THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

Syllabus: STAT 6540
Applied Stochastic Processes
Spring 2021

Course overview

Instructor

Instructor: Shili Lin
Email address: shili@stat.osu.edu
Class website: http://carmen.osu.edu
Lectures: Via CarmenZoom: Mondays and Wednesdays, 9:45 – 11:15 AM
Office hours: Via CarmenZoom: Mondays, 11:15 AM – 12:15 PM
Wednesdays, 1:00 PM – 2:00 PM

Grader

Mr. Shawn Chen; email: chen.4747@osu.edu; OH: TBA

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 https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

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

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen

Technology skills necessary for this specific course

- CarmenZoom

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Course delivery

We will meet at our regularly scheduled class time throughout the semester for most of the lectures through CarmenZoom. Recorded lectures will be posted soon after on class website. For certain topics, lectures may be pre-recorded and posted for asynchronous learning – learn at your own speed and at a time of your choosing – such as solving selected problems. **Detailed instructions for asynchronous learning will be posted prior to the commencing of such activities.**

The instructor will hold weekly office hours – times as given above – via CarmenZoom.

Grading and faculty response

Homework and Exams

Assignment or category	Percentage
Homework	25
Midterm Exam	30
Final Exam	45
Total	100

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. 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 10, 2021; any date changes will be communicated well in advance. The exam will be closed book, but formulas deemed necessary will be provided on the exam. Each exam will be proctored through webcam. The final exam will take place according to the schedule posted by the University Registrar. It will follow the same procedure and rules as for the midterm exam.

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. For the exams, you need to work independently without any forms of assistance (from the internet, books, notes, or other people) or communication with anyone except the proctor. A basic calculator is permitted; however, using a cell phone, tablet, laptop or any other communication device for this purpose is not permitted.

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 his/her own exam in a particular week).

E-mail

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

Attendance, participation, and discussions

Student participation requirements

For lectures that are delivered synchronously, you are encouraged to join the live lectures and participate in discussions. If you have to miss a live lecture, you are responsible for learning the materials discussed in the recorded lectures, and you may ask questions during virtual office hours.

Since we have approximately weekly homework, be sure that you log in to the course in Carmen each week, but most likely, you will probably need to log in many times each week. If you have a situation that might cause you to miss an entire week of class, please communicate with the instructor as soon as possible.

Discussion and communication guidelines

The following are expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should not use text lingo.
- **Tone and civility**: We need to strive to create a supportive learning community where everyone feels safe and people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. (For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.)
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Other course policies

Health and safety

The Ohio State University Wexner Medical Center's Cornavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff. Guidelines and requirements for campus safety from the University's COVID-19 Transition Task Force were published on July 1 on the Safe and Healthy website (https://safeandhealthy.osu.edu).

Potential disruptions to instruction

If the instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing, a new instructor will be assigned to the course. Details will be given on the course website.

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: http://ssc.osu.edu.

Academic integrity policy

- **Reusing past work**: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- **Falsifying research or results**: All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.
- **Collaboration and informal peer-review**: While study groups are encouraged, remember that copying solutions from another student or from any other sources is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

Ohio State's 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 and 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 http://studentlife.osu.edu/csc/.

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

Accessibility accommodations for students with disabilities

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.

Accessibility of course technology

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

- Carmen (Canvas) accessibility
- Streaming audio and video
- Synchronous course tools

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, 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 through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

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.

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	1/11, 1/13	Introduction to stochastic processes and review	Ch 1 and Ch 2
2	1/20	Random sum	Ch 2, Sec 3, 4.
3	1.25, 1/27	Markov chain and examples	Ch 3, Sec 1-3
4	2/1, 2/3	First-step analysis, Gambler's ruin problem	Ch 3, Sec 4, 5
5	2/8, 2/10	Absorbing Markov chain	Ch 3, Sec 6, 7
6	2/15, 2/17	Branching processes; Limiting distribution	Ch 3, Sec 8, Ch 4
7	2/22	Regular matrix, stationary/limiting distributions	Ch 4, Sec 1
8	3/1, 3/3	Operation research and other examples	Ch 4, Sec 2
9	3/8	Classification of states	Ch 4, Sec 3
9	3/10	Midterm (tentative)	
10	3/15, 3/17	Ergodic/limit theorems	Ch 4, Sec 4
11	3/22, 3/24	Poisson processes and associated distributions	Ch 5, Sec 1, 2
12	3/29, 4/2	Spatial point processes and simulating PP	Ch 5, Sec 3, 4
13	4/5, 4/7	Continuous time Markov chain	Ch 6, Sec 1-3
14	4/12, 4/14	Population processes – birth and dead process	Ch 6, Sec 3-5
15	4/19, 4/21	Transition probability functions; sojourn time	Ch 6, Sec 6
	4/27	Final Exam; Tuesday, 10:00 am – 11:45 pm	