Syllabus

ORIE 3510/5510 & STSCI 3510, Spring 2024

Format	Standard lectures and discussions
Lectures	Tue & Thu, 11:40am–12:55pm, Kimball B11
Discussions	DIS 201: Mon, 10:10am–12:05pm, Hollister 206 DIS 202: Mon, 12:20–2:15pm, Hollister 306 DIS 203: Tue, 8:00–9:55am, Rhodes 453 DIS 204: Wed, 8:00–9:55am, Upson 206 DIS 205: Fri, 10:10am–12:05pm, Rhodes 253
Homework	Weekly assignments, usually **due 10:00pm Fri**
Exams	Prelim exam: Mar 26, 7:30pm, Hollister 110 and B14 Final exam: details **TBA**
Credits	4 credits, may be taken for letter grade or S/U
Hours	Expect to spend 6 supplemental hours per week outside of class
AI policy	Large language models, such as ChatGPT, are prohibited
Websites	Canvas `https://canvas.cornell.edu/courses/59697` Gradescope `https://www.gradescope.com/courses/717271` Ed Discussion `https://edstem.org/us/courses/54663/discussion/`
Prerequisites	ORIE 3500 or instructor's permission
Textbook	*Introduction to Probability for Computing* (Harchol-Balter, 2024) `https://www.cs.cmu.edu/~harchol/Probability/book.html`
Quick links	§ Homework, § Grading, § Schedule, § Course management and policies

Course staff and office hours

	Name	*Office hours*		
Instructor	Ziv Scully	Thu	2:30–4pm	Rhodes 253
TAs	Caroline Ryu	Mon	9–10am	Rhodes 421
	Ethan Chen	Mon	5:30–6:30pm	Rhodes 421
	Caroline He	Tue	4:30–5:30pm	Rhodes 421
	Qian Xie	Tue	5:30–7pm	Rhodes 431
	Selina Xiao	Wed	10:10–11:10am	Rhodes 421
	Eric Tang	Wed	5–6pm	Rhodes 421
	Fahaar Pirani	Fri	1–3pm	Rhodes 431

Contact information If you have a question, especially about course material, please post it to Ed Discussion. For personal administrative matters, please email the course staff at **`ORIE-3510-SPRING-2024-STAFF-L@list.cornell.edu`**. You can also reach Prof. Scully at `zivscully@cornell.edu`.

Course description

The course is divided into three units.

- Unit 1 is devoted to *rigorously defining* stochastic processes. We review probability fundamentals, focusing on how to translate an informal description of a random scenario into a formal stochastic model. We practice describing a given scenario with many equivalent models, learning that each model can provide different insight.
- Unit 2 is devoted to *Markov chain modeling and analysis*. We learn how to model scenarios using Markov chains, how to analyze those models, and how to use the analysis results to make system design decisions. We focus on discrete-time, discrete-state models so that we can learn the core ideas in a relatively simple setting.
- Unit 3 is devoted to *going beyond simple Markov chains*. We learn how to build and analyze models with more advanced features, such as continuous time, continuous state, and online decision-making. We encounter many classic stochastic processes along the way, such as Poisson processes and Brownian motion.

Student learning outcomes

- Students can translate informally described random scenarios into formal stochastic models, using probability spaces, Markov chains, and related techniques.
- Students can define and use core concepts in probability theory.
- Students can reason about and fully analyze simple Markov chain models.
- Students can reason about and analyze basic properties of more advanced Markov process models.
- Students can apply specialized techniques (e.g. Z transforms) to analyze models for which they are especially well suited (e.g. branching processes).

Homework

Homework assignments are given weekly. They are **due at 10:00pm ET**, usually on Thursday but occasionally on Friday (see § Schedule). There are 9 homeworks and 4 mini-homeworks, the latter of which are weighted half as much as a full homework.

