

# Syllabus: Introduction to Probability Modeling, 36-410 (Spring 2018)

## 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 Canvas or at the following course website: <http://www.stat.cmu.edu/~siva/410/main.html>
2. **Prerequisites:** 21-325 or 36-217 or 36-225 or 36-625
3. **Textbook:** Introduction to Probability Models by Ross, Eleventh Edition, Academic Press.
4. **Piazza:** We will use Piazza for all questions. Please sign up at the following URL: <https://piazza.com/cmu/spring2018/36410/home>
5. **Lectures:** Tuesdays and Thursdays, 12:00 to 1:20, Location: BH A53.
6. **Instructor:** Siva Balakrishnan, [siva@stat.cmu.edu](mailto:siva@stat.cmu.edu), Office: BH 132K.
7. **Instructor Office Hour:** Tuesdays 1:30 - 2:30 PM, Location BH 132K.

8. **TAs:** Ilmun Kim: ilmunk@andrew.cmu.edu, Boyan Duan: boyand@andrew.cmu.edu
9. **TA Office Hours:** Ilmun Kim: Thursday 9.30 - 10.30 AM, Location WH 4625. Boyan Duan: Wednesday 10 - 11:00 AM, Location BH232K.
10. **Homework:** There will be roughly ten homework assignments, due on Fridays at 3pm. There is a box outside BH132 with my name and the course name on it. You should submit your HWs there. Do not submit late HW in the box. You can also submit a clearly scanned copy of the HW through Canvas.

**Late HW:** You will be allowed 3 total late days without penalty for the entire semester. For instance, you may be late by 1 day on three different homeworks or late by 3 days on one homework. Once those days are used, you will receive **no credit** for the homework.

When you use late days you have to follow this procedure:

- (a) Submit a scanned copy through Canvas.
- (b) Visit the website:

[https://docs.google.com/forms/d/1RJoK-jmMBgQwrTwyex8WILSxWk\\_jGfoXuZ2LiUqCHKg](https://docs.google.com/forms/d/1RJoK-jmMBgQwrTwyex8WILSxWk_jGfoXuZ2LiUqCHKg)

and complete the form. It will send you a confirmation email, save this email with you for your records.

- (c) As far as possible, please do not email me or the TAs about late HW.

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.

11. **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 7 and as late as May 14. Please do not schedule travel until the date of the exam is finalized.
12. **Mid-semester Grades:** Mid-semester grades will be based on the first midterm (75%), the first six homework assignments (25%). If attendance drops or if I find it otherwise beneficial we might have a small number of in-class quizzes. If we do have in-class

quizzes we will appropriately adjust the exam and homework weights to accommodate these in-class quizzes.

By default, letter grades will be assigned according to the usual scale: A for 90% and higher, B for 80% up to 90%, and so forth. These thresholds might be adjusted at the instructor's discretion *in your favor*. At the risk of stating the obvious, receiving a mid-semester grade of "A" is no assurance of a final grade of "A."

13. **Final Letter Grades:** The final grades will be 75% based on your exam scores, 25% 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. These thresholds might be adjusted at the instructor's discretion *in your favor*.
14. **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>).
15. **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](mailto:eos@andrew.cmu.edu) or (412) 268-2012. Also, please come and talk to me early on in the semester.
16. **Calendar:** A course calendar will be maintained. The dates of the exams and the due dates for the home- works 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.
17. **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.

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 and check Piazza regularly. For instance, if there are corrections on the HW they will be posted on Piazza.
- I assume that you check your homework scores on Canvas 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 Piazza) 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.

- I will post notes on my website or on Canvas.