



**EE 503 Probability for Electrical and
Computer Engineers**

Units: 4
Fall 2018

Lectures: Tue-Thu 5:00-6:50 pm
Location: THH 212

Discussion: Fri 3:00-3:50 pm
Location: GFS 101

Instructor: Todd Brun

Office: EEB 502

Office Hours: Mon 2-4 pm, Thu 2-4 pm

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TA: Krishna Kalagarla

Office: EEB 332

Office Hours: Fri 4-6 pm

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TA: Yixian Zhu

Office: KAP 211

Office Hours: Tue 2-4 pm

Contact Info: Email: yixian@usc.edu.

Course Description

Probabilistic tools are widely used to model real systems and do performance analysis throughout the fields of Electrical and Computer Engineering. This course provides a solid mathematical basis of probability theory and related topics for graduate students in Electrical and Computer Engineering, and prepares them for the numerous Electrical and Computer engineering classes that require a strong understanding of probability. The course covers the material from first principles in a more rigorous manner than is typically found in undergraduate probability classes in Engineering.

Learning Objectives

Students who take this class will obtain a deep grounding in probability theory that will serve both as a basis for more advanced topics in future courses and for applications to problems in engineering. Major topics covered include (but are not limited to) sets, sigma-algebras and the axiomatic approach to probability; combinatorics and counting; discrete and continuous random variables, expectation and moments; functions of multiple random variables, covariance and correlation; the Bayes rule, conditional probability and expectation; limit theorems; discrete- and continuous-time Markov chains, and random walks.

Recommended Preparation: Previous familiarity with probability theory is very helpful; calculus, linear algebra, and matrices at the undergraduate level.

Textbook and Other Readings

Required: Alberto Leon-Garcia, *Probability, Statistics, and Random Processes for Electrical Engineering*, 3rd Edition, Pearson Prentice Hall, 2008.

Recommended: John A. Gubner, *Probability and Random Processes for Electrical and Computer Engineers*, Cambridge University Press, 2006.

Other handouts and notes may be provided from time to time; these will be posted on the Blackboard site for the class.

Description and Assessment of Assignments

Problem sets will be assigned approximately weekly. These will include both exercises from the textbook and additional problems. The homework assignments will be posted on the Blackboard site and handed in in class, to be graded and returned approximately one week later. Late assignments will not be accepted except with a medical excuse. There will be two midterm exams (given in class) and one final exam. The exams will be open book/open notes.

Midterm Exam Dates: Exam 1: Thu 27 Sep 2018. Exam 2: Thu 1 Nov 2018. Both exams take place during the usual class period. Rooms TBA.

Final Exam Date: Thu 6 Dec 2018 4:30-6:30 pm. Room TBA.

Grading Breakdown

Assignment	% of Grade
Problem Sets	18%
Midterm Exam 1	16%
Midterm Exam 2	16%
Final Exam	50%

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	Deliverables
Week 1	Introduction; logic and sets; algebra of events, sample and event spaces, sigma-algebras; probability axioms.	Chapter 1, 2.1-2	
Week 2	Independence; conditional probability; the Bayes rule.	2.4-5, handout	HW 1 due
Week 3	Counting; combinatorics; limits of sequences and sets.	handout	HW 2 due
Week 4	Sequential experiments; Bernoulli trials; discrete random variables (RVs) and probability distributions; binomial and Poisson.	2.6, 3.1-5	HW 3 due
Week 5	Continuous RVs, densities, and cumulative distributions; Gaussian and Cauchy.	4.1-6	HW 4 due
Week 6	Expectation and moments of RVs. Midterm Exam 1.	5.1-4	HW 5 due
Week 7	Two or more RVs; densities in 2D and higher. Covariance and correlation. Functions of one RV.	5.5-7	
Week 8	Stochastic convergence. Functions of two RVs.	5.8	HW 6 due
Week 9	Two functions of two RVs; jointly normal RVs.	5.9	HW 7 due
Week 10	Characteristic functions; discrete and continuous transforms.	4.7, handout	HW 8 due
Week 11	Midterm Exam 2. Sample mean; laws of large numbers.	7.1-2	
Week 12	Central limit theorem; approximations; bounds; convergence; parameter estimation.	7.3-5	HW 9 due
Week 13	Random vectors; estimation of RVs; least squares.	6.1-5	HW 10 due
Week 14	Monte Carlo methods. Discrete-time Markov processes; martingales and Markov chains; random walks.	9.1-3, 11.1-4, handout	HW 11 due
Week 15	Brief intro to queueing theory and other applications.	12.1-3	HW 12 due
FINAL	Final Exam		Date: Thu 6 Dec 2018 4:30-6:30 pm.

Statement on Academic Conduct and Support Systems

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 Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. 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>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu