

Course Description

This course covers the formulation and solution of applied problems. Sources of these problems are the fields of engineering, physics, computer science, chemistry, biology, medicine, economics, statistics, and the social sciences. In this course, we will focus on the mathematical underpinnings of modern data science. The core of the class will revolve around understanding high-dimensional space, matrix factorization, and probabilistic techniques. Topics may include Markov chains, streaming/sketching algorithms, clustering, spectral graph theory, random graphs, wavelets, graphical models, and computational topology. The precise topics will vary with the instructor and the interests of the class. This course forms the foundation for research in applied mathematics.

Time and Location

MAT1801 (Winter 2020) Tuesdays 12:00–14:00 and Thursdays 11:00–12:00 in BA6183

Course Instructors

<i>Name</i>	<i>E-mail</i>	<i>Office</i>	<i>Office Hours</i>
Yun William Yu	ywyu@math.toronto.edu	UTSG: BA 6252	Tuesday, 14:00-15:00 Thursday, 12:00-13:00
		UTSC: IC 343	Monday, 11:00-12:00

I are happy to meet with students outside of office hours if an appointment is made ahead of time.

Textbooks

Foundations of Data Science, Blum, Hopcroft, and Kannan (2020) [Cambridge University Press](#)
For an introduction to Python: *Learning Python*, 5nd Edition, Lutz (2013). [O'Reilly](#)

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, some programming experience.

Homework Assignments

There will be 11 homework assignments that will be due weekly and will be assigned and collected on Quercus. The homework questions will be a mix of theory and implementation. I recommend using

Python for implementation, but will accept R or C/C++. If you wish to do an implementation in any other language or framework, please clear it with me beforehand. Notably, I will not be accepting MATLAB implementations in this course, unless you present a very compelling reason.

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

Major Assessments

There will be one in-class term test on Thursday March 26. Please let me know as soon as possible if you have an unavoidable conflict with this date. The test questions will be similar to the theory questions from the homework.

There will be a final project. You, in a group of 2 or 3, will either (A) design and implement a data analysis method for a problem of your choosing or (B) prove a novel theorem about one of the methods we covered. You will submit a written report in the format of a conference proceedings (more details forthcoming) and deliver a 15 minute presentation to your peers.

There will be no final exam.

Marking Scheme

Your final grade is determined in the following way:

Assignments	30 %
Term Test	30 %
Final Project Report	30 %
Final Project Presentation	10 %

Communication

When emailing the instructor, please use your official University of Toronto email address and mention MAT1801 in the subject line. Note that a response will be forthcoming during normal business hours.

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.