

Introduction to Mathematical Programming

IE406

Preliminaries

Dr. Ted Ralphs

Introductory Stuff

- Welcome!
- Class Meeting Time
- Office Hours MW 4:00-5:00??
- Surveys

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 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
 - Problem formulation and modeling
 - Basic computer programming
- 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

<u>Topic</u>	<u>#of lectures/date</u>
Review of Modeling	2
Geometry of Linear Models	3
The Simplex Method	3
First Quiz	October 3
Modeling Languages	1
Duality Theory	3
Sensitivity Analysis	2
Large-scale Linear Programming	1
Interior Point Methods	2
Second Quiz	November 7
Network Flow Models	3
Integer Programming Models	2
Mathematical Programming in Practice	1

Textbook coverage is listed in the syllabus.

Course Requirements

- Attendance
- Participation
- Reading
- Homework
- Exams

Homework and Final Project

- There will be approximately 9 problem sets worth 25% of your grade.
- Problem sets should be turned in electronically according to the procedure in the syllabus.
- There will also be a comprehensive final project worth 5% of your grade.
- Homework is due at the beginning of Thursday's class each week.
- Lateness policy is in the handout.
- I encourage working together, but **you must write up the homework yourself** (unless it is a group assignment).
- **Please reference the work of others.**
- Basic problem types:
 - **Mathematical Proofs**
 - **Modeling**
 - **Computation**

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
- I will be randomly grading selected problems, but detailed solutions for ungraded problems will be distributed.
- I encourage you to assess your solutions to **all assigned problems**.
- Weighting
 - 25% Homework
 - 20% Quizzes (each)
 - 5% Final Project
 - 20% Final Exam
 - 10% Class Participation

Class Web Site

- The class Web site will be at

<http://www.lehigh.edu/~tkr2/teaching/ie406/>

- 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 additional 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 may be more mathematical than you may be used to.
- If you are having trouble, let me know.
- Please pay attention to the policy regarding citing the work of others in the syllabus.
- I take this policy **very seriously**.

Questions?