

CO 351: Network Flows

Overview

Networks are pervasive in everyday life; street-networks connect cities, electrical and phone networks connect our homes, social networks connect friends and associates, ...; the list of examples is endless. In this course we will study optimization problems in domains that have network structure.

An example for a typical network question that we will study is the following:

What is the shortest route between two points A and B in a given network?

We will see that this question as well as many others have efficient solutions. Students taking this class will learn (a) how to develop mathematical models for network flow optimization problems, and (b) how to solve these models using fast algorithms.

Specific topics covered in this class include:

- shortest paths (Dijkstra's algorithm, Bellman-Ford algorithm),
- maximum flows (Ford-Fulkerson method, preflow-push algorithms, max-flow/min-cut theorem and applications),
- minimum cost flows (network simplex, cycle-cancelling algorithms, ...),
- applications to problems in transportation, distribution, job assignments and critical-path planning.

Prerequisites

The prerequisite for this class is one of CO 250/350 or 352 or 255/355 or CM 340.

In particular, students will be assumed to be familiar with the following list of topics:

- Undirected graphs, walks, paths, cycles, cuts, trees
- Linear programming formulations, duality, basic solutions

Chapter 1 of the course notes reviews fundamentals of graph theory.

Instructor

Bruce Richter, MC 5033A, x84625 (or 519-888-4625), brichter@uwat...

Office hour 2:30-3:20 WEDNESDAY

Lecture MWF 1:30 - 2:20pm MC4063

Teaching Assistants

TA	OFFICE	OFFICE HOUR	EMAIL @uwaterloo.ca
Benson Joeris	MC5173	Thu10-11 am	bjoeris
Nishad Kothari	MC6092	Thu 3-4 pm	nkothari

Grading

- Assignments 10%
- Midterm 35% (October 22, in class)
- Final 55%

Text

The class is based on the course notes

Network Flows
Coursenotes for CO351

available through Graphic Services Math (MC2018). Additional material may be posted on the course homepage.

Web Site

We will be using Learn this term as our course website. All assignments, solutions and announcements will be posted there. Students are encouraged to visit the site regularly.

Assignments

There will be weekly assignments to be handed in. These will be due on Fridays by the end of class. Late assignments will not be graded and a mark of zero will be assigned. The assignments and their solutions will be posted on the course website. We will ignore the two assignments with the lowest grade when computing the average. Note that it is not acceptable to discuss the assignment on any other discussion board.

Grade Change Policy

For assignments and the midterm, any grade change requests must be submitted to your instructor within one week of the day the material is returned in class. Grades will not be changed if requested any later.

Students with disabilities

The Office for Persons with Disabilities (OPD), 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 the OPD at the beginning of each academic term.

Please note that the instructor will not sign any OPD forms after September 30.

Collaboration

While it is acceptable for students to discuss the course material and the assignments, the work you hand in should be your own and in your own words. **Outright copying is a very serious offence. A first offence will result in a grade of 0 for all parties involved on that assignment. Additional offences will be referred to the Associate Dean's office.**

If you have gotten an idea from another student, it is good practice to write your own version of the solution and acknowledge the assistance you received. An example of how this might be done is: "The idea for this solution was suggested to me by Jane Doe." Another possibility, if there was an exchange of ideas, is: "I discussed this problem with Jane Doe. The solution presented is based on that discussion."

Students who are unsure whether an action constitutes an offence, or who need help in learning how to avoid offences should seek guidance from the instructor.

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.

[Check www.uwaterloo.ca/academicintegrity/ for more information.]

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>.