SYST 420 001

CRN 71404

Network Analysis

George Mason University

Fall 2014

Instructor: Ursula Morris **Class Room: Engineering Building 1108**

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

Email: **UMorris1@gmu.edu**

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 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 and applied to various problems.

A lecture on minimum cost spanning trees prepares the class for the remaining fundamental topics: assignment and matching algorithm, minimum cost network flow algorithm and network simplex. 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 recommended, not required! *Network Flows: Theory, Algorithms and Applications*, by Ravindra K. Ahuja, Thomas L. Magnanti and James B. Orlin, published by Prentice Hall 1993.

Lecture notes will be posted on blackboard.

Software: During the course, a software package called MPL will be 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.

Course Topics (tentative)

1	Introduction
2	Network Terminology
3	Network Transformations
4	Network Representations
5	'Pure Network Models'
6	Introduction into Complexity
7	Search Algorithms
8	Flow Decomposition
9	Shortest Path Label Setting Algorithms
10	Shortest Path Label Correcting Algorithms
11	Max Flow Algorithms
12	Max Flow - Min Cut
14	Minimum Cost Spanning Trees
15	Assignments and Matchings
16	Minimum Cost Network Flows
17	Network Simplex
18	Additional Topics

Midterm Exam 10/24 1:30 – 4:15.

Final Exam   12/12 1:30 – 4:15.

Grading SYST 420:

Homework	15%
Midterm	35%
Final Exam	35%
Participation	5%
Mini quizzes	10%

Grading Scale: 90 - 100   A;   80 – 89   B; 70 – 79   C; 60 – 69   D, 0 - 59 F;

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

Most classes 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.