Submitting homework All assignments must be submitted on Gradescope. Some problems are completed directly on the Gradescope website, but most homeworks will involve uploading a PDF of your solutions. Your solutions can be prepared digitally with a tablet or LaTeX, or you can scan hand-written solutions. Please ensure scanned solutions are legible. You can scan solutions from a smartphone using the Gradescope app: `https://help.gradescope.com/article/alyonjbud4-mobile-app`.

Every homework deadline has a brief but unspecified grace period. Please do not worry if your upload is a few minutes late. (Concretely, 3 minutes is definitely just "a few".)

Late submissions and dropped homeworks Homework assignments can be turned in up to 48 hours late. You get **two free late assignments**. After that, late submissions

subtract 20% of the maximum possible score from your grade for that homework. We will apply your two free late submissions to full homeworks if possible, so don't worry about accidentally wasting them on mini-homeworks.

The equivalent of your lowest full homework grade is dropped:

- If your lowest homework grade is a full assignment, that grade is dropped.
- If your lowest two homework grades are mini-assignments, both grades are dropped.
- If your lowest homework grade is a mini-assignment and second-lowest is a full assignment, the mini's grade is dropped, and the full's grade weight is halved.

We expect these accommodations, i.e. late submissions and a dropped assignment, to cover most unforeseen circumstances for most students. If you need additional accommodations due to exceptional circumstances, please contact the course staff.

Collaboration You may discuss homework problems with your fellow students and course staff, but your solutions must be your own work. List any student collaborators on the first page of your homework. Someone counts as a collaborator if you solve at least one problem together, or if you talk about a problem for at least 10 minutes.

Bonus problems for ORIE 5510 Many full assignments have an extra "Problem A" at the end. This is a *bonus problem*, and it is required only for ORIE 5510 students. The bonus problem is graded separately from the rest of the homework, effectively serving as an extra very-mini-assignment for ORIE 5510 students (see § Grading).

Bonus problems are meant to encourage additional understanding of some aspect of the course material. For instance, they may reinforce material covered in lecture but absent from other homework problems. All students are welcome to solve bonus problems, but only ORIE 5510 students receive grades for them.

Grading

110% grading **All homework assignments and exams are graded out of 110%**, but each assignment's maximum grade is capped at 100%. That is, if you get $P\%$ of the points on a homework/exam, where $P\%$ ranges between 0% and 110%, your grade is $\min\{P\%, 100\%\}$.

We hope this policy lets worry less about getting every last homework point. A few minor mistakes or the occasional unsolved problem will not hurt your grade. (But do come to office hours to ask about those unsolved problems—we're here to help!)

Final grade weights

	ORIE 3510 & STSCI 3510	*ORIE 5510*
Lower-scoring exam	20%	20%
Higher-scoring exam	30%	30%
Homework	50%	45%
Bonus problems	0%	5%

Tentative grading scale

*Percent grade**	*Letter grade*	*Percent grade**	*Letter grade*
93–100%	A	77–79%	C+
90–92%	A–	73–76%	C
87–89%	B+	70–72%	C–
83–86%	B	50–69%	D
80–82%	B–	0–49%	F

*rounded up

Schedule

Unit 1: Probability fundamentals

Tue	Jan 23	Lecture		
Thu	Jan 25	Lecture		
Fri	Jan 26		*10:00pm*	*Mini-homework due*
Tue	Jan 30	Lecture		
Thu	Feb 1	Lecture		
Fri	Feb 2		*10:00pm*	*Homework due*
Tue	Feb 6	Lecture		
Thu	Feb 8	Lecture		
Fri	Feb 9			*Due date extended*
Tue	Feb 13	Lecture	***10:00pm***	***Homework due***
Thu	Feb 15	Lecture		
Fri	Feb 16			*No homework*
Tue	Feb 20	Lecture		
Thu	Feb 22	Lecture		
Fri	Feb 23		*10:00pm*	*Homework due*

