Department of Mathematics & Statistics
Concordia University

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STAT 461 (MAST 729), Sec. CA
Statistical Simulation
Summer 2020

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Instructor: Dr. A. Sen
Email: arusharka.sen@concordia.ca

Text: *Simulation*, 5th Edition, by Sheldon M. Ross (Academic Press): *available for download as e-book on Library website via Concordia Netname log in*.

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.

Lecture: **Mon + Wed 10:15 – 12:45** via Zoom; link will be available on Moodle; *first* lecture Mon, 29 June, *last* lecture Wed, 12 August 2020.

Office hours: **Wed 16 – 18:00** via Zoom (*subject to change*); via email, anytime; **please send email from your email account, not from Moodle.**

Final Grade: **Midterm** (*Wed, 22 July 2020*) 30% + **Final** 60% + **Assignments** (4) 10%. Assignments and exams will all be <u>take-home</u> and posted on Moodle; once posted, *assignments* will be due in a week, *midterm* in 3 hours (tentative), *final*: to be decided. There will be a few separate questions for undergraduate and graduate students in the assignments and exams.

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.

Assignments: Most of the assignment and exam questions will involve use of the software R that will be demonstrated during one or two classes. R is installed on the PCs in the Department's Computer Lab, and a freely downloadable 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).

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).

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: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*