

CO 353: Computational Discrete Optimization

Winter 2018 Outline

March 22, 2018

Objective. CO 353 covers the computational aspects of discrete optimization. Optimization problems are called *discrete* when the decision variables take discrete values (often 0 or 1). The objective of the course is to understand the basics of computational complexity, and to determine the best algorithmic approaches for different types of discrete problems, both in theory and in practice.

Textbook. There is no required textbook. The following textbooks are suggested readings and contain some of the material covered in the course:

- *Combinatorial Optimization*, W. J. Cook, W. H. Cunningham, W. R. Pulleyblank, A. Schrijver. Wiley-Interscience, 1998.
- *Integer Programming*, L. Wolsey. Wiley-Interscience, 1998.

Course website. We will use UWaterloo's LEARN website (learn.uwaterloo.ca).

Lectures. MC 2054, Mon-Wed-Fri 11:30 – 12:20

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Assignments. There will be four large computational assignments. Each assignment will consist in implementing, in C, C++ or Python, an algorithm seen in class. The precise question and due date will be communicated at least two weeks in advance. No late submissions will be accepted, regardless of circumstances.

You may work on the assignments in groups of two. Groups of three may be accepted only upon explicit approval by the instructor, at least one week before the assignment's due date.

No external help will be allowed, from any source. All the code must be written by members of the group, without looking at any other source code. Every member of the group must be able to understand and motivate

every line of the submitted code.

Class behavior. Class-related use of laptops is ok, as long as it does not create a disturbance. No cell phones, iPods, etc. As a general rule, be respectful of me and your fellow students: You are not required to attend the lectures, so if you do so, I expect you to respect everyone in it.

Exams. There will be one midterm exam and one final exam. The midterm will be held on Friday, February 16, during regular class time (11:30am – 12:20pm) in the regular classroom (MC 2054). The final exam will be comprehensive, and will be held on Tuesday April 24, 12:30pm – 3:00pm in PAC Upper 9.

Only Faculty of Math approved calculators are allowed in the exams. Missed exams will count as 0 unless suitable medical documentation is provided. There will not be any make-up exams.

Final grade. Each homework assignment will count for at least 10% of the final grade (depending on the scope of the assignment). The exact weight will be specified along with the assignment. The midterm will count for 15%. The rest will be determined by the final exam.

Schedule. This is a tentative schedule with topics that we plan to cover. The schedule will be adjusted as the term progresses, and it will be updated here accordingly.

Week	Dates	Topics
1	January 3, 5	Big-O notation and algorithmic running time
2	January 8, 10, 12	Greedy algorithms: Prim, Kruskal
3	January 15, 17, 19	Matroids
4	January 22, 24, 26	Dynamic programming: knapsack problems
5	January 29, 31, February 2	Computational complexity
6	February 5, 7, 9	Dual simplex method
7	February 12, 14, 16	Computational simplex methods, Midterm
8	February 19, 21, 23	Reading week
9	February 26, 28, March 2	Branch and Bound
10	March 5, 7, 9	Cutting planes
11	March 12, 14, 16	Cutting planes
12	March 19, 21, 23	Column generation
13	March 26, 28	Approximation algorithms
14	April 2, 4	Review

Discipline, appeals, accessibility

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 <http://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.