Math 407, Probability Theory 1, Spring 2023

Exterior Course Website: http://www.stevenheilman.org/~heilman/407s23.html
Prerequisite: MATH 226 or MATH 227 or MATH 229.
Course Content: Probability spaces, discrete and continuous distributions, moments, characteristic functions, sequences of random variables, laws of large numbers, central limit theorem, special probability laws.

Lecture Meeting Time/Location: Mondays, Wednesdays, and Fridays, 10AM-1050AM CPA 152
Instructor: Steven Heilman, stevenmheilman@gmail.com
Office Hours: 8AM-10AM, Tuesdays, on zoom [link posted on blackboard]
TA: Quinn Le, ntle@usc.edu
TA Office Hours: Held in the Math Center
Discussion Session Meeting Time/Location:

- 39976, Tuesdays and Thursdays, 2PM-250PM, CPA 102

- 39977, Tuesdays and Thursdays, 3PM-250PM, CPA 102

Recommended Textbook D. P. Bertsekas and John N. Tsitsiklis, Introduction to Probability, 2nd edition. (The book is freely available online
Another Recommended Textbook: Sheldon Ross, A First Course in Probability, any edition. (The book is freely available online
Another Recommended Textbook Elementary Probability for Applications, Durrett.

Exam 1: Friday, February 10, 10AM-1050AM, CPA 152
Exam 2: Friday, March 24, 10AM-1050AM, CPA 152
Final Exam: Monday, May 8, 8AM-10AM, CPA 152

Email Policy:

- My email address for this course is stevenmheilman@gmail.com.

- It is your responsibility to make sure you are receiving emails from stevenmheilman@gmail.com, and they are not being sent to your spam folder.

- Do NOT email me with questions that can be answered from this document.

Exam Procedures: Students must bring their USCID cards to the midterms and to the final exam. Phones must be turned off. Cheating on an exam results in a score of zero on that exam. Exams can be regraded at most 15 days after the date of the exam. This policy extends to homeworks as well. All students are expected to be familiar with the USC Student Conduct Code. (See also here.)

Student Conduct: 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/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.

Accessibility Services: If you are registered with accessibility services, I would be happy to discuss this at the beginning of the course. Any student requesting accommodations based on a disability is required to register with Accessibility Services and Programs (OSAS) each semester. A letter of verification for approved accommodations can be obtained from OSAS. Please be sure the letter is delivered to me as early in the semester as possible. OSAS is located in 301 STU and is open 8:30am-5:00pm, Monday through Friday.
https://osas.usc.edu
213-740-0776 (phone)
213-740-6948 (TDD only)
213-740-8216 (fax)
OSASFrontDesk@usc.edu

Other Resources: An introduction to mathematical arguments

Homework Policy:

- Homeworks are due roughly every week, at **2PM Thursdays**, i.e. at the beginning of the first discussion session on Thursdays.

- Homeworks are submitted in blackboard, under the "Assignments" tab. You are allowed unlimited submission "attempts" for an assignment, but only the last submission will be graded. To avoid internet issues, I recommend making your first submission of an assignment well in advance of the deadline. (Note that phone tethering can also give you an internet connection to a computer.)

- Homeworks should be submitted as single PDF documents. One way to create a PDF document from paper homework assignments is the freely available Adode Scan App.

- Late homework is not accepted.

- If you still want to turn in late homework, then the number of minutes late, divided by ten, will be deducted from the score. (The time estimate is not guaranteed to be accurate.)

- **Do not submit homework via email.**

- The **two lowest** homework scores will be dropped. This policy is meant to account for illnesses, emergencies, dropped internet connections, etc.

- You may not use the internet to try to find answers to homework problems.

- A random subset of the homework problems will be graded each week. However, it is strongly recommended that you try to complete the entire homework assignment.

- All homework assignments must be **written by you**, i.e. you cannot copy someone else's solution verbatim. However, collaboration on homeworks is allowed and encouraged.

- Homework solutions will be posted a few days after the homework is turned in.

Grading Policy:

- The final course grade is weighted as the larger of the following two schemes:

- Scheme 1: class participation (3%), homework (22%), the first midterm (20%), the second midterm (20%), and the final (35%).

- Scheme 2: class participation (3%), homework (22%), the largest midterm grade (30%), and the final (45%).

