Department of Industrial Engineering & Operations Research

IEOR162 Linear Programming (3 units)

Semester: Fall 2009 *Instructor: Alper Atamtürk*

Prerequisites: Math 53, Math 54

Required text: Introduction to Mathematical Programming: Applications and Algorithms, W. L. Winston & M. Venkataramanan, 4th ed., Duxbury Press, 2002. ISBN: 0-534-35964-7

Recommended book: AMPL: A Modeling Language For Mathematical Programming, Robert Fourer, David M. Gay, and Brian W. Kernighan, 2nd ed., Duxbury Press/Brooks/Cole Publishing Company, 2002. ISBN 0-534-38809-4

Instructor: Alper Atamtürk (email: `atamturk@berkeley.edu`)
Lectures: Tue Thr 9–10 AM (3106 ETCHEVERRY)
Office hrs: Wed 4–6 PM (4175 ETCHEVERRY)

Teaching assistant: Ling-Chieh Kung (email: `lckung@berkeley.edu`)
Discussion session: Sec 101: Fri 9–10 AM (3111 ETCHEVERRY)
Sec 102: Fri 1–2 PM (3111 ETCHEVERRY)
Office hrs: Mon 10 AM – 12 PM (1116 ETCHEVERRY)

Course web page: Maintained at `http://bspace.berkeley.edu/`
Final exam: TUESDAY, DECEMBER 15, 2009 8–11 AM

Course description

This is an introductory course on formulating mathematical models and developing solution methods for real–life optimal decision problems. We will study how to obtain the best decisions (according to a well–defined objective) in allocating scarce resources such as capital, materials, equipment, manpower, energy, etc. among competing activities that produce goods and services. Rather than developing a specific solution method for each optimization problem, we will build abstractions of these problems in the form of mathematical models and study a general method to solve these models.

The course will focus on a class of problems that can be modeled as a Linear Programming Model. Formally, a linear programming model is either a minimization or maximization of a linear function of several variables constrained with linear inequalities. Surprisingly, a large number of decision problems fit into this framework. This explains why linear programming is so widely used in a variety of industries, ranging from transportation to health care, from finance to manufacturing.

The methodological development will include the simplex algorithm, theorems of duality, complementary slackness, sensitivity analysis, network flows, and network simplex.

Organization

Students will be assigned theoretical, modeling, as well as computational homework problems, some of which will require the use of computers. Homeworks are due at the beginning of the class. There will be one midterm exam and a final exam (closed book, closed notes). If you miss the midterm exam, your final exam grade will be prorated to cover the midterm. You can use calculators during the exams, but programmed calculations are considered cheating. Suspected violations of the Code of Student Conduct will be reported to the Office of Student Conduct.

Grading

- Homework: 20%
- Midterm exam: 30% [October 27, 2009, 9–10 AM]
- Project: 10%
- Final Exam: 40% [December 15, 2009, 8–11 AM]

Outline

1. Formulating linear programs: Chapter 3 (7 lectures)
2. The simplex algorithm: Chapter 4 (7 lectures)
   - Basic feasible solutions and standard form
   - The simplex algorithm
   - Certificates of optimality, infeasibility and unboundedness
3. Duality and sensitivity analysis: Chapter 6 (8 lectures)
   - The dual problem
   - Duality theorems
   - Complementary slackness
   - Changing the right hand side
   - Changing the objective
4. Discrete optimization: Chapter 9 (7 lectures)
   - Integer programming
   - Modeling with integer variables
   - Branch–and–bound method
   - Implicit enumeration

This syllabus may be modified as time and interests dictate.