
MATH 441 Discrete Optimization Problems

Course Outline 2022W1

Formulation of real-world optimization problems using techniques such as linear programming, network flows, integer programming, dynamic programming. Solution by appropriate software.

MATH 441 is a project-based course which emphasizes mathematical research, communication, collaboration, computation and reflection. Students will collaborate on a group project and also work independently to create a personal learning portfolio. The group project is an opportunity for students to research a single topic in depth and the learning portfolio is a self-directed project where students demonstrate their individual learning over a range of topics.

Learning Goals

- Formulate well-defined optimization problems based on real-world phenomena
- Describe and contrast algorithms for solving optimization problems
- Describe and contrast the computational complexity of optimization problems
- Use mathematical software to compute solutions of optimization problems
- Communicate solutions of optimization problems to a general mathematical audience

Instructors

<i>Name</i>	<i>Office</i>	<i>Email</i>
Patrick Walls (he/him)	MATH 229E	pwalls@math.ubc.ca

Lectures

Tuesday & Thursday	11–12:30pm	LSK 121
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Assessments

Learning Portfolio	50%
Group Project	50%

Prerequisites

MATH 340 Introduction to Linear Programming is *required*. It will also be *very* helpful if students have completed MATH 200, 210 and 307. See the [UBC Course Schedule](#).

Canvas

All course information and communication will be posted on [Canvas](#). Please check often!

Schedule

<i>Hours</i>	<i>Topics</i>
2	Overview. Objective functions, decision variables, constraints, classification of optimization problems. Mathematical software: Python, SciPy and Jupyter.
10	Linear Optimization. Standard/canonical forms, duality, simplex algorithm, interior point methods. Applications: resource allocation, transportation, network flows.
10	Combinatorial Optimization. Integer programming, graph theory, computational complexity. Applications: routing, scheduling, assignment, bin packing.
10	Compressed Sensing. L1 optimization, basis pursuit, sparse vector recovery, matrix completion. Applications: image reconstruction, recommender systems.
4	<i>Group Project Presentations</i>
36	

Important Dates

Tuesday September 6	UBC Imagine Day (No lecture)
Thursday September 8	First lecture
Friday September 30	National Day for Truth and Reconciliation (UBC closed)
Monday October 10	Thanksgiving Day (UBC closed)
November 9–11	Midterm Break (No lectures)
Friday November 11	Remembrance Day (UBC closed)
Wednesday December 7	Last day of class

- See the [UBC Academic Calendar 2022/2023](#)

Student Resources

Science Advising	Health and Wellbeing	Centre for Accessibility
Academic Concession	Academic Integrity	Counselling Services

University Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the [UBC Senate website](#).