- The grade for the semester will be curved. However, I do not "curve down" since anyone who exceeds my expectations in the class by showing A-level performance on the exams and homeworks will receive an A for the class.

- If you cannot attend one of the exams, you must notify me within the first two weeks of the start of the quarter. Later requests for rescheduling will most likely be denied.

- Class participation is not the same as attendance. I will never explicitly take attendance, but I will notice if someone is frequently absent. Things that increase your class participation grade include: asking good questions, paying attention in class, showing up on time or early to class, etc. Things that decrease your class participation grade include: excessive talking or disruptions during class, frequent absences, excessive texting/smartphone usage in class, frequent tardiness, etc.

- You must take the final exam to pass the course.

Tentative Schedule: (This schedule may change slightly during the course.)

Week	Monday	Tu	Wednesday	Th	Friday
1	Jan 9: 1.1, Sets		Jan 11: 1.2 Probabilistic Models	Jan 12: Homework 0 (ungraded)	Jan 13: 1.2, Probabilistic Models
2	Jan 16: No class (MLK Day)		Jan 18: 1.3, Conditional Probability	Jan 19: Homework 1 due	Jan 20: 1.3, Conditional Probability
3	Jan 23: 1.4, Total Probability Theorem and Bayes' Rule		Jan 25: 1.5, Independence	Jan 26: Homework 2 due	Jan 27: 11.5, Independence
4	Jan 30: 1.6, Counting		Feb 1: 2.1, Discrete Random Variables	Feb 2: Homework 3 due	Feb 3: 2.2, Probability Mass Function
5	Feb 6: 2.3, Functions of Random Variables		Feb 8: 2.4, Expectation and Variance	Feb 9: No homework due	Feb 10: Midterm #1
6	Feb 13: 2.5, Joint PMFs, Covariance and Variance		Feb 15: 2.6, Conditioning	Feb 16: Homework 4 due	Feb 17: 2.6, Conditioning
7	Feb 20: No class		Sep 30: 2.7, Independence	Feb 23: Homework 5 due	Feb 24: 2.7, Independence
8	Feb 27: 3.1, Continuous random variables and PDFs		Mar 1: 3.1, Continuous random variables and PDFs	Mar 2: Homework 6 due	Mar 3: 3.2, Cumulative Distribution Functions
9	Mar 6: 3.3, Normal Random Variables		Mar 8: Joint PDFs of Multiple Random Variables	Mar 9: Homework 7 due	Mar 10: 3.5, Conditioning
10	Mar 13: No class (spring break)		Mar 15: No class (spring break)		Mar 17: No class (spring break)
11	Mar 20: 3.5, Conditioning		Mar 22: 4.2, Covariance	Mar 23: No homework due	Mar 24: Midterm #2
12	Mar 27: 4.4, Moment Generating Function		Mar 29: 4.4, Fourier Transform	Mar 30: Homework 8 due	Mar 31: 4.2 Convolution
13	Apr 3: 7.1, Markov and Chebyshev Inequalities		Apr 5: 7.2, Weak Law of Large Numbers	Apr 6: Homework 9 due	Apr 7: 7.3, Convergence in Probability
14	Apr 10: 7.4, Central Limit Theorem		Apr 12: 7.4, Central Limit Theorem	Apr 13: Homework 10 due	Apr 14: 7.4, Central Limit Theorem
15	Apr 17: 7.5, Strong Law of Large Numbers		Apr 19: 7.5, Strong Law of Large Numbers	Apr 20: Homework 11 due	Apr 21: 7.5, Strong Law of Large Numbers
16	Apr 24: Leeway		Apr 26: Leeway	Apr 27: Homework 12 due	Apr 28: Leeway

Advice on succeeding in a math class:

- Review the relevant course material **before** you come to lecture. Consider reviewing course material a week or two before the semester starts.

- When reading mathematics, use a pencil and paper to sketch the calculations that are performed by the author.

- Come to class with questions, so you can get more out of the lecture. Also, finish your homework at least **two days** before it is due, to alleviate deadline stress.

- Write a rough draft and a separate final draft for your homework. This procedure will help you catch mistakes. Also, I would very much recommend typesetting your homework. Learning LaTeX is a very important skill to have for doing mathematics. Here is a template .tex file if you want to get started typesetting.

- If you are having difficulty with the material or a particular homework problem, review Polya's Problem Solving Strategies, and come to office hours.