homework?”

    Also, you should realize that questions submitted a few hours before the homework deadline may not receive a response.

    • My plan is to use the document camera as the primary means of delivering the lectures.

    • I will post on Blackboard the notes I create during lecture but this shouldn’t be a reason to skip lecture. If the attendance drops then I may choose assign a portion of your final grade to class participation.
Homework Release Statement

“I hereby authorize Professor Balakrishnan to distribute my graded assignments via a large envelope which will be passed around the room and then left on a table. In so doing, I recognize that such graded assignments are not perfectly secure, and I accept the potential that this may allow access to these documents by others.”

Signature:

Please Print Name: