

**Department of Electrical Engineering
University of Southern California**

EE 503 — Probability for Electrical and Computer Engineers

Fall 2017

Instructor: Urbashi Mitra, Professor
540 EEB, 213 740 4667, ubli@usc.edu

TA: TBA office hours: TBA.

Course Web Page: Blackboard blackboard.usc.edu
Contains homework, solutions, and relevant handouts. Course announcements, homework hints and modifications will be posted on this page – please check it regularly.

Lectures: MW 10:00–11:50, TTH 119

Discussion: Th 3:00pm–3:50pm, VKC 150

Course Objectives: To provide a fundamental understanding of concepts and techniques of random variables. The emphasis will be on developing the analysis and design tools needed to apply probability and random variables in graduate electrical engineering courses and research.

Prerequisites: Multivariable calculus (Math 445 or equivalent), undergraduate linear algebra (EE 141 or equivalent) and very basic matrix theory, undergraduate linear system theory (EE 301 or equivalent).

Other Requirements: Basic computer skills (*i.e.* programming and plotting). While not required to know Matlab specifically, several homework problems will be stated in the context of Matlab and associated solutions will be in Matlab.

Text: 1. Probability, Statistics, and Random Processes For Electrical Engineering, 3rd ed., by Alberto Leon-Garcia, Addison-Wesley Publishing Co., Reading MA, 2008; ISBN-10: 0131471228.

References: 1. Introduction to Probability, 2nd edition, by Dimitri P. Bertsekas and John N. Tsitsiklis. Athena Scientific, 2008.
2. Probability and Random Processes for Electrical and Computer Engineers, by J. A. Gubner, Cambridge University Press, 2006.
3. Probability, Random Variables and Stochastic Processes, 4th ed., Athanasios Papoulis and S. Unnikrishna Pillai, McGraw-Hill, 2002, or the previous third edition of the same book by A. Papoulis as a single author.
4. Schaum's Outline of Probability, Random Variables, and Random Processes, Hwei Hsu, McGraw-Hill, 1996.
5. Probability, Random Processes, and Estimation Theory for Engineers, 2nd ed., H. Stark and J. Woods, Prentice-Hall, 1994.
6. Probability and Random Processes, Y. Viniotis, McGraw-Hill 1997.

Grading: (tentative) 20% Homework
25% Midterm 1 (2.0 hours)
25% Midterm 2 (2.0 hours)
30% Final (2.0 hours)
Final grades will be assigned by a combination of student score distribution (curve) and the discretion of the instructor.

Exams: **Midterm 1** (tentative) Wednesday, October 4, 2017 10:00am – 11:50am
Midterm 2 (tentative) Wednesday, November 8, 2017 10:00am – 11:50am
Final (fixed) Monday, December 11, 2017 8:00am–10:00am

Office Hours: TBA.

Use of email to set up appointments encouraged: ubli@usc.edu. Attending office hours in person is encouraged.

Late Policy: No late homework will be accepted. A late assignment results in a zero grade. In the final assessment, the lowest homework score will not be considered.

Make-up Material: Homework assignment dates are non-negotiable. No make-up exams will be given. In the case of a required business trip or a medical emergency, a signed letter from your manager or doctor is required. This letter must include the telephone number of your doctor or supervisor.

Grade Adjustment: If you dispute any scoring of a problem on an exam or homework set, you have **one week** from the date that the graded paper is returned to request a change in the grade. After this time, no further alterations will be considered. All requests for a change in grade must be submitted in writing to me.

Attendance: Lecture attendance is encouraged; many examples and applications not in the text will be covered in the lectures; related problems may appear on the exams. The student is responsible for all assignments, changes of assignments, announcements, lecture notes *etc.* All such changes should be posted on the course web-site.

Academic Conduct: Plagiarism presenting someone else's ideas as your own, either verbatim or recast in your own words is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>. Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity <http://equity.usc.edu/> or to the Department of Public Safety <http://capsnet.usc.edu/department/departement-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community such as a friend, classmate, advisor, or faculty member can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Students with Disabilities: A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information <http://emergency.usc.edu/will> provides safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

- Outline:**
1. Algebra of events - set theory
 2. Sample, event spaces
 3. Combinatorics
 4. Probability as a measure in sample space
 5. Conditional probability and sample spaces
 6. Independence of events
 7. Probability mass and densities
 8. Random variables
 9. Expectations and moments of random variables
 10. Named densities and distributions
 11. Discrete and continuous transforms
 12. Frequently occurring densities
 13. Poisson, Bernoulli, Markov processes
 14. Gaussian, Poisson distributions
 15. Gaussian random vectors, principal component analysis and whitening
 16. Functions of random variables
 17. Limit theorems and convergence
 18. Estimation
 19. Introduction to statistics, confidence intervals

- Suggestions:**
1. Remember the big picture.
 2. Read the book and supplementary sources.
 3. Prepare your own summaries from texts and notes.
 4. Work as many extra problems as you can.