STAT 410 / MATH 464
Statistics and Probability II

Fall 2026

Sections 3GR and 3UG • MWF 1:00–1:50 p.m. • 112 Huff Hall • August 24–December 9, 2026

Instructor	Chen Cheng	**TA**	Xinran Li
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Office	**TBD**	**Office**	**TBD**
Office hours	**TBD**	**Office hours**	**TBD**

Course links. Canvas, Gradescope, Piazza.

1 Course overview

Content. STAT 410 is a calculus-based second course in probability and mathematical statistics. It develops multivariate probability, transformations and sampling distributions, and the foundations of statistical inference. By the end of the course, students should be able to:

- Work with joint, marginal, and conditional distributions and expectations;
- Derive distributions of transformed random variables and order statistics;
- Analyze normal, multivariate normal, gamma, chi-square, and related models;
- Establish probabilistic limits and apply the central limit theorem and delta method;
- Construct and evaluate estimators using likelihood, sufficiency, Fisher information, efficiency, and Bayesian criteria; and
- Formulate and analyze hypothesis tests, including likelihood-ratio and Neyman–Pearson procedures.

Prerequisite. STAT 400 or an equivalent first course in probability. The course carries 3 or 4 credit hours; students should follow the requirements for their registered section.

Course systems. Announcements and course files will be posted on Canvas. Homework will be submitted through Gradescope. Piazza will be used for course questions and discussion. Students are responsible for announcements made through these systems.

2 Text and reference materials

- Hogg, McKean, and Craig, *Introduction to Mathematical Statistics*, 8th edition (the 7th and 6th editions are also usable; recommended but not required).
- John I. Marden, *Mathematical Statistics: Old School* (optional).

Course notes, slides, worked examples, and probability tables will be posted on Canvas.

3 Assessment and grading

Component	Points	Course weight
Homework (best 10 of 12 assignments)	100	25%
Midterm exam I	80	20%
Midterm exam II	80	20%
Final examination	140	35%
Total	**400**	**100%**

Course grades are determined from the total points earned out of 400. Percentage equivalents are shown for reference only. The planned thresholds follow the prior offering and may be lowered, but will not be raised. The A+ cutoff will be announced.

Grade	A+	A	A–	B+	B	B–	C+	C	C–	D+	D	D–
Minimum percentage	**TBD**	93%	90%	87%	83%	80%	77%	73%	70%	67%	63%	60%
Minimum points	**TBD**	372	360	348	332	320	308	292	280	268	252	240

Scores below 240 points receive an F. Grades are determined from total points, not from a rank-based curve.

3.1 Homework

Twelve weekly assignments are planned, generally omitting the opening week and exam weeks. The two lowest homework scores will be dropped, so the best ten assignments determine the homework grade. Unless an assignment says otherwise, work is due on Gradescope at 11:59 p.m. on the stated date. **Late homework will not be accepted except for an approved accommodation or documented exceptional circumstance.**

Gradescope regrade requests and grading disputes will be considered only if submitted within one week of the homework grade announcement.

Discussion of homework with classmates is encouraged, but **each student must write and submit an independent solution in their own words**. Collaborators must be acknowledged. Sharing or copying complete solutions is not permitted. Unless explicitly authorized for an assignment, solutions generated by artificial intelligence may not be submitted as the student's own work.

3.2 Examinations

Exam	Date and time	Location
Midterm I	Thursday, October 8, 7:00–8:30 p.m.	Siebel Center, Rooms 1304 and 1404
Midterm II	Thursday, November 19, 7:00–8:30 p.m.	Siebel Center, Rooms 1304 and 1404
Final exam	University final-exam period, December 11–17	Date, Time, and Room: **TBD**

Examinations are closed book and closed notes, except that one letter-size (8.5 by 11 inch) sheet of handwritten or typed notes, using both sides, is permitted.

A basic or scientific calculator is allowed unless announced otherwise. **Show sufficient work to receive credit.** State the support of every probability mass or density function and give a closed-form answer whenever requested. **Numerical answers must contain at least four significant digits.**

4 Weekly schedule

Topics and assignment dates may move as the course develops.

Week	Dates	Topics	Notes
1	Aug. 24–28	Discrete and continuous random variables; transformations of one random variable	Opening week
2	Aug. 31–Sept. 4	Further transformations; mixed random variables; joint distributions, independence, and covariance	HW begins
3	Sept. 7–11	Conditional distributions and conditional expectation	No class Sept. 7
4	Sept. 14–18	Functions of two random variables; convolution and Jacobian methods	
5	Sept. 21–25	Further transformations of two random variables; order statistics	
6	Sept. 28–Oct. 2	Normal probabilities; bivariate and multivariate normal distributions; random vectors and covariance matrices	
7	Oct. 5–9	Student's t distribution and sampling distributions; consolidation of multivariate probability	Midterm I Oct. 8
8	Oct. 12–16	Poisson, gamma, and chi-square distributions; introduction to point estimation and method of moments	
9	Oct. 19–23	Maximum likelihood and further properties of point estimators	
10	Oct. 26–30	Convergence in probability; consistent estimators; convergence in distribution	
11	Nov. 2–6	Central limit theorem; asymptotic distributions; delta method; confidence intervals; sufficient statistics	
12	Nov. 9–13	MLE theory; Fisher information; Cramér–Rao lower bound; efficiency; introduction to hypothesis testing and power	
13	Nov. 16–20	Significance levels, p-values, power, and one-sample Z procedures	Midterm II Nov. 19
14	Nov. 23–27	Fall Break	No classes
15	Nov. 30–Dec. 4	Neyman–Pearson lemma; most powerful and uniformly most powerful tests; likelihood-ratio tests	
16	Dec. 7–9	Bayesian estimation and Bayesian hypothesis testing; synthesis and review	Classes end Dec. 9

5 Course policies and support

Academic integrity. Students are expected to follow the University of Illinois Student Code. Unauthorized aid, copying, and misrepresentation of work are prohibited. Course-specific collaboration rules stated above do not replace the Student Code.

Accessibility. Students who need disability-related accommodations should contact the Division of Disability Resources and Educational Services (DRES) and share the official accommodation letter with the instructor as early as possible. Accommodations will be implemented confidentially and consistently with University policy.

Religious observances and excused absences. Contact the instructor in advance when a religious observance or University-approved activity conflicts with a course obligation. For emergencies or illness, communicate as soon as reasonably possible and provide documentation when required by University policy.

Sexual misconduct and reporting. The University prohibits sexual misconduct and offers confidential and non-confidential support resources. University employees may have reporting obligations; students seeking confidential help should use a designated confidential resource.

Safety and respectful learning. Follow campus emergency instructions and classroom evacuation directions. The course should be a respectful, inclusive environment in which questions, mistakes, and differing mathematical approaches can be discussed constructively.