This course introduces concepts of randomness and uncertainty. Probability and statistics form the foundation for many fields in electrical engineering and computer science. Probability theory uses models to predict the outcome of real-world experiments and to answer complex questions where relations and effects may be only partially known in advance. Statistics formalizes data analysis and connects closely with probability models and data collection methods. The course begins with basic concepts involving set probability, conditional probability, and random variables. The remainder of the course presents applications of these concepts to problems in estimation and decision theory.

Instructor: Brandon Franzke
Email: franzke@usc.edu
Office: EEB 504B
Zoom: meet:  998 5176 5591
      code: 574987
Hours: Monday: 17:00 - 18:00
       Wednesday: 12:00 - 14:00

Lecture
  Tuesday, Thursday (section: 30480)  12:00 – 13:50
Discussion
  Friday (section: 30481)            11:00 – 11:50

Attendance and Participation
This class is offered with in-person enrollment ONLY. Attendance is mandatory to all lectures and discussions. You are responsible for missed announcements or changes to the course schedule or assignments. Taping or recording lectures or discussions is strictly forbidden.

Piazza
https://piazza.com/usc/fall2022/ee364
Piazza enables fast and efficient help from classmates and instructors. Use Piazza to post questions about course material, homeworks, and policies instead of emailing questions to the teaching staff.

Canvas (replaces blackboard)
https://canvas.usc-ece.com
Use Canvas to electronically submit your homework and view course grades. You will receive an email to register during the first week of classes. Contact Dr. Franzke with any technical issues.

Autolab
https://autolab.usc-ece.com
Use Autolab to electronically submit programming portions of homework for “auto-grading”. You will receive an email to register during the first weeks of the course. Contact Dr. Franzke with technical issues.
TAs and staff

TA: Samantha Samuelson  Grader/CP: Simran Saxena
Zoom: meet: 933 9545 4310  Hours: by appointment
      code: 979834  E-mail: saxenas@usc.edu
Hours: Monday: 13:00 - 14:00
       Wednesday: 14:00 - 15:30
Email: sasamuel@usc.edu

Course materials


Learning objectives

Upon completion of this course a student will be able to:

- Understand probability as a model for uncertainty.
- Perform basic set probability relations including conditional probabilities and Bayes’ Law.
- Understand random variables as models for numerical measurements with uncertainty.
- Use the complete statistical characterization of random variables (e.g., distribution and density functions) to compute probabilities.
- Develop novel probability distributions given a description of a random experiment.
- Interpret the incomplete statistical characterization of random variables, such as mean and variance, to draw qualitative and quantitative conclusions.
- Apply common distributions such as Gaussian, Poisson, Binomial, Exponential and uniform to solve problems as appropriate.
- Utilize joint distributions and joint moments to compute probabilities and make estimates of random variables.
- Understand the Law of Large Numbers and Central Limit Theorem and their relation to statistical analysis.
- Apply basic confidence interval formulas to characterize the accuracy of estimates from experimental data.
- Make decisions between a finite set of hypotheses from experimental data.
- Perform linear regression to estimate one variable from another using experimental data.
Course Outline (tentative)

week of
1 23 Aug  Introduction. Modeling and measurement. Set theory.
3 06 Sep  Combinatorics. Binomial random structures.
4 13 Sep  Quiz 1 (weeks 1-3), 12:00 - 12:50.
15 Sep  Random variables. Probability mass functions (complete description).
5 20 Sep  Incomplete statistical descriptions (moments, tail bounds).
6 27 Sep  Multiple discrete random variables. Joint, marginal, and conditional distributions.
8 11 Oct  Midterm (Exam #1), 12:00 - 13:30.
13 Oct  No class: Fall recess, University holiday.
9 18 Oct  Continuous random variables. Density function and cumulative distribution.
10 25 Oct  Multiple continuous random variables.
11 01 Nov  Central limit theorem. Laws of large numbers.
12 08 Nov  Quiz 2 (weeks 8-11), 12:00 - 12:50.
13 15 Nov  Confidence intervals and hypothesis tests for the sample mean and proportions.
14 22 Nov  Linear regression. Function approximation.
24 Nov  No class: Thanksgiving, University holiday.
01 Dec  Review.
13 Dec  Final (Exam #2), 11:00 – 13:30.

Grading Procedure

Homework

Assigned weekly. This is an introductory course and homework is meant to supplement topics we cannot cover fully in class. Staying current with the class requires practice to master the concepts. Experience has shown that students who put in the effort on these homeworks, struggle with problems, and ask questions when they did not understand a problem did the best in this course.

Your total homework score sums your best homework scores (as a percentage) after removing the lowest two weekly assignments scores (of minimum 50%). Homeworks are due by the posted due date. Late homework will be accepted with a 10% deduction per 24-hours for up to 2 days. Homework will not be accepted after solutions are distributed. Solutions may be posted as soon as 2 days after the due date.

You may discuss homework problems with classmates but each student must do their own original work. Cheating warrants an F in the course. Turning in identical homework establishes a rebuttable presumption of cheating.
Checkpoint Quizzes
Checkpoint quizzes are short (50 minutes) non-cumulative assessments that cover only the most recent material. Quizzes highlight important concepts and methods. They test your conceptual understanding and application of major principles. They occur approximately during week 4 and week 12. You may use one-side of a single 3.5”x5” reference card. You are expected to bring a scientific (non-graphing) calculator. Make up exams will only be given for valid medical or family emergency excuses (proof required).

Exams
Exams are cumulative. They are closed book with no note sheet allowed. You are expected to bring a non-graphing scientific calculator. You must show how you arrived at your answers to receive full credit. Any cheating may result in an “F” in the course and will be referred to Student Affairs for other penalties. Make up exams will only be given for valid medical or family emergency excuses (proof required).

Course Grade
Weekly HW (drop 2 ≥ 50%) 25% A if 90 – 100 points
Computer HW 10% B if 80 – 89 points
Quizzes 20% C if 70 – 79 points
Exam #1 20% D if 60 – 69 points
Exam #2 25% F if 0 – 59 points

(“+” and “–” within approx. 3% of grade boundary)

Cheating
Cheating is not tolerated on homework or exams. Penalty ranges from F on assignment or exam to F in course to 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-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/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.