Computational Optimization
ISE 407

Introduction

Dr. Ted Ralphs
Administrivia

- Class Meeting Time
- Introductions
- Office Hours
- TA
What is the motivation for this class?

• This class will introduce you to tools you will need to do computational research.

• We will touch on a wide range of topics that you should be familiar with before you start coding.

• We will not be able to go into any of the topics we cover in much depth.

• It is expected that this introduction will be the beginning of your own investigation.

• As you do more coding and gain experience, you will quickly add to your repertoire.
What will this class be about?

- We’ll talk about how computers work and how we can model them.
- We’ll talk about how to use those models to analyze the efficiency of computational methods in theory.
- We’ll discuss practical tools for implementing computational methods and talk about how they work,
- We’ll discuss and analyze the implementations of data structures and algorithms.
- The ultimate focus will be on developing the practical toolbox needed to solve optimization problems using a computer.
Topic Coverage

• Fundamentals of Computer Systems
• Models of Computation and Complexity
• Programming, Data Structures, and Empirical Analysis
• Algorithms
  – Combinatorial
  – Numerical
Prerequisites

• Strong undergraduate mathematics background
• Some programming experience
• Graph theory helpful
• Optimization background helpful
Unified Approach

- We will talk about the design and implementation process from end to end
- As much as possible, we’ll treat all subjects as a unified whole
- We’ll assume parallel platforms and algorithms from the outset
- We'll try to emphasize modern hardware trends
- Programming projects will build on each other
- There is flexibility in the syllabus
What will I get out of this class?

• What you put into it . . . .
• In this course, we will raise a myriad of interesting computational issues
• We won’t have time to resolve them all
• It is more important to have awareness of the issues
• The best solutions may differ over time and with different platforms
My approach to lectures

- There should be an active dialog between teacher and students
- This course will be loosely structured, so it’s important that you ask questions!
- I will try to customize lectures them to the background of the students.
- Lectures will be an introduction to more in-depth reading.
More on lectures

• There will be a Web site for the class at

http://coral.ie.lehigh.edu/ ted/teaching/ie407

I will do my best to post the lecture slides there before the class so that you can prepare if you want.

All handouts for the class will be available at the site.

All readings will also be posted there.
Assignments and Exams (Tentative)

- There will be two types of assignments:
  - Programming
  - Written
- Assignments will be given approximately once every two weeks.
- There will be no formal written exams.
- There will be no written final.
- There will be a final project.
Submitting Assignments

- Assignments can be submitted by e-mail as described in the syllabus.
- For programming assignments, I would like well-commented, formatted source code.
- It would be helpful to have an accompanying write-up explaining the code.
Textbook

• There will be no single required textbook
• There are a few books that may be worth purchasing
• I will have references available in my office
• There will be readings available on the Web site
Programming Environment

• Operating Systems
  – Unix
  – Windows

• Languages
  – C/C++
  – Matlab
  – Python
  – Go?