Economics 172B: Introduction to Operations Research B

Spring 2006

Course Web Site

The objective of this course is to provide you training in mathematical techniques used in optimization. These techniques can be applied in a wide variety of settings that have to do with logistics, production planning, and resource allocation. Particular topics covered in the class include linear, integer, and nonlinear programming.

Instructor:

Peter Katuscak: pkatuscak@ucsd.edu (please write ECON 172B in the email subject); Office: Economics 222

Office Hours:

Tue 1:45-3:15pm in Economics 222 or 210, or by appointment

Teaching Assistants:

Alex Ivanov: aivanov@ucsd.edu; Office hours: Wed 3:00-4:30pm in Sequoyah 244, or by appointment;
Patricia Tong: pktong@ucsd.edu; Office hours: Tue 11:00am-12:30pm, or by appointment; Office: Economics 113

Lectures:

Tue and Thu, 5:00-6:20pm in Warren Lecture Hall 2005

Discussion Sessions:

Purpose: to discuss homework problems and answer questions about lectures and readings
Mon, 7-7:50pm and Tue, 8-8:50 in Pepper Canyon Hall 106 (there will be no discussion sections in weeks 1 and 6)

Special review sessions for the midterm:
TBA

Special review sessions for the final:
TBA

Principal Text:

Hillier, Frederick S. and Gerald J. Lieberman, *Introduction to Operations Research*, 8th edition, McGraw-Hill, 2005, ISBN 0-07-252744-7.
Note: The textbook should be available for sale at the UCSD Bookstore. It is also available from online merchants. Student Soft Reserves are also selling a coursepack with copies of chapters 11 and 12, which account for about 75% of the material we cover in this class. However, we will be using a software package in this class that only comes with the book.

Prerequisite:
Economics 172A

Homework Assignments, Final Exam, and Grades:

An in-class midterm will be given on May 4. It will contribute 30% of your grade. The final will take place on June 14. The final will contribute 50% of your grade.

In addition, about 8 weekly homework problem sets will be assigned, and they will contribute 20% of your grade. The homework assignments will be posted on the website and due as announced. There will be no homework due during the first week and the week after the midterm. From each homework assignment, two randomly selected problems will be graded and the score for that homework assignment will be determined based on the grade for the selected problems. Answers will be provided on the course website. Since the course builds up methods from the simplest problems to more complex settings, it is important to keep up with the material week by week. Apart from directly contributing to your grade, doing the problems will be a great practice for the midterm and the final. Not doing the problems will be risky and will significantly increase your chances of doing poorly in the course.

Homework Assignments and Solutions:

- Homework 1 (due Apr 13); Solutions to Homework 1
- Homework 2 (due Apr 20): Solutions to Homework 2
- Homework 3 (due Apr 27): Solutions to Homework 3
- Homework 4 (due May 2): Solutions to Homework 4
- Homework 5 (due May 18): Solutions to Homework 5
- Homework 6 (due May 25): Solutions to Homework 6
- Homework 7 (due Jun 1): Solutions to Homework 7
- Homework 8 (due Jun 8): Solutions to Homework 8

Additional Practice Problems and Solutions:

- Practice for midterm: exam 1, (solutions to exam 1), exam 2
- Practice for final: exam

Exams:

- Midterm and solutions
- Midterm results:
- Final and solutions
- Final results:

Lectures, Topics, and Reading Assignments:

Course Overview

- Lecture 1 : course overview and introduction (Apr 4)

Review of Linear Programming (HL, Chapters 3-6)

- Lecture 2 : introduction, graphical analysis, simplex method (Apr 6)
- Lecture 3 : simplex method in Excel (WyndorGlass,xls, Union Airways.xls) and IOR Tutorial, multiple optimal solutions, more general problems (Apr 11)
- Lecture 4 : fundamental insight, shadow prices, complementary slackness, sensitivity analysis (Apr 13)

Integer Programming (HL, Chapter 11)

- Lecture 5 : introduction, examples, thinking about the solution (Apr 18)
- Lecture 6 : binary integer programming (BIP) in Excel (California Mfg.xls, Southwestern Airways.xls), branch-bound-fathom technique (Apr 20)
- Lecture 7 : applications of BIP, BIP in IOR Tutorial (Apr 25)
- Lecture 8 : Mixed IP in Excel (A Mixed IP example.xls), branch-bound-fathom technique for mixed IP, mixed IP in IOR Tutorial (Apr 27)
- Lecture 9 : Applications and midterm Q&A (May 2)

May 4: In-class MIDTERM (you can use one double-sided letter-sized page of notes, you can use calculators, bring a bluebook)

Non-linear Programming (HL, Chapter 12)

- Lecture 11 : introduction, examples, derivatives, convexity and concavity (May 9)
- Lecture 12 : derivative tests for concavity /convexity of multivariate functions, quasi-concavity and quasi-convexity, classification of NLPs (May 11)
- Lecture 13 : one-variable unconstrained optimization (May 16)
- Lecture 14 : one-variable unconstrained optimization cont'd (May 18)
- Lecture 15 : multi-variable unconstrained optimization (May 23)
- Lecture 16 : multi-variable unconstrained optimization cont'd (May 25)
- Lecture 17 : constrained optimization, Karush-Kuhn-Tucker conditions (May 30)
- Lecture 18 : constrained optimization: equality constraints, interpretation of Lagrange multipliers, applications (June 1)
- Lecture 19 : numerical methods for solving constrained optimization problems (June 6)
- Lecture 20 : applications, Q&A about the final (June 8)

June 14 (Wed): Final Exam, 7-10pm, in Warren Lecture Hall 2005