

STAT 461 (MAST 729/MAST 881), Sec. G
Statistical Simulation
Winter 2025

- Instructor:** Dr. A. Sen
Email: arusharka.sen@concordia.ca
- Preface:** This course will be offered in person (Tue+Thu, 13:15–14:30). However, assignments will be posted on Moodle, and students will have to upload their solutions on Moodle as well.
Note: There will be a mid-term break from February 24 to March 2.
- Office Hours:** Wednesdays, 14:00–15:30 (in person). Students can also send questions via email. Note that the system does not allow one to reply to an email sent from Moodle. Thus, emails should be sent from one's own emailer, not Moodle. Note, however, that if you missed a class it is not reasonable to expect your professor to cover the missed material for you.
- Text:** *Simulation*, 5th Edition, by Sheldon M. Ross (Academic Press): available for download as eBook on Library website via Concordia Netname log in.
<https://concordiauniversity.on.worldcat.org/oclc/818733978>
- Objectives:** This course is an introduction to the methods of *simulation* and *Monte Carlo* techniques. In Simulation, we consider joint distributions of random variables, and more generally, stochastic models describing systems in economy, industry, insurance etc., which essentially are specifications of complex joint distributions; we then *generate* (pseudo) values of those variables using appropriate algorithms to study the models. Monte Carlo techniques are statistical methods for estimating, based on repeated simulations, various quantities of interest related to the models, which are difficult to compute theoretically. In Part I of the course, we shall review basic probability theory and study methods for generating random variables. In Part-II we shall study simulation of a few complex systems and their estimation using Monte Carlo methods.
- Content:** Part I: Review of Probability Theory (Ch. 2), Random Numbers (Ch. 3), Generating Discrete Random Variables (Ch. 4), Generating Continuous Random Variables (Ch. 5).
Part II: Discrete Event Simulation (Ch. 7), Statistical Analysis of Simulated Data (Ch. 8), Variance Reduction Methods (Ch.9).

Assignments: There will be 4 or 5 assignments, to be posted on, and returned via, Moodle. Most of the assignments will involve use of the software **R** that will be demonstrated during one or two classes. A freely downloadable student version can be found at <http://www.r-project.org>. A useful reference is the book, *A first course in statistical programming with R*, 2nd Edition, by W. John Braun and Duncan J. Murdoch (Cambridge University Press).

There will be some separate questions for undergraduate and graduate students in the assignments and exams.

Midterm Test: Exam date: **Thursday, 6 March 2025 (in class)**. The midterm test, based on the material of Weeks 1-6, will contribute up to 25% of your final grade (see the Grading Scheme below).

NOTE: It is the Department's policy that tests missed for any reason, **including illness**, cannot be made up. If you miss the midterm test because of illness (*medical note required*) the final exam will count for 85% of your final grade, and the assignments will count for the remaining 15%.

Final Exam: The final examination will be in person.

NOTE: Students are responsible for finding out the date and time of the final exams once the schedule is posted by the Examinations Office. Conflicts or problems with the scheduling of the final exam must be reported directly to **the Examinations Office, not to your instructor**. It is the Department's policy and the Examination Office's policy that students must be available to take the final exam on the selected date and time. Conflicts due to travel plans will not be accommodated.

Final Grade:

- a) Assignments (15%)
- b) Midterm test (25%)
- c) Final examination (60%)

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

IMPORTANT: **PLEASE NOTE THAT THERE IS NO "100% FINAL EXAM" OPTION IN THIS COURSE.**

Student Services

You may wish to access the many services available to you as a Concordia student. An overview of these resources can be found here: <https://www.concordia.ca/students/services.html>

Academic Integrity and the Academic Code of Conduct

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to

students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: <https://www.concordia.ca/conduct/academic-integrity.html>" [Undergraduate Calendar, Sec 17.10.2]

Behaviour

All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the [Code of Rights and Responsibilities](#) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

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Extraordinary circumstances

In the event of extraordinary circumstances and pursuant to the [Academic Regulations](#) the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.