Unit 2: Modeling with Markov chains

Tue	Feb 27	No lecture: February break		
Thu	Feb 29	Lecture		
Fri	Mar 1		*10:00pm*	*Mini-homework due*
Tue	Mar 5	Lecture		
Thu	Mar 7	Lecture		
Fri	Mar 8		*10:00pm*	*Homework due*
Tue	Mar 12	Lecture		
Thu	Mar 14	Lecture		
Fri	Mar 15		*10:00pm*	*Homework due*
Tue	Mar 19	Lecture		
Thu	Mar 21	Lecture		
Fri	Mar 22		*10:00pm*	*Mini-homework due*
Tue	Mar 26	Lecture	***7:30pm***	***Prelim exam***
Thu	Mar 28	Lecture		
Fri	Mar 29			*No homework*

Unit 3: Beyond simple Markov chains

Tue	Apr 2	No lecture: spring break		
Thu	Apr 4	No lecture: spring break		
Fri	Apr 5			*No homework*
Tue	Apr 9	Lecture		
Thu	Apr 11	Lecture		
Fri	Apr 12		*10:00pm*	*Mini-homework due*
Tue	Apr 16	Lecture		
Thu	Apr 18	Lecture		
Fri	Apr 19		*10:00pm*	*Homework due*
Tue	Apr 23	Lecture		
Thu	Apr 25	Lecture		
Fri	Apr 26		*10:00pm*	*Homework due*
Tue	Apr 30	Lecture		
Thu	May 2	Lecture		
Fri	May 3		*10:00pm*	*Homework due*
Tue	May 7	Lecture		
Thu	May 9	No lecture: study period		
Fri	May 10			*No homework*
TBA				***Final exam***

Course management and policies

Exams There are two exams, a prelim and a final (see § Schedule). **If you cannot make a scheduled exam date, please let the course staff know as soon as possible.**

Exams are closed-book, but you may bring a single double-sided letter-paper-size review sheet. The review sheet must be your own original work. You will turn your review sheet in along with your exam, so please put your name and NetID on it.

Websites & and announcements There are three websites used by the course.

- *Canvas:* This is the main hub for accessing course materials, such as homework handouts. Major announcements, e.g. updates to exam logistics, will be posted here. Access at `https://canvas.cornell.edu/courses/59697`.
- *Gradescope:* This is a portal for viewing homework due dates and turning in homework. Access via Canvas or at `https://www.gradescope.com/courses/717271`.
- *Ed Discussion:* This is a discussion forum for asking questions about the course. Minor announcements, e.g. correcting typos in homework problems, will be posted here. Access at via Canvas or at `https://edstem.org/us/courses/54663/discussion/`.

Large language models **Using large language models such as ChatGPT to generate solutions is prohibited.** Large language models are an exciting technology, but achieving the learning outcomes relies on you thinking through homework problems yourself. The point of this course is not to produce solutions to probability problems, but rather to change the way you think about probability. That change only happens if *you* produce the solutions.

Using AI-based grammar and style checkers is allowed. For example, you may use Grammarly provided you do not use GrammarlyGO.

Inclusion Students in this course come from a variety of backgrounds, abilities, and identities. To promote learning for all, each member of this course is expected to contribute at all times to an inclusive and respectful environment in and out of class.

We value your participation in the course—you belong here, and we want you to be here! If you are not finding the course to be an inclusive environment, please let the course staff know or instructor know. We sincerely value your feedback.

Accommodations for students with disabilities Your access in this course is important. Please give me your Student Disability Services (SDS) accommodation letter early in the semester so that we have adequate time to arrange your approved academic accommodations. If you need an immediate accommodation for equal access, please send an email message to me and/or SDS at `sds_cu@cornell.edu`. If the need arises for additional accommodations during the semester, please contact SDS.

Academic integrity Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. The complete code is available at `https://`

theuniversityfaculty.cornell.edu/dean/academic-integrity/. Violations of the code may result in failing the course, or a zero on the relevant homework or exam.

Course materials are the intellectual property of the instructor. You may not publish or post course materials in any form without the express permission of the instructor, including to websites like Chegg and CourseHero. Buying or selling of course materials is prohibited.