

COLLEGE OF ARTS AND SCIENCES

Syllabus: STAT 6540 Applied Stochastic Processes Spring 2024

Course overview

Instructor

Instructor: Shili Lin
Email ad dress: shili@stat.osu.edu
Class website: <u>http://carmen.osu.edu</u>
Lectures: Baker Systems 260, Wednesdays and Fridays, 9:35 – 10:55 AM
Office hours: Wednesdays 3:00 – 4:00 PM and Fridays, 2:00 – 3:00 PM; Cockins Hall 440K

Grader

Mr. David Angeles; email: angeles.6@osu.edu; OH: Fridays, 11 AM – 12 Noon; Cunz Hall 305E

Course description

An introduction to some of the commonly encountered stochastic processes, including Markov chains and population processes. Both discrete-time and continuous-time stochastic processes will be covered. Basic theory as well as applications will be discussed. **Prerequisites:** 6301, or permission of instructor.

Course learning outcomes

By the end of this course, students should be able to:

- Understand some common types of stochastic processes.
- Master techniques for answering questions pertaining to a set of selected common stochastic processes.
- Work proficiently with discrete-time Markov chains; understand transition probability matrix, convergence, and stationary and limiting distributions.

• Gain familiarity with a number of continuous-time stochastic processes, including Poisson processes, branching processes, and birth and death processes.

Course materials

Required text

Taylor and Karlin (1998) An Introduction to Stochastic Modeling, 3rd Edition. Academic Press (electronic, on Carmen)

Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <u>https://ocio.osu.edu/help/hours</u>, and support for urgent issues is available 24x7.

- Self-Service and Chat support: <u>http://ocio.osu.edu/selfservice</u>
- Phone: 614-688-HELP (4357)
- Email: <u>8help@osu.edu</u>
- TDD: 614-688-8743

Grading and faculty response

Homework and Exams

Assignment or category	Percentage	
Participation	5	
Homework	25	
Midterm Exam	30	
Final Exam	40	
Total	100	

Participation. Students are expected to participate in various activities throughout the semester, including surveys, feedback, and discussions.

Homework. There are (approximately) weekly homework assignments throughout the semester. You may discuss with other students, but DO NOT simply copy any part of someone else's work or solutions from any other sources. *Violations will be treated as academic misconducts and will be referred to the Committee on Academic Misconduct for investigation.* You are encouraged to talk to the instructor and the grader if you have questions after serious attempts have been made to work on an assignment. The lowest score will be dropped from the final grade calculation.

Exams. There is one in-class midterm, tentatively scheduled to be on March 1, 2024; any date changes will be communicated well in advance. The exam will be closed book, but *one* 8.5" X 11" sheet of notes (double-sided) may be used for the exam. The final exam will take place according to the schedule posted by the University Registrar. The exam will also be closed book, and you are allowed *two* 8.5" X 11" sheets of notes (double-sided). A basic calculator is permitted; however, using a cell phone, tablet, laptop, or any other communication device for this purpose is not permitted.

Logistics and policies. Homework will be submitted through the class website. Typically, no late homework will be accepted, and no make-up exams will be given. However, if you are unable to complete an assignment on time or have an emergency that prevents you from taking the exams on the dates specified, please get in touch with the instructor as soon as possible so that a solution can be worked out ahead of time.

Faculty feedback and response time

Grading and feedback

Sample solutions to homework assignments will be posted soon after all the papers are submitted. You can generally expect feedback within **7 days**, but there may be exceptions (e.g. grader has her own exam in a particular week).

E-mail

The instructor will reply to e-mails within **24 hours on weekdays**.

Other course policies

Student academic services

Student academic services on the OSU main campus: http://advising.osu.edu/welcome.shtml.

Student support services

Student support services offered on the OSU main campus: <u>http://ssc.osu.edu</u>.

Academic integrity policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <u>http://studentlife.osu.edu/csc/</u>.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e.,

committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu

Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Land Acknowledgement

We would like to acknowledge the land that The Ohio State University occupies is the ancestral and contemporary territory of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. Specifically, the university resides on land ceded in the 1795 Treaty of Greeneville and the forced removal of tribes through the Indian Removal Act of 1830. I/We want to honor the resiliency of these tribal nations and recognize the historical contexts that has and continues to affect the Indigenous peoples of this land.

More information on OSU's land acknowledgement can be found at <u>https://mcc.osu.edu/about-us/land-acknowledgement</u>

Your mental health

As a student you may experience a range of issues that can cause barriers to learn, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Religious accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief. Students planning to use religious beliefs or practices accommodations for course requirements and the formation of the statement of the second statement

must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course

requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates, exam dates or the methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

Accessibility accommodations for students with disabilities

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** <u>slds@osu.edu</u>; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This course requires use of CarmenCanvas (Ohio State's learning management system) and other communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

<u>Canvas accessibility (go.osu.edu/canvas-accessibility)</u>

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds@osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Course schedule (tentative)

Note: Reading assignments are from the text by Taylor and Karlin: An Introduction to Stochastic Modeling, 3rd Edition.

Week	Dates	Topics	Assigned Readings
1	1/10, 1/12	Introduction to stochastic processes and review	Ch 1 and Ch 2
2	1/17, 1/19	Random sum; Stochastic processes	Ch 2, Sec 3, 4.
3	1/24, 1/26	Markov chain; N-step transition probabilities	Ch 3, Sec 1-5
4	1/31, 2/2	Markov chain and examples	Ch 3, Sec 6, 7
5	2/7, 2/9	Markov chain and examples	Ch 3, Sec 8
6	2/14, 2/16	Branching processes; Limiting distribution	Ch 4, Sec 1, 2
7	2/21, 2/23	Operation research and other examples	Ch 4, Sec 2, 3
8	2/28, 3/1	Classification of states	Ch 4, Sec 3, 4
8	3/1	Midterm (tentative)	
9	3/6, 3/8	Poisson processes	Ch 5, Sec 1, 2
10	3/13, 3/15	Spring break – no classes	
11	3/20, 3/22	Poisson processes and associated distributions	Ch 5, Sec 1-3
12	3/27, 3/29	Spatial point processes and simulating PP	Ch 5, Sec 3, 4
13	4/3, 4/5	Continuous time MC; Birth/Dead Processes	Ch 6, Sec 1-3
14	4/10, 4/12	Transition probability functions; sojourn time	Ch 6, Sec 4-6
15	4/17, 4/19	Introduction to Martingale, Brownian Motion, and Gaussian Processes	Ch 8, Sec 1.
	4/24	Final Exam; Wednesday, 10:00 am – 11:45 am	