Integer Programming
IE418

Introduction

Dr. Ted Ralphs
Introductory Stuff

- Welcome Back!
- Class Meeting Time
  - MW 4:10-5:25
- Office Hours
  - TR 10:35-12:00
What will this class be about?

- Introduction: Modeling With Integer Variables
- Computational Methods
  - Branch and Bound
  - Bounding Methods
  - Branching Methods
  - Implementation
  - Software
- Complexity
  - Classifying Integer Programs
  - Complexity Theory
- Polyhedral Theory
  - Polyhedra and Dimension
  - Theory of Valid Inequalities
- Advanced Computational Methods
What won’t this class be about?

- Dynamic Programming (well, maybe a little)
- Heuristic Methods (well, maybe a little)
Prerequisites

• This class requires substantial background and is targeted students studying optimization in the Ph.D program.

• Expected background
  – Linear algebra
  – Linear programming (406)
  – Familiarity with basic graph theory
  – Familiarity with modeling languages
  – Familiarity with Linux will be helpful
  – Familiarity with C++/Python will be helpful
Goals for the course

After this course, you should be able to:

• Given an optimization problem, formulate an appropriate integer linear model.
• Understand the basic mathematical structure of the model.
• Understand the techniques that could be used to solve the model.
• Understand how to use a modeling language and/or commercial solver to solve the model.
• Understand the limitations of “off the shelf” solvers and how to tune their parameters to improve performance.
• Understand how to build a solver for a specific problem class.
Course Requirements

• Attending Lectures
• Attending Seminars
• Reading
• Homework
• Exams
Homework

- Homework will be due approximately every two weeks.
- Homework is due at the beginning of class.
- Lateness policy is in the syllabus.
- I encourage working together, but you must write up the homework yourself.
- Please reference the work of others.
- There will also be a computational project at the end of the course.
Grading

Grading Scheme:

- 10% Homework
- 20% Exams (each)
- 25% Final Exam
- 15% Project
- 10% Class Participation
Class Web Site

• The class Web site will be at

   http://coral.ie.lehigh.edu/~ted/teaching/ie418/

• I will post lecture slides before class so you can use them to take notes.
• The slides will be in PDF format.
• All handouts for the class will also be available.
• There will also be links to other relevant sites and reference materials.
COR@L Account

- For some of the computational experiments in the class, it will be useful to have access to the COR@L Lab.
- Please let me know if you do not already have an account on COR@L.
Textbook and Other References

- The primary text for the course is *Integer and Combinatorial Optimization* by Nemhauser and Wolsey.

- A more concise text you may find useful is *Integer Programming* by Wolsey.

- Marlow is a concise summary of the mathematical background needed for the course (and cheap too).

- Parker and Rardin and Bertsimas and Weismantel are also good books on discrete optimization.

- We will also be reading a number of papers to supplement the main text.

- Please let me know if you want supplementary material.
My Approach to Lectures

• I want to make lectures as interactive as possible.
• You will get more out of this course if you ask questions during lecture.
• The pace and structure of the lectures can be adjusted.
• I need feedback from you to adjust appropriately.