Syllabus: Network Flows and Graphs
OA 4202

You can find lectures, handouts, notes, and a class calendar on the course page:
http://neddimitrov.org/teaching/201302NFG.html

Instructor: Ned Dimitrov ned@nps.edu

Lectures: Monday through Thursday
0900-0950 Glasgow 118
1400-1450 Glasgow 110

Contact Hours: Monday 1200-1300 GL 232 (will change later)
Tuesday 1200-1300
Wednesday 1500-1600

Sakai: Web space for questions and discussion with classmates:
https://cle.nps.edu/

E-mail policy: Feel free to send administrative concerns or questions. Ask questions on class material during Contact Hours instead.

Course Objectives:

1) Learn to think creatively about network modeling
2) Learn basic network and algorithm definitions
3) Learn a handful of basic data structures and their properties
4) For several graph algorithms, understand:
   a) How the algorithm works: the algorithm pseudo-code
   b) Why the algorithm works: proof/intuition of correctness
   c) The algorithm's basic properties: appropriate uses of the algorithm
   d) How to apply the algorithm to real problems

Course Content:

Lectures: The class lectures are the primary method of presenting the course content. Two helpful texts from which some, but not all, of the lecture material is derived are "Network Flows: Theory, Algorithms, and Applications" by Ahuja, Magnanti, and Orlin (the main book for the class) and "Introduction to Algorithms", by Cormen, Leiserson, Rivest, and Stein (a helpful second reference). Ultimately, you will only be tested on and only be responsible for the material covered in lecture or explicitly assigned during lecture. The course lectures are available online for you to view at your convenience.

Recorded versions of the class lectures are available here:
http://neddimitrov.org/teaching/networks-lecture-videos.html

Assignments and Evaluation: There are three types of evaluated assignments for the course:

1. Homework assignments and in-class participation (20% total): We will have several homework assignments, both hand written and programming assignments. The assignments and solutions are available online. The problems are difficult, but you should be able to do them on your own, without looking at the solutions. They are there to provide you practice with the class material.

   It is a good idea and recommended that you work with other students on the homeworks, usually small groups of two or three work best. When working with other students, everyone has to turn in their own, individually written copy of the assignment. Homeworks are not intended to be stressful, but simply to provide incentive for you to train on the lecture material. The homeworks will be graded on completeness, not correctness.

   No late homework assignments will be accepted, however your lowest homework assignment score will be dropped.

2. Exams (2 x 20% each and 1 x 5%): There will be 3 exams during the course. The exams are the primary way of ensuring you have learned the lecture material. Exams will have a strict grading policy in comparison to homeworks. By the time of the exam, you are expected to know the lecture material, and certainly solve problems similar to those assigned for homework or done in class.

3. Project (35%): There will be one small-group project. We'll start thinking about the project early on, but you are expected to do most of the work later in the course. The deliverables include a 20-30 minute in-class presentation and a written paper.

Class Schedule:

Apr 1: First day of class
May 3: First exam
May 24 : Second exam
June 6: Third exam (quiz)
June 10-13: Project presentations
June 13: Final class day

Things you can do to be successful:

1. Communicate with me when you are lost, don't understand, or need help
2. Expect questions without obvious answers in class, homeworks, exams, and lecture
3. Keep up with your understanding of the lecture material because things build up over time
4. Be sure you individually understand the homework solutions
5. Expect to work extensively on course material outside of class every week by doing homework and reviewing lectures

Rough Course Topics Outline: We will adapt and change this as we progress. More up-to-date information will be posted on the class website.

Week 1,2: Graph Terms, Storing Graphs in a Computer, Intro to Shortest Path as an LP, Graph Search. HW0, HW1, GAMS prep.

Week 3-4: Graph Search Applications, Dijkstra's algorithm, Directed Acyclic Graphs, In depth Shortest Path as an LP. HW2, GAMS 0, EXAM 0.

Week 5-6: In depth Shortest Path as an LP, Interdicting Shortest Path, Benders for Interdicting Shortest Path, Intro to Max Flow. HW3.1, HW3.2.

Week 7-8: Max Flow – Min Cut, Ford Fulkerson, Reading primal/dual variables, Max Flow applications. HW3.3, GAMS 1, EXAM 1.

Week 9: Max Flow applications, Min Cost Flow, Min Cost Flow applications, Network Simplex HW4, HW5.

Week 10-11: Project Presentations.