Stat 244: Statistical Theory and Methods 1

Course description This course is the first quarter of a two-quarter systematic introduction to the principles and techniques of statistics, as well as to practical considerations in the analysis of data, with emphasis on the analysis of experimental data. This course covers tools from probability and the elements of statistical theory. Topics include the definitions of probability and random variables, binomial and other discrete probability distributions, normal and other continuous probability distributions, joint probability distributions and the transformation of random variables, principles of inference (including Bayesian inference), maximum likelihood estimation, hypothesis testing and confidence intervals, likelihood ratio tests, multinomial distributions, and chi-square tests. Examples are drawn from the social, physical, and biological sciences.

See `www.stat.uchicago.edu/~yibi/IntroStat` for help deciding between Stat 200, 220, 234, 244, and 24410.

Course info

- Instructors: Section 1 (2:00pm–3:20pm in Eckhart 133) — Rina Barber, `rina@uchicago.edu`
  Section 2 (3:30pm–4:50pm in Hinds 101) — Yi Sun, `yisun@statistics.uchicago.edu`
- TAs: Yuhan Liu, `yuhanphilipliu@uchicago.edu`
  Huanlin Zhou, `hlzhou@uchicago.edu`
  Lijia Zhou, `zlj@uchicago.edu`
  Lizhen Nie, `lizhen@uchicago.edu`
- 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
- Class will be held in-person. Office hours will be on Zoom.
- Zoom intro meeting to go over course logistics — Monday 9/27 8pm or Tuesday 9/28 8pm (choose either one)
  All students are encouraged to attend one, but all relevant info will be posted online after the meetings.
- Office hours schedule (all on Zoom):
  - Mondays 11am–1pm (TAs) (starts on week 2)
  - Mondays 4:30–6pm (TAs) (starts on week 2)
  - Wednesdays 5:00pm–6:30pm (Yi)
  - Thursdays 8:00–9:00pm (TAs)
  - Fridays 9:30–11am (Rina)
- COVID-19 policies:
  - Masks: Per UChicago policy, students and instructors must wear masks in classrooms.
  - Quarantine / Isolation: Always stay home if you feel sick or test positive for COVID-19. Those who test negative should still stay away from classes if they have symptoms that are not typical for them.
  - Last year's recorded lectures will be posted on Canvas to accommodate students who are not able to attend class.

Contacting us We will 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 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.

Textbook & resources The textbook for this course is:

- *Mathematical Statistics and Data Analysis*, Rice, 3rd edition.

The textbook can be rented from the publisher:
https://www.cengage.com/c/mathematical-statistics-and-data-analysis-3e-rice/9780534399429PF/
We will not assign HW problems from the textbook, but the book is a very useful reference for the material, and we will also be posting suggested practice problems from the textbook.

Handing in assignments

- Assignments are due on Tuesdays at 2:00pm.
- At the end of the quarter, the lowest HW grade (or one missing grade) will be dropped. We cannot excuse any missed HWs beyond the one that is dropped.
- To give additional flexibility due to COVID, late HWs will be accepted with a penalty of 4% per hour (late time is rounded up, i.e., one minute late counts as one hour late).
- Assignments are submitted and graded via 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's 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.
- If you are having trouble uploading to the website and run out of time, please email your work to the instructors or TAs before the time HW is due as proof of completion. The time of your email will count as the time of your HW submission. We do not accept the time stamp of the file on your computer as proof of completion.

Exams

- Details about exams (e.g., remote or in person, closed or open book, etc) will be decided later on depending on the conditions of the pandemic.
- The midterm exam should be taken during class time on Thursday 10/28. Please contact your instructor immediately if you may need an alternative exam time.
- The final exam will be given during the registrar-assigned day & time (which the registrar will announce later on). Please contact your instructor immediately if you may need an alternative exam time.

Grading The final grade will be determined by the following approximate weights (exact weights will be determined later in the quarter):

- Problem sets: 25% (with lowest HW grade, or one missing HW, dropped)
- Midterm exam: 35%
- Final: 40%
- If the final exam grade is higher than the midterm grade, it will instead be given more weight (30% midterm, 45% final)

Collaboration guidelines & plagiarism policy For problem sets, students are free to discuss the problems and collaborate on strategies for solving the problems, but all writing, code, etc, should be done completely on your own. For example, working out a solution as a group, then transferring it to your own page, is not acceptable. Referring to material from past quarters of this course is not permitted. For exams, no collaboration or discussion of any kind is allowed.

