Advanced Operations Research Techniques
IE316

Introduction

Dr. Ted Ralphs

Introductory Stuff

- Welcome Back!
- Class Meeting Time
- Office Hours
  - M 10-11
  - TR 2:30-3:30

What will this class be about?

- Modeling of Optimization Problems (10%)
  - Linear Programming
  - Network Flows
  - Integer Programming
  - Some Advanced Models
- Mathematical Structure of Linear Models (40%)
  - Geometric
  - Algebraic
- Techniques for Solution and Analysis (30%)
- Modeling Languages and Commercial Solvers (20%)

What do I expect you to know?

- Things I expect you to know or pick up "along the way":
  - Undergraduate mathematics
    - Logic and proof
    - Linear algebra
  - A little modeling
- We will cover these topics in class, but not in much depth.

What are the goals for the course?

After this course, you should be able to:

- Given an optimization problem, formulate an appropriate linear model.
- Use a modeling language and/or commercial solver to solve the model.
- Understand the basic mathematical structure of the model.
- Understand the techniques used to solve the model.
- Analyze the model.

Approximate Syllabus

Topic	#of lectures/date
Review of Modeling	2
Geometry of Linear Models	4
The Simplex Method	4
First Quiz	October 2
Using AMPL/CPLEX	1
Duality Theory	4
Sensitivity Analysis	2
Large-scale Linear Programming	2
Second Quiz	November 8
Network Flow Models	4
Integer Programming Models	2
Advanced Models and Methods	1

Textbook coverage is listed in the syllabus.

Course Requirements

- Attendance
- Participation
- Reading
- Homework
- Exams

Homework

- There will be three homeworks in each third of the course.
- The last homework will be worth twice the normal amount and will be comprehensive.
- Homework is due at the beginning of class.
- Lateness policy is in the handout.
- I encourage working together, but you must write up the homework yourself.
- Please reference the work of others.
- Basic problem types:
  - Mathematical Proofs
  - Modeling
  - Computational

Grading

- Your grade will correspond to your learning and understanding of the course material.
- Some areas to keep in mind
  - Good proof technique
  - Level of detail and rigor
  - Accurate self-assessment
  - Class participation
- Weighting
  - 25% Homework
  - 20% Quizzes (each)
  - 25% Final
  - 10% Class Participation

Class Web Site

- The class Web site will be at

  http://www.lehigh.edu/~tkr2/teaching/ie316/

- 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.

Textbook

- The primary text is Bertsimas and Tsitsiklis.
- I will also take material out of some other texts.
- There is an abundance of reference material on the Web.
- Check the Web site for links.
- Please let me know if you want supplementary material.

My Approach to Lectures

- Lectures should be 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.

Some More Notes

- This course will be more mathematical than previously.
- If you are having trouble, let me know.
- There is plenty of supplementary material.

Questions?