Course Syllabus

IEE376 Operations Research-Deterministic Techniques (3 units)

Semester: Spring 2015

Instructor: Pitu Mirchandani (pitu@asu.edu)
Teaching assistant: Gina Dumkrieger (Gina.Dumkrieger @asu.edu)

Prerequisites: Basic Linear Algebra
Required text: *Introduction to Operations Research*, Ninth Edition, Hillier & Lieberman, Irwin/McGraw-Hill, 2010

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

Lectures: Tue Thurs 12.00-1.15 PM: (Tempe COOR 199)
Lecturer Office hrs: Wed 12.00 – 1.30 PM (BYENG 332) (May change. By appointment preferred)
TA Office hours: TBA

Course description

This is an introductory course on deterministic Operations Research (OR). In the course, we will formulate mathematical models and develop 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, 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 two midterm exams and a final exam. You can use calculators during the exams, but cannot access the web.
Use of cell phones during classes and cheating during exams will not be tolerated

Grading

_Homework: 15%
_Two midterm exams: 20% each
_Final Exam: 45%

Outline (from last offering)

_ Introduction to Operations Research: Chapter 1 and Chapter 2 (1 week)

2. Formulating linear programs: Chapter 3 (3 weeks)

_ Work scheduling
_ Capital budgeting
_ Financial planning
_ Multiperiod problem

3. The Simplex algorithm: Chapter 4 and Chapter 5(3 weeks)

_ Basic feasible solutions and standard form
_ The simplex algorithm
_ Certi_cates of optimality, infeasibility and unboundedness
_ Computer implementation

4. Duality and sensitivity analysis: Chapter 6 (3 weeks)

_ The dual problem
_ Duality theorems
_ Complementary slackness
_ Changing the right hand side

5. Network optimization: Chapter 9 (4 weeks)

_ Definitions and notation
_ Min cost network flow problem
_ Special case: shortest path problem
_ Special case: maximum flow problem
_ Network simplex algorithm
_ Network simplex algorithm
_ Assignment Problem
_ PERT-CPM Methods

6. Advanced Topics

Integer Programming
Nonlinear Optimization
Dynamic Programming and Optimal Control
Stochastic Optimization