STATISTICS 251: INTRODUCTION TO MATHEMATICAL PROBABILITY

1. OVERVIEW AND PREREQUISITES

Overview: This course covers fundamentals and axioms; combinatorial probability; conditional probability and independence; binomial, Poisson, and normal distributions; the law of large numbers and the central limit theorem; and random variables and generating functions.
Prerequisites: One of the following:

- Math 16300, Math 16310, Math 20500, Math 20510, or Math 20900, with no grade requirement;
- Math 19520 or Math 20000 with either a minimum grade of B-, statistics major, or current enrollment in prerequisite course.

Contact us by email if you have questions about whether this course is appropriate for you,

2. Course INFO

Lecture: MWF 12:30pm-1:20pm, Eckharts 133 by Zhongjian Wang (zhongjian@uchicago.edu)
TAs:

- Kulunu Ransika Dharmakeerthi (kulunud@uchicago.edu)
- Wanrong Zhu (wanrongzhu@uchicago.edu)
- Angela Wang (anyuwang@uchicago.edu)

Office Hours.

- Monday 2:30pm-4:30pm (Zhongjian)
- Wednesday 2:30pm-3:30pm (Wanrong)
- Thursday 1:30pm-2:30pm (Kulunu)

Textbook: A First Course in Probability by Sheldon Ross (6th, 7th, 8th, 9th, or 10th edition).
Website: The main course page is on Canvas and you can find all lecture videos, slides, assignments, etc there. Homework will be handed in and graded on Gradescope. We will also use Ed Discussion for Q&A.
Contacting us: We aim to reply to all questions within 24 hours.

- For any questions about the material or HW or exams (aside from regrade requests), please contact us through the discussion boards on Ed Discussion.
- You can write a public post if appropriate (e.g., questions about material, clarification on HW, questions to help understand a midterm problem after the exam has been graded, etc). Note that you can choose to post anonymously but your name will still be visible to the instructor/TAs.
- Alternatively, you can write a private post, visible only to the instructor/TAs (e.g., if you need help on a HW problem but posting your question would reveal too much of your work).

- For any questions about your graded HW or exams, please submit a regrade request on Gradescope.
- For other questions such as enrollment, prerequisites, accommodations, makeup times for exams, etc, please contact the instructor by email.

3. Course Policies

Homework: There will be weekly written homeworks due Monday at 12:30pm.

- The lowest homework score will be dropped to accommodate illness and other unforeseen circumstances. Late homework will not be accepted.
- HW 8 will count for double weight, and only the first or second half of HW 8 may be dropped.
- Homework should be submitted on Gradescope (which can be accessed from the Canvas course page).
- For each problem, Gradescope will prompt you to tag the pages containing your answer to that problem. Be sure to tag all the pages that contain any part of your answer-for example if for problem 1, your written explanation is on page 1 and on half of page 2, you will need to tag both of these pages for problem 1 .
- It is fine to have multiple problems on the same page (be sure to tag that page for all problems it contains). - To submit via Gradescope, you will need to upload a single PDF file. If photographing/scanning handwritten work via smartphone, we recommend the free CamScanner or Dropbox apps to produce a single PDF file containing all pages.

Exams: There will be a midterm exam and a cumulative final exam according to the following schedule.

- Midterm: Monday, April 24 during class
- Final Examination: Scheduled by the registrar

The use of notes, textbooks, or electronic devices will not be allowed during exams. No make-up exams will be offered without a letter from the dean or a doctor's note. No make-ups are possible for the final exam.

Grading: The final course grade will be determined according to the following formula:

(20% Homework) + max{(40% Final) + (40% Midterm), (50% Final) + (30% Midterm)}.

Collaboration and Academic Integrity: We encourage you to work together on homework! For written homework, you must write your solutions alone and understand what you write. When submitting your homework, you should cite any sources you used (text or human) other than the textbook and myself.

Accessibility: The University of Chicago is committed to ensuring equitable access to our academic programs and services. Students with disabilities who have been approved for the use of academic accommodations by Student Disability Services (SDS) and need a reasonable accommodation(s) to participate fully in this course should follow the procedures established by SDS for using accommodations. Timely notifications are required in order to ensure that your accommodations can be implemented. Please meet with me to discuss your access needs in this class after you have completed the SDS procedures for requesting accommodations. Information on the SDS registration process is available at disabilities.uchicago. edu.

4. Schedule

Week	Topic	Section
1 Mar. 20, 22, 24	Counting principles	1.1 – 1.5
	Set theory and probability spaces	2.1 – 2.3
2 Mar. 27, 29	Probability and equal likelihood	2.4 – 2.5
HW 1 due Mar. 27	Conditional probability	3.1 – 3.2
	Bayes' rule and independence	3.3 – 3.5
3 Apr. 3, 5, 7	Discrete random variables	4.1 – 4.2
HW 2 due Apr. 3	Expectations	4.3 – 4.4
	Variance and standard deviation	4.5
4 Apr. 10, 12, 14	Binomial random variables	4.6
HW 3 due Apr. 10	Poisson random variables	4.7
	Other discrete random variables	4.8 – 4.10
5 Apr. 17, 19, 21	Continuous random variables	5.1 – 5.3
HW 4 due Apr. 17	Gaussian distribution	5.4
	Exponential distribution	5.5
6 Apr. 24, 26, 28	Midterm	
HW 5 due Apr. 24	Change of variables (univariate)	5.6 – 5.7
	Joint distributions	6.1 – 6.2
7 May 1, 3, 5	Sums and conditional distributions	6.3 – 6.5
HW 6 due May 1	Change of variables (multivariate)	6.7
	Expectations of sums	7.1 – 7.2
8 May 8, 10, 12	Covariance and correlation	7.3 – 7.4
HW 7 due May 8	Conditional expectation	7.5 – 7.6
	Weak law of large numbers	8.1 – 8.2
9 May 15, 17, 19	Central limit theorem	8.3
HW 8 due May 22	Strong law of large numbers	8.4

Dates of problem sessions: March 31, April 21, May 5, May 19.
Last updated: March 19, 2023. Subject to change.