

Western University
STATISTICAL SCIENCES 4654A 2018-2019
Markov Chains with Applications

Instructor Information

Instructor: Dr. Azaz Sharif

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Office hours: Tues at 3:00 pm to 4:00 pm and Fri at 10 am to 11 am at WSC#105, or by appointment
** Any changes to these hours will be announced in class and posted under Announcements on our OWL site.

Lecture Hours: Mon, Tue, Wed 4:30 pm to 5:30 pm/TC#204

Course Information

Course Description: Continuous-time Markov chains, applications to phase-type distributions, Markov chain Monte Carlo simulation and queuing theory.

Prerequisites: SS3657A/B A minimum mark of 60% in Statistical Sciences 3657A/B. A minimum mark of 60% in Statistical Sciences 3657A/B.

Antirequisites: The former Statistical Sciences 3652A/B, former Statistical Sciences 4652A/B, former Statistical Sciences 4657A/B and former Statistical Sciences 4737A/B.

Warning: Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. You can be deregistered at any time even after writing the final exam. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Course Website

Please check OWL (Online Western Learning) regularly for lecture notes, exam materials and announcements. A copy of this course outline is posted.

Course Textbook

Textbook: Introduction to Probability Models, 11th edition, by Sheldon M. Ross (Academic Press).

Course Objectives

Following a brief review of discrete time Markov chains, this course provides a thorough treatment of the theory and application of continuous time Markov chains, including phase-type distributions. Students will become familiar with Markov Chain Monte Carlo methods. A substantial part of the course pertains to the application of both discrete-time and continuous-time Markov chains to model queues. In addition to the theory of queues, students will gain insight regarding how congestion manifests itself in single-server and multi-server queues under first-come, first-served (FCFS) and priority arrangements. Networks of queues will be considered as well. The role of occupancy and variability on the degree of congestion will be analyzed, as well as the impacts of pooling of service resources and priority queueing arrangements. Motivating examples will be drawn from call centres and health care applications.

A Rough Timeline of Materials to be Covered

Review of discrete time Markov chains (Chapter 4), strong and weak convergence (2 weeks)

Markov chain Monte Carlo methods (section 4.9 and supplements) (1 week)

Continuous time Markov chains (Chapter 6), including Phase-type distributions (5 weeks)

Theory and application of queues (Chapter 8 and supplemental notes) (5 weeks)

Assessments

Assignments (10%)

There will be four or five assignments at roughly two-week intervals, worth 10% of the final grade.

Participations (5%)

5% of the course grade will be allocated to classroom involvement

Midterm Exam (35%)

In class on September 10th, it will be decided whether to have a single two-hour midterm test roughly midway through the course (LATER IN OCTOBER), or two one-hour tests at roughly monthly intervals. Majority rule will decide this. In total, midterm evaluation will be worth 35% of the final grade

	Date	Time	Location
Midterm Test	TBA	TBA	TBA

Final Exam (50%)

The date and time for the 3-hour final exam will be announced by the registrar's office, usually near the first part of November. Students are required to wait until the final exam schedule is posted before making arrangements for travel over the Christmas period. Exams will not be moved to accommodate students who ignore this requirement.

Evaluation

Your course grade will be determined using the following marking scheme:

Assessments	Weight
Participation	5%
Assignments	10%
Midterm Test	35%
Final Exam	50%

Calculator Requirement

Students should bring a non-programmable calculator to midterm test and final exam. **It is the best practice to carry a non-programmable calculator with you all time during the term.**

Department Policy on Missed Course Requirements

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible.

A student requiring academic accommodation due to illness must use the Student Medical Certificate (student.uwo.ca) when visiting an off-campus medical facility.

For further information, please consult the university's medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

Missed Midterms: The policy of the department of Statistical and Actuarial Sciences is that there will be no make-up exams for missed midterms or tests. If recommendation for accommodation is received from your Dean's office, the weight of the missed midterm will be reassigned to the final exam. If no recommendation is received, then you will receive a mark of 0 for your midterm.

Missed Final Exam: If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (the name given by the university to a make-up Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

Student Health and Wellness

As part of a successful student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (undergraduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html.

To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: http://www.health.uwo.ca/mental_health/module.html. This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.

Accessibility

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 if you have questions regarding accommodation.

Support Services

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.

E-mail Communication

You are welcome to communicate with your instructor by email, **but email communication should only be used to provide them with information or to ask a question that requires a brief response.** For more lengthy discussions and for discussions on lectures/course material please see your instructor during their scheduled office hours or by appointment. If you do email them, please use your UWO account, as these are often the only e-mails read.

Attendance

Classroom attendance is viewed as an important part of the learning process. Students are advised that excessive absenteeism may result in the student being disbarred from the final exam (see Western Academic Calendar).

Classroom Environment

The Department has adopted a “Mutual Expectations” policy governing the classroom environment and all work submitted by students. The full text of the policy can be found at: <https://www.uwo.ca/stats/undergraduate/mutual-expectations.html>. In summary, the policy was developed under the premise that all interactions between students and faculty should be governed by the principles of courtesy, respect and honesty.

