SYLLABUS

Probability for Electrical and Computer Engineers

EE 503: Summer 2024 (4 units)

This course focuses on **reasoning** with *probabilistic uncertainty*. This involves developing *careful* skills in logical reasoning and applying those skills to a wide range of problems in probabilistic and statistical inference from signal processing to machine learning. The course depends primarily on lecture material and handouts. Attendance is **mandatory**. There are weekly exams and no make-ups. Unexcused absences or early departures result in an automatic zero exam score.

Instructor:	Brandon Franzke	
Email:	franzke@usc.edu	
Office:	EEB 504B	
Hours:	Monday:	16:30 – 18:00
	Thursday:	11:30 – 13:00 (remote)

Lecture

Monday (section: 30401, DEN:30403)
12:00 – 16:10

Discussion

Friday (section: 30402, DEN:30404)
10:00 – 10:50

Enrollment is in-person and DEN ONLY. Attendance is mandatory to all lectures. Taping or recording lectures or discussions is strictly forbidden without the instructor's explicit written permission.

Teaching assistants

TA:	Akash Panda	Grader:	Catherine Aurelia Christie Alexander
Email:	akashpan@usc.edu	Email:	cc98905@usc.edu
Office:	(see D2L)	Office:	(see D2L)

Course materials

- "*Probability and Random Processes for Electrical and Computer Engineers*", 1st edition, John A. Gubner, Cambridge University Press, 2006, (ISBN: 0521864704). (*required*).
- "*Probability, Statistics, and Random Processes for Electrical Engineering*", 3rd edition, Alberto Leon-Garcia, Pearson, 2008, (ISBN: 0131471228). (*required*).
- "*Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*", 1st edition, Bradley Efron and Trevor Hastie, Cambridge University Press, 2016, (ISBN: 1107149894). (*recommended*).

NOTE: Texts are secondary to in-class lecture material and homework sets.

Piazza https://piazza.com/usc/summer2024/ee503

Course Outline (tentative)

	week of	
1	20 May	Logic and sets. Proof technique. Sigma-algebras. Probability axioms.
2	27 May	**No class, Memorial Day.**
	29 May	Uncountability. Borel sigma-algebra. Independence. Total probability.
3	03 Jun	Combinatorics. Limits of sequences and sets. Borel-Cantelli Lemma.
4	10 Jun	Discrete probability and approximations. Poisson Theorem.
5	17 Jun	Random variables. Continuous densities. Bayes conjugate inference.
6/7	24 Jun	Expectations and moments of random variables.
	26 Jun	Covariance. Correlation. Uncertainty principles and applications.
8	01 Jul	Stochastic convergence. Laws of large numbers.
9	08 Jul	Conditional expectations. Maximum likelihood estimation.
10	15 Jul	Transformed densities. Monte Carlo. Entropy and mixtures.
11	22 Jul	Central limit theorem. Confidence intervals. Queues.
12	29 Jul	Discrete time Markov processes. Optimal estimation and least squares.
	03 Aug	**Review.**
	05 Aug	**Final, 12:00 - 14:30**

Grading Procedure

Weekly Exams. 60 Points. 11 weekly exams. **Closed book.** 10 minutes at the start of each Monday lecture session (and Wednesday on week 6). Each weekly exam is worth 6 points. No make-up exams. Missed exams earn 0 points. The total weekly exam score sums your 9 best weekly exam scores. Algorithm: label your weekly exam scores from lowest to highest: $w_1 \leq \cdots \leq w_{11}$. Then $W = 6 + w_3 + \cdots + w_{11}$ is your total weekly-exam score. Class attendance is *mandatory*. **Unexcused absences get an automatic exam score of zero for that week's exam grade.**

Final Exam. 40 Points. Cumulative. The final exam is **closed book with no note sheets**. You are expected to bring a non-graphing scientific calculator.

Homework. *Textbook* problems are checked but not graded. *Handout* problems are graded but count only as optional points. Homework counts at most as 10 points if all homework sets turned in and accurately worked. Your grade remains as is if only some homework turned in. How much homework affects which cases is at the discretion of the instructor. You may discuss homework problems with classmates but each student must submit their own orginal work. Turning in identical homework sets counts as cheating. Cheating warrants an F in the course.

Course Grade

A if 90 - 100 points, **B** if 80 - 89 points, **C** if 70 - 79 points, **D** if 60 - 69 points, **F** if 0 - 59 points.
("+" and "–" at $\approx$ 1.5% of grade boundary).

Cheating

Cheating is not tolerated on homework or exams. Penalty ranges from F on exam to F in course and recommended expulsion.

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-andappropriate-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/department-public-safety/online-forms/contactus. This is important for the safety of the 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/studentaffairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Academic Integrity

Academic integrity is critical the assessment and evaluation we perform which leads to your grade. In general, all work should be your own and any sources used should be cited. Gray-areas occur when working in groups. Telling someone how to do the problem or showing your solution is a VIOLATION. Reviewing examples from class or other sources to help a fellow classmate understand a principle is fine and encouraged. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code in Section 10, while the recommended sanctions are located in Appendix A. 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.

Support Systems

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 provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Academic Accommodations

Any student requiring 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 as early in the semester as possible. DSP is located in GFS 120 and is open 08:30 – 17:00, Monday through Friday. The phone number for DSP is (213) 740-0776.