

Business 9882 –Management Science Special Fields: Statistical Methodology Fall 2026

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Wednesdays, 9:00am – 12:00pm
12 Sessions
See Learn for Course Dates

Class on Wednesday Nov 25 is tentatively canceled. It will be tentatively replaced by a midterm test on Friday Nov 6 from 9 a.m. to 12 a.m. The Final Exam is tentatively scheduled for Wednesday December 16 from 9 a.m. to 12 a.m.

COURSE DESCRIPTION

Both theoretical and applied approaches to statistical learning will be introduced. The major objective is to provide an underpinning for research that involves statistical methodology. Topics will include Maximum Likelihood Estimation, Bayesian/Empirical Bayesian methods, Linear Models and Survival Analysis. Simulation techniques such as MCMC and bootstrap will be covered. Other topics including statistical learning via machine learning, basic neural nets, Bayesian neural nets, tree based methods and classification will be covered as time permits.

LEARNING OUTCOMES/OBJECTIVES

By the end of the course, students will have a clear overview knowledge of the most important statistical theories relevant for research and applications; a clear understanding of the differences between approaches such as frequentist statistics and Bayesian statistics; core computational methodologies such as MCMC and resampling; machine learning as applied to statistical problems.

Each student should come prepared to class and be ready to contribute both verbally and by demonstrating/presenting models, research papers and data set descriptions/analyses. Each student will be required to participate in every class and complete any assignments provided. Students should attend all classes. Contribution will be assessed on the best 9 out of 12 classes. This will allow for students missing classes where no contribution mark will be assigned.

METHODS OF EVALUATION

Contribution (15 points)

Discussion forms an important part of the course. You should be ready to contribute without having to be called upon. Being unprepared or not willing will result in negative points.

Individual/Group Assignments (15 points)

There will be three individual assignments (5 points each) after classes 3, 5 and 9. They are due by 9 a.m. the following Wednesday.

Student Presentations (20 points)

Each week, students will lead part of the class by presenting key statistical concepts, selecting a simple open-source dataset and demonstrating its application or presenting a research paper. Selection of the topics will be in conjunction with the instructor. The number of student presentations will depend on the number of students in the class. Evaluation will be based on clarity of the presentation and slides and on lecture content. Slides must be made available the night before class.

Mid-Term Exam (15 points)

Open notes. Open Book.

Final Project/Exam (35 points)

Open Notes. Open Book.

Upon approval from the instructor, it might be possible to substitute a project or case study for the final and/or mid-term exams. This is not guaranteed and depends on the instructor's evaluation of the potential of any project/case study.

MATERIALS/REQUIRED READING

- **Required textbook:** Simon N. Wood, *Core Statistics*, 1e, Cambridge University Press, April 2015. <https://www.cambridge.org/core/books/core-statistics/F303F4463E162C6534641616AE38C0A6>
Students are welcome to purchase second-hand or earlier editions of this textbook or use online versions
- *The Elements of Statistical Learning*, Hastie et al, 2e, Springer, 2017. Available online. <https://hastie.su.domains/ElemStatLearn/>

COURSE TIMELINE AND FORMAT

Classes are generally in-person. However, there might be some unforeseen circumstances that necessitate moving to Zoom. So always check your emails before class.

The following is the *tentative* outline of sessions. This may change depending on students' level of difficulty with the material

Session 1

Random Variables and Basic Distributions

- The Central Limit Theorem
- Chebyshev, Jensen's Inequality and the Law of Large Numbers
- The Multivariate Normal Distributions
- The Poisson Process
- R Basics

Session 2-3

- Methods of estimation. Maximum Likelihood. Method of Moments
- Resampling

Session 3-7

Regression Modelling: Linear models, logistic models, Poisson regression, ridge, lasso, shrinkage estimators, survival modeling, principal components. Tree based methods.

Session 7-10

Bayesian Modeling

- Improper priors
- Empirical Bayesian Approaches
- Markov Chain Monte Carlo

Sessions 11-12

Introduction to statistical learning via neural networks and machine learning, tree-based methods.

USE OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI)

Use of AI is permitted for assignments and preparation subject to the following:

Any use of GenAI tools in the preparation of assignments must be clearly acknowledged, including identification of the GenAI tool(s) used, an explanation of how they were used (e.g., brainstorming, outlining, drafting, editing, or summarization), and the extent to which GenAI-generated content appears in the final submission.

AI is not permitted during exams.

ENROLLMENT RESTRICTIONS

Enrollment in this course is restricted to graduate students in the Ivey PhD Program, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

ACADEMIC OFFENCES: PLAGIARISM AND ACADEMIC INTEGRITY

Scholastic offences are taken seriously and students are directed to read the Scholastic Offences policy, specifically, the definition of what constitutes a [Scholastic Offence](#).

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.

GENDER-BASED SEXUAL VIOLENCE SUPPORT

“Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts on the [Wellness and Wellbeing website](#). To connect with a case manager or set up an appointment, please contact support@uwo.ca.”

HEALTH AND WELLNESS SERVICES

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. See <https://www.uwo.ca/health>.

Students who are in emotional/mental distress should refer to [Mental Health Support at Western](#) for a complete list of options about how to obtain help.

ACCESSIBLE EDUCATION

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 strongly encouraged to register with [Accessible Education \(AE\)](#), a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AE 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 may include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.