

Business 9882 – Statistical Analysis and Predictive analytics

Winter 2025

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Wednesdays 8:00 am – 11:00 am
Location: IVEY 2348
(12 Sessions)

COURSE DESCRIPTION

We continuously make decisions and most often, those decisions are to be made under uncertainty, i.e., some of the aspects of that decision-making problem are not known in advance. Prediction and optimization under uncertainty are pivotal in navigating the complexities of modern decision-making. By utilizing predictive models, we can foresee future events, allowing us to plan ahead rather than just react. Optimization techniques, when combined with uncertainty, allow for robust and resilient planning, ensuring that solutions remain effective even under varying conditions. This approach enhances efficiency, minimizes risks, and maximizes opportunities across various fields such as finance, healthcare, and engineering.

The aim of the course is to introduce the students to the theoretical and practical frameworks of making decisions under uncertainty. It explores the concepts of uncertainty and prediction in various fields, focusing on the mathematical and computational methods used to quantify uncertainty and make predictions. The course has a strong focus on prediction, modelling, Monte Carlo simulation, as well as optimization.

COURSE OBJECTIVES

This course demonstrates to students how predictive analytics can model uncertainty and how these models can be solved by optimization methods:

- The students will analyze decision problems in various applications to point out uncertainties and understand what effect these uncertainties can have on the decision.
- The goal of the course is to introduce students to the use of prediction and statistical analysis to quantify and simulate uncertainty and use that as an input to formulate and solve stochastic and robust optimization models.

- Students will learn software skills to model the uncertainty and provide predictions. They will also conduct and report experimental results.
- The course involves a project in which the student selects a problem in practice and is expected to perform modeling, analytical solution and output analysis.

COURSE ACTIVITIES / GRADING / METHODS OF EVALUATION / EXPECTATIONS / CLASS CONTRIBUTION / ATTENDANCE

20% Class Contribution

20% Assignments

20% Leading Content Discussion (Scribing, Exercises, and Code development)

40% Project

MATERIALS / REQUIRED READING

- The course mainly relies on the material that will be directly provided to the students, i.e., slides, code notebooks, etc.
- Additional optional resources:
 - Hillier and Liebermann, "Introduction to Operations Research" (McGraw Hill),
 - "Introduction to Stochastic Programming" from Birge and Louveaux

ACADEMIC OFFENCES: PLAGIARISM AND ACADEMIC INTEGRITY

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

SUPPORT SERVICES: HEALTH AND WELLNESS

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.

As part of a successful graduate 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 graduate 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.

STUDENT ACCESSIBILITY SERVICES

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are encouraged to register with Student Accessibility Services, a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both SAS and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction. For more information, see <http://www.sdc.uwo.ca/ssd>

DETAILED SESSION SCHEDULE

Week	Topic
1	Course introduction
2	Forecasting and Prediction
3	Forecasting and Prediction
4	Monte Carlo Simulation
5	Monte Carlo Simulation
6	Stochastic Optimization
7	Stochastic Optimization
8	Robust Optimization
9	Robust Optimization
10	Chance Constraint Optimization
11	Term Projects Presentations
12	Term Projects Presentations