EE 503: Probability for Electrical and Computer Engineers
Spring 2020

Lecture Time & Venue: MW 2PM-3:50PM, ZHS 352

Discussion Section: Friday 1-1:50PM, GFS 116

Office Hours: MW, 1-2pm

Course page: http://www-bcf.usc.edu/~rahuljai/Teaching.html

Instructor: Prof. Rahul Jain, EEB 316, rahul.jain@usc.edu

TAs:

Prerequisites: Calculus, linear algebra (EE 441)

Course Description: This course covers mathematical and probabilistic descriptions of unpredictable or random phenomena, with applications to many engineering problems. Probabilistic tools are among the most useful for modeling real systems and analyzing system performance. The course provides a solid background in probability theory and related topics for graduate students in electrical and computer engineering (ECE), financial engineering, and other engineering majors. The course includes material from first principles in a more rigorous manner than is typically found in undergraduate probability classes in engineering.

We will make use of Blackboard for posting homework, solutions, etc. and a Piazza page for all other interactive discussion.

Intended Audience:
The course is primarily intended for MS and PhD Students in Communications, Controls, Networks and Signal Processing Areas of Electrical Engineering. It should also be of interest to students in Industrial and Systems Engineering and Computer Science.

Suggested Texts:
Primary:

(i) *Introduction to Probability models, 10th ed., by S. Ross, Academic Press, 2010.*
(ii) *Probability, Statistics and Random Processes for Electrical Engineers, 3rd ed.*, by Alberto Leon-Garcia, Person Prentice-Hall, 2008.

Supplementary:
(i) *Discrete Stochastic Processes,* Robert Gallagher, Cambridge, 2013.
(ii) *Probability and Random Processes for Electrical and Computer Engineers* by J. Gubner, Cambridge University Press, 2006
(iii) *Essentials of Stochastic Processes* by R. Durrett, Springer, 1999.
(iv) *Probability and Random Processes,* 3rd edition, by Grimmett & Stirzaker, OUP, 2001

Grading:

1. *Home Works 24%*
2. *Quizzes: 16%*
3. *Mid-Term Exam: 20%*

4. *Final Exam: 40%*

There may be Pop-up Quizzes from time to time. Average score of two Pop-up Quizzes may be used to substitute for one Homework grade.

Exam Dates:
Quizzes:
Quizzes (4): Last lecture of every month.
Midterm EXAM (1): During the first lecture after Spring break
Final EXAM: As per University Calendar

TOPICS:

1. *Overview of Probability:* Sample spaces, Set algebra, Probability axioms, conditional probability, independence, Bayes' rule

2. *Random Variables:* Discrete RVs, examples, Continuous RVs, examples, expectation, Jointly distributed RVs, moment generating functions

3. *Conditional Probability and Expectation:* Conditional probability for discrete and continuous RVs, Computing expectation, applications

4. *The Poisson Process:* Exponential distribution and properties; Definition of counting processes, Conditional distribution of the arrival times

5. *Discrete-time Markov Chains:* Examples in Communication Systems, Chapman-Kolmogorov equations, Stationary distribution, examples

6. *Sums of Random Variables, and Long-Term Averages:* Laws of Large Numbers, Central Limit Theorem, Convergence of Sequence of Random Variables

7. **Statistics:* Parameter Estimation, Confidence Intervals, Hypothesis Testing.

How to Study for this Course. Probability can be a difficult topic for most people. It takes time to absorb it. Don't miss any lectures. If you have to, try to make up for it as soon as you can. Attend all discussion sections. Start working on the homework 4-5 days in advance. If you have any difficulties, post on Piazza for help. If you need further help, go to the TA's or the Instructor's office hours. Once the homework solutions have been posted, go through them to understand if there is any thing you did incorrectly, or missed. If you don't understand any part of the solution, go to the TA's office hours.

Statement on Academic Integrity:
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section

11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Statement regarding Plagiarism/Copying:
Plagiarism or copying of home-works is strictly forbidden, and will result in penalties. Repeat plagiarism/copying by a student will be reported to Student Judicial Affairs and Community Standards for possible probation.

Specifically, all the homeworks/exams must be written by students, individually. No part of the homework should be copied from any other document including the solutions from books, other student's homework, etc.

Make sure to review the "Behavior Violating University Standards and Appropriate Sanctions" section of the SCampus Student Guidebook.
http://web-app.usc.edu/scampus/1100-behavior-violating-university-standards-and-appropriate-sanctions/

Statement for Students with Disabilities:
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.