Any copied material (from websites, published materials, or another students' work) that is handed in without attribution will be considered to be plagiarism and will be reported to the appropriate university department. Feel free to reach out to the instructor or TAs if you have any questions about what is appropriate for collaboration or online resource use.

Please consult the student manual on university policies and regulations that make it clear that the University will not tolerate cheating and plagiarism: `https://studentmanual.uchicago.edu`

Recording and Deletion Policies The Recording and Deletion Policies for the current academic year can be found in the Student Manual under Petitions, Audio & Video Recording on Campus.

- Do not record, share, or disseminate any course sessions, videos, transcripts, audio, or chats.
- Do not share links for the course to those not currently enrolled.
- Any Zoom cloud recordings will be automatically deleted 90 days after the completion of the recording.

By attending course sessions, students acknowledge that:

- They will not: (i) record, share, or disseminate University of Chicago course sessions, videos, transcripts, audio, or chats; (ii) retain such materials after the end of the course; or (iii) use such materials for any purpose other than in connection with participation in the course.
- They will not share links to University of Chicago course sessions with any persons not authorized to be in the course session. Sharing course materials with persons authorized to be in the relevant course is permitted. Syllabi, handouts, slides, and other documents may be shared at the discretion of the instructor.
- Course recordings, content, and materials may be covered by copyrights held by the University, the instructor, or third parties. Any unauthorized use of such recordings or course materials may violate such copyrights.
- Any violation of this policy will be referred to the Area Dean of Students.

Special Accommodations 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 contact the instructor to discuss your access needs in this class after you have completed the SDS procedures for requesting accommodations.
Phone: (773) 702-6000, Email: `disabilities@uchicago.edu`

Schedule

Week	Dates	Topics	Due (Tuesday 2pm)
1	Tue Sep 28	Lecture 1a: Intro to probability Lecture 1b: Conditional probability & independence	
	Thu Sep 30	Lecture 2a: Intro to discrete random variables part 1 Lecture 2b: Intro to discrete random variables part 2	
2	Tue Oct 5	Lecture 3a: Intro to continuous random variables Lecture 3b: Random variables & distributions part 1	PSet 1 due
	Thu Oct 7	Lecture 4a: Random variables & distributions part 2 Lecture 4b: Expected value	
3	Tue Oct 12	Lecture 5a: Variance Lecture 5b: Joint distributions part 1	PSet 2 due
	Thu Oct 14	Lecture 6a: Joint distributions part 2 Lecture 6b: Joint distributions part 3	
4	Tue Oct 19	Lecture 7a: Joint distributions part 4 Lecture 7b: Covariance & correlation	PSet 3 due
	Thu Oct 21	Lecture 8a: Conditional expectation & variance part 1 Lecture 8b: Conditional expectation & variance part 2	
5	Tue Oct 26	Lecture 9a: Conditional distrib.'s and intro to Bayesian inference, part 1 Lecture 9b: Conditional distrib.'s and intro to Bayesian inference, part 2	PSet 4 due
	Thu Oct 28	Midterm exam (During class time)	
6	Tue Nov 2	Lecture 10a: Rejection sampling Lecture 10b: Intro to frequentist inference	PSet 5 due
	Thu Nov 4	Lecture 11a: Central limit theorem part 1 Lecture 11b: Central limit theorem part 1	
7	Tue Nov 9	Lecture 12a: χ^2 distribution & t distribution Lecture 12b: Inference for sample means	PSet 6 due
	Thu Nov 11	Lecture 13a: Parameter estimation Lecture 13b: Maximum likelihood estimation part 1	
8	Tue Nov 16	Lecture 14a: Maximum likelihood estimation part 2 Lecture 14b: Bayesian inference	PSet 7 due
	Thu Nov 18	Lecture 15a: Hypothesis testing part 1 Lecture 15b: Hypothesis testing part 2	
9	Tue Nov 30	Lecture 16a: Generalized likelihood ratio test Lecture 16b: χ^2 test for multinomial data part 1	PSet 8 due
	Thu Dec 2	Lecture 17a: χ^2 test for multinomial data part 2 Lecture 17b: Estimation & inference: more examples	
	Tue–Fri Dec 7–10	Final exam (Dates & times TBD)	