CO 227: Introduction to Optimization

Winter 2021 Course Outline

Course description. Suppose that the owner of a factory wants to maximize its production for the next 30 days. There is a limit on the resources available. Resources may include raw materials, labour, machine capacities, etc. This is an example of an optimization problem. We can describe the amount of production using a function. This is the function that we want to maximize, and it is called the objective function. The conditions imposed by the available resources are the constraints of the problem.

This course will discuss optimization problems where the objective function and the constraints are linear. We plan to cover the following topics:

1. Formulating and modeling real world problems as linear programs.
2. The simplex algorithm for solving linear programs.
3. Some theory behind the algorithm, including geometry and duality.
4. Strategies in solving integer programs.
5. Applications to a graph theory problem.

Lecturer

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Teaching assistants

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Schedule

Week	Date	Schedule	Assignment deadline
1	Jan 11	Modelling	Jan 20
2	Jan 18	The geometry of linear programming	Jan 27
3	Jan 25	The geometry of linear programming	Feb 3
4	Feb 1	The geometry of linear programming	Feb 10
5	Feb 8	The simplex method	Feb 24
6	Feb 15	No new material - catch up time	n.a.
7	Feb 22	The simplex method	Mar 3
8	Mar 1	The simplex method	Mar 10
9	Mar 8	Duality theory	Mar 17
10	Mar 15	Duality theory	Mar 24
11	Mar 22	Integer programs and applications	Mar 31
12	Mar 29	No new material - catch up time	n.a.

Course website

Go to the University of Waterloo's LEARN website `learn.uwaterloo.ca` to find news, assignments, solutions and information about this course. The piazza link is

Textbook

- Introduction to Linear Optimization by Dimitris Bertsimas
- A Gentle Introduction to Optimization by B. Guenin, J. Könemann, and L. Tunçel

Assignments

There are 10 weekly assignments. You will receive a Crowdmark link for each assignment, and you need to submit your solutions on Crowdmark. You must submit each question in the corresponding box, or it will not be graded. Late submissions will not be accepted. We will not give individual extensions for any reason.

Asking questions

If you have questions, then you can get help from the Piazza forum. The teaching assistants will answer your questions on a regular basis. You can also schedule an office hour to ask questions remotely.

Exams

The final exam will be comprehensive, and is scheduled by the Office of the Registrar later in the term.

Time limit.

The final exam will be held on Sunday April 18, 2021 4:00 PM. You have 2.5 hours to finish the exam.

You will have access to the examination via Crowdmark and LEARN at 3:45 PM, i.e., 15 minutes before the exam. Please make sure that you can download and access the exam properly, and start answering the questions at 4:00 PM.

You have to finish your answers before 6:30 PM, and you have to make sure the answers is submitted via Crowdmark before 6:45 PM, i.e., within 15 minutes after the exam.

Final grade. Your final grade is:

- 40% assignments, 60% final exam.

Policy on collaboration and internet usage in assignments. You may ask your instructor or the TAs for help during their office hours. You may also discuss the assignment problems in small groups. However, **you must write up the solutions on your own**. This means that you may not write up your solutions while you are with a group, and you should not consult any notes you have taken during your group discussions while writing up your solutions. If a classmate asks for your help, only give hints, and do not give away the entire solution. In addition, you may not use electronic resources for help with assignment problems directly. You are not allowed to use or consult solutions to assignment problems from previous offerings of related courses. Any submitted assignments that are suspected of cheating will be reported to the integrity officer of the Faculty of Mathematics.

INC policy. In case of serious illness during the final exam, you will be granted a grade of INC provided that (a) you have suitable medical documentation that you submit to the Math Undergraduate Office; and (b) you have passing grades for the assignments and at least one midterm. In particular, an INC cannot be granted if you miss both midterms and the final for any reasons. There will not be any make-up exams.

Academic Integrity. In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. For more information, check www.uwaterloo.ca/academicintegrity.

Grievance. A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4,
http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm.
When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline. A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline,
http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm.
For typical penalties check Guidelines for the Assessment of Penalties,
http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

Appeals. A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals,
http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Students with disabilities. The AccessAbility Services, located in Needles Hall, Room

1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with them at the beginning of each academic term.