SYST 420 001

Network Analysis

George Mason University

Fall 2011

Instructor: Ursula Morris   **Class Room: Research Hall 201**

Class Time: Fr. 1:30 - 4:10   **Office Hours: after class and by appointment**

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Course Description

This course introduces network flow problems. These problems arise in many fields like computer networking, engineering, scheduling and routing, transportation, and telecommunication. The course provides insights into applications, modeling, and algorithms of network flow problems.

The focus will be on shortest paths, maximum flow, minimum cost spanning tree, minimum cost network flow, assignment and matching problems.

The course begins with an introduction into network nomenclature, elementary graph theory, data structures, complexity theory, search algorithms and flow decomposition. Using these concepts, different shortest path and maximum flow algorithms are analyzed.

A lecture on minimum cost spanning trees prepares the class for the remaining fundamental topics, minimum cost network flow algorithm and assignment and matching algorithm. As time permits, other topics might be added to the syllabus.

Course Objectives

This course challenges the students' analytical skills.

The students will learn network terminology and graph theory. This knowledge will enable the students to present and model real world problems using these concepts.

The knowledge of data structures, search algorithms, complexity considerations and flow decomposition enables the students to analyze and compare algorithms.

The students will use pseudo code for different algorithms to solve shortest path, maximum flow, minimum cost spanning tree, and minimum cost network flow, and assignment and matching problem network problems. The students will understand and apply optimality criteria for the different algorithms.

The students will use the software package MPL to solve network problems.

Text: *Network Flows: Theory, Algorithms and Applications*, by Ravindra K. Ahuja, Thomas L. Magnanti and James B. Orlin, published by Prentice Hall 1993.

Software: During the course, the software package MPL is used. A free student version can be obtained by going to *http://www.maximalsoftware.com* downloading the student version, and requesting an activation code asap.

Every student is expected to give two presentations of homework problems in class.

Course Topics (tentative)

Lagrangian Relaxation

	Topic	Lecture Notes
1	Introduction	
2	Network Terminology	
3	Network Representations	
4	Network Transformations	
5	Pure Network Models	
5	(Data Structures)	
6	Introduction Complexity	
7	Search Algorithms	
8	Flow Decomposition	
9	Shortest Paths Label Setting Algorithms	
10	Shortest Paths Label Correcting Algorithms	
11	Max Flow Algorithms	
12	Max Flow - Minimum Cut	
13	**Midterm Exam**	Sept. 26 - Oct. 21
14	Max Flow Algorithms cont.	
15	Minimum Cost Spanning Trees	
16	Assignments and Matchings	

17	Minimum Cost Network Flows	
18	Network Simplex	
19	Additional Topics	
20	**Final Exam**	Fr.12/16 1:30 - 4:15 pm

Grading SYST 420:

Homework	15%
Midterm	35%
Final exam	35%
Presentations	5%
Mini quizzes	10%

In the beginning of the course, each student will be requested to sign the George Mason Honor Code.

Each class will begin with a mini quiz (10 points each). The worst of those grades will be deleted.

A legible paper copy of the homework is due in the beginning of each class. The teacher decides if every homework problem or just a selection of the problems will be graded.

Make-up midterm exams will be 10% harder.

Class Website: http://classweb.gmu.edu/umorris1