

EBGN 456 - Network Models

Spring 2013

Lectures	Monday, Wednesday	2:00pm - 3:15pm	211 Engineering Hall
Instructor	A. M. Newman		
	Office:	319 Engineering Hall	
	Office Hours:	Monday	10:45am-11:15am
		Tuesday	8:00am-9:00am; 5:00pm-8:00pm
		Wednesday	10:45am-11:15am
	email:	newman@mines.edu	
Teaching Assistant (TA)	Gavin Goodall		
	Office:	212 Engineering Hall and EB Computer Lab	
	Office Hour:	Monday	11:30am-12:30pm

GENERAL INFORMATION

- **Textbooks:** (*recommended*)
 - ★ R. Ahuja, T. Magnanti, and J. Orlin *Network Flows*, Prentice Hall, 1993.
 - ★ Fourer, Gay, Kernighan. *AMPL: A Modeling Language For Mathematical Programming*, Thompson, 2003.
- **Assignments:** There will be a weekly assignment due Wednesday (the following week). The TA will grade the homework, so direct homework grading questions to him. *Do not send email to the TA!!*
- **Project:** There will be an *optional* project involving formulating, solving and analyzing a challenging problem, writing code, and/or performing a literature review. The project group may consist of between one and four students. The project will be due during finals week.
- **Exams:** There will be a midterm and a final examination. Both are open book. You must wait 48 hours after the exam has been handed back to ask (me) any grading questions.

- **Grading:**

- ★ Class Participation: 5%
- ★ Homework Assignments: 20%
- ★ Project: 25%
- ★ Midterm: 20%
- ★ Final: 30%

or

- ★ Class Participation: 5%
- ★ Homework Assignments: 25%
- ★ Midterm: 30%
- ★ Final: 40%

Grading is done on a curve where 90% is sufficient but not necessarily necessary for an A-, 80% is sufficient but not necessarily necessary for a B-, etc.

COURSE OUTLINE

- **I. Background**

- ★ Differentiation between networks and linear programs
- ★ Basic definitions, e.g., nodes, arcs
- ★ (Early) motivation for studying network problems

- **II. Spanning Trees**

- ★ Mathematical formulation
- ★ Applications
- ★ Kruskal's algorithm (including optimality conditions and complexity)

- **III. Shortest Path Problems**

- ★ Mathematical formulation
- ★ Applications
- ★ Dijkstra's algorithm, label correcting algorithm (including optimality conditions and complexity)

- ★ All-pairs shortest path problem

- **IV. Maximum Flow Problems**

- ★ Mathematical formulation

- ★ Applications

- ★ Maximum flow-minimum cut theorem

- ★ (Shortest) augmenting path algorithm (including optimality conditions and complexity)

- **V. Minimum Cost Flow Problems**

- ★ Mathematical formulation

- ★ Applications

- ★ Network simplex algorithm (including optimality conditions and complexity)

- **VI. Other Network Problems**

- ★ Transportation and assignment problems

- ★ Maximum weight closure problem

- **VII. When Networks Become Integer Programs**

- ★ Networks with side constraints, e.g., generalized assignment, multicommodity flow

- ★ Matching problem

- ★ Routing problems, e.g., traveling salesman

RULES

- Please do not send email regarding homework problems; come to office hours instead.

- Statute of limitations for questions about grading is one week from the student's receipt of the graded work.

- I do not want to see or hear your cell phone. Ever. This includes during office hours.

- No rudeness of any kind towards anyone in the class will be tolerated.

- Do not talk to your neighbor during class.

- You may confer with others regarding the homework and project, but the work you hand in must be your own. Please ensure it is done neatly.

- Attendance in class is required. Be on time.
- Any alternate arrangements for exams must be submitted in writing at least one week in advance of the exam. Any additional arrangements regarding disabilities must be *formally* and *legally* documented and approved.

A minor infraction of the above rules will result in a warning. A major infraction will result in expulsion from the class.