Monte Carlo Methods and Financial Applications 2019/2020

Financial Modelling 9593B Section 001

Course Outline

Instructor Information

Instructor  Hao Yu
Office      WSC 217
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Phone       519-661-3622 ext 83622
Office Hours Wed,Fri 9:00 AM-10:30 AM;

Course Information

Course Description  This course is intended to be an introduction to Monte Carlo simulation methods. Topics to be covered include i) random number generation for uniform, non-uniform, discrete and continuous distributions; ii) simulation of stochastic processes; iii) variance reduction techniques; and iv) special topics as time allows. The use of simulation in financial applications, including derivatives pricing, will be emphasized.

Prerequisites  A third-year undergraduate understanding of probability and statistics is required for this course. Students should be comfortable with commonly used univariate and multivariate distributions, expectations (including variance and covariance), transformation of variables, linear regression, estimation, and basic statistical tests. The ability to program in a quantitative programming environment such as MATLAB and R is also required. It would be helpful (although not necessary) to have basic knowledge of ordinary and partial differential equations, stochastic processes, stochastic differential equations, and Ito calculus. As most of the examples are from financial applications, some knowledge of finance and derivatives pricing would also be useful.

Antirequisites  A graduate course in Monte Carlo methods.
Pre,Co-requisites  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
Warning

Lecture Hours  Mon,Wed,Fri 1:30 PM-2:30 PM WSC 248;

Book Information

Text Book(s)

Reference Books
Course Objectives

This course is intended to be an introduction to Monte Carlo simulation methods. Topics to be covered include

1. Random number generation (RNG) for uniform, non-uniform, discrete and continuous distributions
   How to check RNG quality.
2. Simulation of stochastic processes
   Introduce some R packages to simulate SDE.
3. Variance reduction techniques
   Many techniques are introduced.
4. Special topics as time allows

The use of simulation in financial applications, including derivatives pricing, will be emphasized.

Assessment

Assignments and/or Quizzes

There will be approximately 5 assignments

Midterms or Tests

2-hour test: in Feb (TBA)

Final Exam

Final exam: TBA

Evaluation

Students will be evaluated on the basis of assignments (40%), a midterm (20%) and a final exam (40%).

Department Policy on Missed Course Requirements and Student Health and Wellness

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation like self-report channel to your Dean's office as soon as possible, and contact your instructor immediately. If accommodation is approved by your Dean's office, your instructor will be notified, then it is your responsibility to make alternative arrangements with your instructor. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see: http://fisher.stats.uwo.ca/accommodation_medical.pdf. A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility. The form can be found at: http://fisher.stats.uwo.ca/medicalform.pdf. Or, request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services.

Missed Midterm or Test: The policy of the department of Statistical and Actuarial Sciences is that there will be no make-up exams for a missed midterm. For those that do legitimately miss a midterm and provide the required supporting documentation, the standard practice will be that the weight of the midterm will be reassigned to the final exam. If your reason is not deemed valid, then you will receive a mark of 0.

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 (graduate 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: https://www.uwo.ca/health/mental_wellbeing/education/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 661-2111 ext. 82147 if you have questions regarding accommodation.

**Support Services:** Learning-skills counsellors at the Student Development Centre (SDC) (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.

Additional student-run support services are offered by the USC, http://westernusc.ca/services. The website for Registrarial Services is http://www.registrar.uwo.ca.

**Email 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 emails read (as emails sent from other addresses often get spammed).

**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: http://www.stats.uwo.ca/mutual_expectations.pdf. 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. Students who are in emotional/mental distress should refer to Mental
Health@Western http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.