Network Flows
IE 604
Department of Industrial and Systems Engineering
Spring 2022
Meeting: MWF 10:30–1:20AM
Class Location: 261 ZEC

Instructor:Jim Ostrowski
Office: 519 JDT
Hours: By appt.)
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1 Course Description:

An introduction to network flows optimization, focusing on three classes of problems: shortest path problems, maximum flow problems, and minimum cost flow problems. The class will emphasize modeling and algorithms, introducing theory as needed.

2 Course Objectives:

- At the end of the course students should be able to:
- Formulate optimization problems as equivalent shortest path problems.
- Solve a shortest path problem using various algorithms.
- Formulate optimization problems as equivalent maximum flow problems.
- Solve a maximum flow problem using various algorithms.
- Formulate optimization problems as equivalent minimum cost flow problems.
- Solve a minimum cost flow problem using various algorithms.
- Derive the time complexity of various network flow algorithms (shortest path, maximum flow, minimum cost flow).
- Prove the optimality of various network flow algorithms (shortest path, maximum flow, minimum cost flow).

3 Required Text:

Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Upper Saddle River, NJ: Prentice Hall, 1993.

The Solution Manual for this book is available on-line at:
`http://web.mit.edu/jorlin/www/SolutionManual/SolutionManual.html`
Recommended Texts:

For more of a theoretical perspective, try: Nonlinear Programming: Theory and Algorithms, by Mokhtar Bazaraa, Hanif Sherali, and C. M. Shetty, 3rd Edition, 2006, ISBN-10: 0471486000, ISBN-13: 978-0471486008

4 Required and Recommended Background

Students should have proficiency in at least one programming language. Students should also have taken linear programming and have some experience with mathematical proofs.

5 Requirements and Grading

This course is (hopefully) *not* about getting a good grade. Instead, it should be about challenging yourself and learning about nonlinear programming. It won't be easy! The expectations for the course are:

- Learn
- *Read ahead!* We will be going at a brisk pace, I won't be able to cover all required material in class.
- Attend lectures and participate.
- Do the problem sets
- Not be rude, if possible. Especially to your classmates.
  - Sleeping
  - Talking
  - Cell Phones
  - Leaving in the middle of lecture

6 Academic Integrity

You are all graduate (or Ph.D.) students. You are all grown-ups. **Do not cheat**. According to Hilltopics, the student handbook academic integrity is defined by:

> ACADEMIC INTEGRITY
> Study, preparation, and presentation should involve at all times the student's own work, unless it has been clearly specified that work is to be a team effort. Academic honesty requires that the student present his or her own work in all academic projects, including tests, papers, homework, and class presentation. When incorporating the work of other scholars and writers into a project, the student must accurately cite the source of that work. (See Standards of Conduct Honor Statement. Additional resources are available at http://www.lib.utk. edu/instruction/plagiarism.)

The two most relevant issues of academic integrity for this class are copying homework solutions (including computer code) from other sources (either online or class mates) and making up data for computational results. The first incidence of this will result in a warning with a zero for the homework assignment. The second instance will result in failing the class.

7 Grading Scheme

There will be weekly-ish homework assignments that will account for 75% of your grade. One midterm will account for the remailing 25%.

There is a penalty of 10% for each day that an assignment is late, without exception. Once I have graded and returned an assignment, that homework will no longer be accepted. The lowest score on a problem set will only count 50% towards a student's final problem set score.