Course Description

This course will develop advanced methods in linear algebra and introduce the theory of optimization. On the linear algebra side, we will study important matrix factorizations (e.g. LU, QR, SVD), matrix approximations (both deterministic and randomized), convergence of iterative methods, and spectral theorems. On the optimization side, we will introduce linear programming, gradient methods, and basic convex optimization. Additional topics may be included as time and interest permit.

Time and Location

MAT1850 (Fall 2021)   Tuesdays 12:00–13:00 and Thursdays 13:00–15:00   on Zoom

Course Instructors

Name	E-mail	Office	Office Hours
Yun William Yu	ywyu@math.toronto.edu	UTSG: BA 6252 / Zoom	By Appointment Only

Textbooks

Linear Algebra and Optimization with Applications to Machine Learning, Volume I: Linear Algebra for Computer Vision, Robotics, and Machine Learning, Jean Gallier and Jocelyn Quaintance (2020) [World Scientific](#)

Linear Algebra and Optimization with Applications to Machine Learning, Volume II: Fundamentals of Optimization Theory with Applications to Machine Learning, Jean Gallier and Jocelyn Quaintance (2020) [World Scientific](#)

The authors have graciously made PDFs available online: `https://www.cis.upenn.edu/~jean/gbooks/linalg.html`

Quercus

Announcements, homework assignments, and other important information will be posted on the course [Quercus](#) page, so you should check it regularly. Course material may not be reproduced or distributed without written permission of the instructor.

Prerequisites

Linear algebra, probability, algorithms

Homework Assignments

There will be 10 homework assignments that will be due weekly and will be assigned and collected on

Quercus. There will be no extensions to posted homework due dates. However, the lowest homework mark will be dropped.

Major Assessments

There will be a term paper. You will submit a typeset LaTeX report in the format of a short review article on a group of relevant papers or topics.

There will be an in-class presentation associated with the term paper. You will deliver a 15 minute presentation to your peers.

There will be an online final examination, date to be determined. The exam will be administered online, and it will be open-book, but it will be restricted to a 2-hour period. There will be a short 1-on-1 oral exit interview after the exam.

Marking Scheme

Your final grade is determined in the following way:

Assignments	40 %
Final Exam	30 %
Term paper	20 %
In-class Presentation	10 %

Communication

When emailing the instructor, please use your official University of Toronto email address and mention MAT1850 in the subject line. Note that a response will be forthcoming during normal business hours.

Zoom Lectures

Please be aware that all of the Zoom lectures will be recorded. If your camera is on, your likeness may be captured. These recordings will be shared internally within the University of Toronto network to your peers. Further instructions on how to access class recordings will be provided on Quercus.

Code of Behaviour / Plagiarism

The University of Toronto treats cases of academic misconduct very seriously. Academic integrity is a fundamental value of learning and scholarship at the UofT. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that your UofT degree is valued and respected as a true signifier of your individual academic achievement.

The University of Toronto's Code of Behaviour on Academic Matters outlines the behaviours that constitute academic misconduct, the processes for addressing academic offences, and the penalties that may be imposed. You are expected to be familiar with the contents of this document. Potential offences include, but are not limited to:

- In papers and assignments:

  - Using someone else's ideas or words without appropriate acknowledgement.
  - Submitting your own work in more than one course without the permission of the instructor.
  - Making up sources or facts.
  - Obtaining or providing unauthorized assistance on any assignment (this includes working in groups on assignments that are supposed to be individual work).

- On tests and exams:

  - Using or possessing any unauthorized aid, including a cell phone.
  - Looking at someone else's answers.
  - Letting someone else look at your answers.
  - Misrepresenting your identity.
  - Submitting an altered test for re-grading.

- Misrepresentation:

  - Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.
  - Falsifying institutional documents or grades.

All suspected cases of academic dishonesty will be investigated following the procedures outlined in the *Code of Behaviour on Academic Matters.* If you have any questions about what is or is not permitted in this course, please do not hesitate to contact an instructor. If you have questions about appropriate research and citation methods, you are expected to seek out additional information from an instructor or other available campus resources like the College Writing Centres, the Academic Success Centre,

or the U of T Writing Website.

Students must not distribute, in any form, any course materials to any third parties.

Accessibility

Students with diverse learning styles and needs are welcome in this course. Please feel free to approach the instructor or contact Accessibility Services (accessibility.services@utoronto.ca) so we can assist you in achieving academic success in this course.