

Course Outline

MATH/STAT 452/552: Stochastic Processes/Applied Stochastic Models

Instructor(s)

Lecturer Farouk S. Nathoo, Associate Professor

Research Area Biostatistics, Neuroimaging Statistics, Bayesian Methods, High-Dimensional Data

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General Course Information

Number of Units 1.5

Pre-requisites MATH 352 or STAT 350

Office Hours and Assistance

Wednesday 4:30 pm to 5:30 pm, CLE A307

Thursday 4:30 pm to 5:30 pm, CLE A307

By appointment (send email to book one)

Math Club Students in Undergraduate Mathematics and Statistics (SUMS) was founded in 2014 as the reincarnation of a previous undergraduate course union that had been inactive for a few years. Please see <http://www.uvic.ca/science/math-statistics/current-students/undergraduate/sums/index.php> for more information.

Learning Objectives

- Modeling systems with stochastic processes
- Learn the mathematics behind stochastic modeling
- Become familiar with the theories of discrete and continuous Markov chains, the Poisson process, renewal theory, random walks and Brownian motion

Course Materials and Online Resources

Textbook Textbook Sheldon M. Ross, Introduction to probability models 10th, Academic Press. [Earlier Editions, 9th or even 8th, are OK]. Just make sure that the topics covered in class are included. You can purchase a new or used copy from the bookstore.

Calculator If a calculator is allowed in tests and examinations in a course offered by the Department, then the only acceptable calculator is the Sharp EL-510, EL-510RN or EL-510RNB models. It may be purchased at the UVic Bookstore or elsewhere for about \$12. A calculator is permitted in this course.

Class Meetings

The class meets Monday, Wednesday and Thursday 3:30pm – 4:20pm in Clearihue A307. The course has no tutorials.

Specific Topics

- Introduction: General review of probability theory and random variables (Chaps. 1 & 2)
- Topic Conditional probability and conditional expectation (Chap 3.): Computing expectations, variances, and probabilities by conditioning, compound random variables, and some applications.
- Markov chains (Chap. 4): Transition probability matrix and Chapman-Kolmogorov equations, Transient and recurrent states, Random walk, Stationary distribution (limiting probabilities), Mean time spent in transient states, Branching Processes, Time reversible Markov Chains, Markov Chain Monte Carlo.
- The exponential distribution and the Poisson process (Chap. 5): Exponential distribution, Counting process, Interval and waiting times, Conditional distribution of arrival times.
- Continuous-Time Markov Chains (Chap. 6): Definition, Birth-death process, Transition probability function, Limiting probabilities, Time reversibility.
- Renewal theory (Chap 7.): Limit theorems, Renewal reward process, Alternating renewal processes, Applications (Patterns and Insurance ruin problem).
- Brownian Motion and Stationary processes (Chap. 10): Hitting times, Drift and Geometric BM, Pricing Stock options, White Noise, Gaussian Processes.

Evaluation and Grading

There will be a maximum of six homework assignments consisting of 4-5 problems (similar to those in the book) that will be handed out every two weeks of so. There is also one midterm and one final exam. The assignments will have additional questions and readings for graduate students enrolled in STAT 550.

Your final percentage grade will be computed according to the following scheme.

Homework Assignments	Midterm Exam	Final Exam
Bi-weekly	Thurs. Oct. 11	TBA
50%	20%	30%

Missing work If you miss the midterm for a valid documented medical reason then the final will count 50%. No makeup midterm will be provided. Assignments are due in class on the date specified in class. Late assignments are not accepted without valid reason.

Accessibility Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Centre for Accessible Learning (CAL) as soon as possible. The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations <http://uvic.ca/cal>. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Grading Percentage scores will be converted to letter grades according to the university-wide standard table

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/grading.html>

Graduate: <http://web.uvic.ca/calendar/grad/academic-regulations/grading.html>)

Final Examination Off-schedule final examinations (i.e., deferred examinations) are given only in accordance with the university policy as outlined in the Calendar. If you are unable to write a final examination due to illness, accident or family affliction, please refer to the following webpages for detailed instructions how to proceed:

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/concessions.html>

Graduate: <http://web.uvic.ca/calendar/grad/registration/concessions.html>

Students are strongly advised not to make plans for travel or employment during the final examination period as special arrangements will not be made for examinations that conflict with such plans.

Supplemental Examinations. The Department of Mathematics and Statistics does not award 'E' grades or offer Supplemental Examinations in any of its courses.

Policies and Ethics

Attendance The University Calendar states 'Students are expected to attend all classes in which they are enrolled.' Our courses are conducted on that basis. If you miss an announcement (information concerning midterms, corrections to assignment, etc.) because you did not attend class, you must accept the consequences of not having learned of the change.

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/attendance.html>

Graduate: <http://web.uvic.ca/calendar/grad/academic-regulations/attendance.html#>

Guidelines on Religious Observances Where classes or examinations are scheduled on the holy days of a religion, students may notify their instructors, at least two weeks in advance, of their intention to observe the holy day(s) by absenting themselves from classes or examinations. Instructors will provide reasonable opportunities for such students to make up work or missed examinations.

Academic Integrity Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offenses.

The responsibility of the institution

Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student

Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the students transcript, or a suspension.

It is your responsibility to understand the University's policy on academic integrity:

Undergraduate: <http://web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html>

Graduate: <http://web.uvic.ca/calendar/grad/academic-regulations/academic-integrity.html>

How to Succeed in This Course

Work hard and put a lot of effort into the assignments. Come to office hours to discuss the problems.



Course Schedule (Dates are approximate)

Week of	Lecture
03/09/2018	Review and course outline
10/09/2018	Conditional probability and conditional expectation
17/09/2018	Markov chains Last day for adding courses that begin in the Fall term: September 21, 2018
24/09/2018	Markov chains
01/10/2018	Exponential distribution and Poisson process
08/10/2018	Continuous time Markov chains
15/10/2018	Continuous time Markov chains
22/10/2018	Continuous time Markov chains
29/10/2018	Renewal theory Last day for withdrawing from second-term courses without penalty of failure: 31/10/2018
05/11/2018	Applications
12/11/2018	Reading Break, no classes on November 12 through November 14, 2018
19/11/2018	Limit of a random walk
26/11/2018	Brownian Motion
03/12/2018	Applications Last day of class: 05/12/2018 Exam Period begins: 08/12/2018 Exam Period Exam Period ends: 22/12/2018