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

- Instructor: Rina Barber, `rina@uchicago.edu`
- TAs: Yuguan Wang, `yuguanw@uchicago.edu`
  Beining Wu, `beiningw@uchicago.edu`
  Tannistha Mondal, `tannistha@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 in-person or on Zoom (as listed below).
- Class time & location: Tuesday/Thursday 9:30–10:50am, Eckhart 133
- Weekly office hours schedule (starting week 2)
  - Mondays 3:30–5pm (Rina — Jones 214)
  - Tuesdays 4:30–6pm (TAs — zoom)
  - Wednesdays 5pm–6:30pm (TAs — Jones 226)
  - Problem session, Fridays 4–5pm (TAs — Jones 226)

Exams

- The midterm exam is **tentatively** scheduled for **Monday Feb 5, 6:00pm** (we are waiting to receive a room assignment so the date/time is still uncertain). Please contact the 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.

Handing in assignments

- Assignments are due on Thursdays at 9:30am (at the start of class).
- At the end of the quarter, the lowest problem set grade (or one missing grade) will be dropped. We cannot excuse any missed problem sets beyond the one that is dropped.
- Late assignments 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). We cannot offer any additional extensions.
- Assignments are submitted and graded via Gradescope (which can be accessed from the Canvas course page). Students are required to tag pages for each problem.
- 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 problem set is due as proof of completion. The time of your email will count as the time of your problem set submission. We do not accept the time stamp of the file on your computer as proof of completion.

Contacting us We will aim to reply to all questions within 24 hours.

- For any questions about the material or homework or exams (aside from regrade requests), please contact us through the discussion boards on Ed Discussion.
  - Please post publicly if possible (e.g., questions about material, clarification on problems sets, 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 homework problem but posting your question would reveal too much of your work).
- For any questions about your graded homework 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.

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 grade, or one missing assignment, 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)

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 homework 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.

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`

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 (Thu 9:30am)
1	Thu Jan 4	Lecture 1a: Intro to probability Lecture 1b: Conditional probability & independence	
2	Tue Jan 9	Lecture 2a: Intro to discrete random variables part 1 Lecture 2b: Intro to discrete random variables part 2	
	Thu Jan 11	Lecture 3a: Intro to continuous random variables Lecture 3b: Random variables & distributions part 1	PSet 1 due
3	Tue Jan 16	Lecture 4a: Random variables & distributions part 2 Lecture 4b: Expected value	
	Thu Jan 18	Lecture 5a: Variance Lecture 5b: Joint distributions part 1	PSet 2 due
4	Tue Jan 23	Lecture 6a: Joint distributions part 2 Lecture 6b: Joint distributions part 3	
	Thu Jan 25	Lecture 7a: Joint distributions part 4 Lecture 7b: Covariance & correlation	PSet 3 due
5	Tue Jan 30	Lecture 8a: Conditional expectation & variance part 1 Lecture 8b: Conditional expectation & variance part 2	
	Thu Feb 1	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
6	Mon Feb 5	**Midterm exam** (6–8pm, location TBD)	
	Tue Feb 6	Lecture 10a: Rejection sampling Lecture 10b: Intro to frequentist inference	
	Thu Feb 8	Lecture 11a: Central limit theorem part 1 Lecture 11b: Central limit theorem part 1	PSet 5 due
7	Tue Feb 13	Lecture 12a: χ^2 distribution & t distribution Lecture 12b: Inference for sample means	
	Thu Feb 15	Lecture 13a: Parameter estimation Lecture 13b: Maximum likelihood estimation part 1	PSet 6 due
8	Tue Feb 20	Lecture 14a: Maximum likelihood estimation part 2 Lecture 14b: Bayesian inference	
	Thu Feb 22	Lecture 15a: Hypothesis testing part 1 Lecture 15b: Hypothesis testing part 2	PSet 7 due
9	Tue Feb 27	Lecture 16a: Generalized likelihood ratio test Lecture 16b: χ^2 test for multinomial data part 1	
	Thu Feb 29	Lecture 17a: χ^2 test for multinomial data part 2 Lecture 17b: Estimation & inference: more examples	PSet 8 due
	Tue–Fri Mar 5–8	**Final exam** (Date & time & location TBD)	