IEN 642J: Linear Programming
Fall 2009

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Office Hours: M & W 9:30-11:00 AM and by appointment

Class hours: M-W 5:00-6:15 PM, Room: MM201
Prerequisite: Linear algebra

Overview

A linear program is an optimization problem that seeks to minimize or maximize a linear function subject to a system of linear inequalities and equations. Applications of linear programs include transportation problems, flight scheduling, corporate planning, linear and nonlinear curve fitting, product mix, load balancing, production scheduling, inventory control, and many others. There are two major classes of algorithms for solving linear programs: simplex methods and interior point methods. Simplex methods stem from a basic operation, called pivot algebra, whereas interior point methods are based on the use of penalty functions. This course will cover the simplex method in detail, emphasizing both mathematical foundations as well as computational considerations for effective computer implementations. A brief coverage of interior point methods will also be provided. In addition to these two algorithms, the course will discuss issues such as model building in mathematical programming, duality theory, sensitivity analysis and decomposition techniques. If time permits, we will look additional topics such as network flow problems and integer programming models.

The course will rely heavily on the use of AMPL. A significant amount of the assignments will involve AMPL programming and MS Excel Solver. However, prior knowledge of AMPL and Excel Solver is not a prerequisite for the course. The student version of AMPL software can be downloaded from www.ampl.com for free. You can obtain useful material and further information, and find good examples at this web site.

Course Objectives

- Develop an appreciation for the importance and broad applicability of linear programming
- Become comfortable modeling problems as linear programs.
- Learn the basic mathematical theory of linear programming.
• Gain a detailed understanding of the simplex algorithm.
• Achieve a strong understanding of duality.
• Learn to interpret solutions to linear programs and how to perform sensitivity analysis.
• Introduce network flow problems and large scale optimization issues.
• Understand the use of decomposition in linear programming

Course Materials

Primary and Required Text:


Supplemental Text:


Assignments

**Homeworks:** Homework will be assigned each week. Each homework assignment will be due at the beginning of class one week after it is assigned. **NO LATE HOMEWORK WILL BE ACCEPTED.** I will drop your lowest homework grade. You are encouraged to discuss the homework questions with classmates; however, you should write up the solutions separately.

**Projects:** Everyone will be required to complete an assigned project. I will provide the details of the project(s) in class.

**Tests:** There will be a mid-term and a final exam. Both exams will be closed book.
Grading
Homework 25% - Project 20% - Midterm 25% - Final 30%

Course Outline (tentative)
-LP formulation
-The geometry of linear programming
-Linear algebra, convex analysis and polyhedral sets
-The Simplex Method
-Duality and sensitivity analysis
-Alternatives to the Simplex Algorithm
-Integer Programming