APPLICATIONS OF OPTIMIZATION

Fall term 2015

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Buchanan 102
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Course Description

This course builds on the optimization coverage in the core and provides the student with advanced modeling and optimization tools that can be useful in a variety of industries and functions. The course emphasizes the use of spreadsheets and expands the student's capabilities in using Solver.

We begin by reviewing the formulation and interpretation of linear programming models using spreadsheets and Solver. The course provides an overview of the major types of linear programs, reviewing the allocation, blending, covering, and network models featured in the core, and proceeding to general network formulations. Next, the course introduces Data Envelopment Analysis (DEA), a sophisticated linear programming approach to evaluating the efficiency of similar businesses or operating units. We look briefly at nonlinear programming, highlighting the classical portfolio optimization model, for perspective on the other approaches. Then we cover the formulation and solution of integer programs, focusing on the use of binary variables and emphasizing applications in distribution, marketing and logistics. Included in the coverage are location models, traveling salesperson problems, and cluster analysis. Finally, we examine evolutionary algorithms and their use in finding heuristic solutions to challenging combinatorial problems in scheduling, forecasting, and system design.

Requirements

Homework. The course schedule contains regular written homework assignments. Preparation for virtually every class, including the first, involves building models and running Solver. Strict due dates for the homework assignments will be observed.

Exams. There is a midterm exam and a final exam. These are open book/open notes exams, each with a time limit.

Software. We rely on Analytic Solver Platform. This is an advanced Windows version of the Solver packaged with Excel and is part of the student software template for Tuck students. For more information, visit www.solver.com.

Materials

The text is *Optimization Modeling with Spreadsheets* (*Second Edition*) by Kenneth Baker. This edition is published by John Wiley & Sons.

Supplementary Readings

Ronald Rardin, *Optimization in Operations Research*, Prentice-Hall (1998).

Linus Schrage, *Optimization Modeling with LINGO*, Lindo Publishing (2003).

Wayne L. Winston and Munirpallam Venkataramanan, *Introduction to Mathematical Programming*, Brooks/Cole (2003).

Fred Hillier and Mark Hillier, *Introduction to Management Science*, McGraw-Hill/Irwin (2013).

Policies

Attendance
The general policies of the Tuck School apply. In part, this means that all students are expected to prepare for and attend class each day. Personal illness or family emergency, but not placement activities, are considered grounds for excused absences. Penalties for unexcused absences will be reflected in the course grade.

Grading

Homework	*20%*
Midterm	*35%*
Final	*45%*

Schedule

Class #1
Allocation, Covering, and Blending Models
Readings
Chapter 2
Assignments
Chapter 2/3, 4, 6

Class #2
Case: Red Brand Canners (in course folder)
Readings
Handout
Assignments
Chapter 2/5

Class #3
Special Network Models
Readings
Chapter 3.1-3.4
Assignments
Chapter 2/7, 13, 16

Class #4
Case: Hollingsworth Paper Company
Readings
See Chapter 3
Assignments
Chapter 3/1, 3

Class #5
General Network Models
Readings
Chapter 3.5-3.7
Assignments
Chapter 3/2, 4, 5

Class #6
Patterns in linear programming solutions
Readings
Chapter 4
Assignments
Chapter 3/10, 11

Class #7
Data Envelopment Analysis (DEA)
Readings
Chapter 5
Assignments
Chapter 4/4, 5, 6, 13

Class #8
Case: Nashville National Bank
Readings
See Chapter 5
Assignments
Chapter 5/5, 8, 10

Class #9
Nonlinear Programming
Readings
Chapter 8.1-8.4
Assignments
Chapter 5/6

Class #10
Midterm Exam

Class #11
Integer Programming
Readings
Chapter 6.1-6.3
Assignments
Chapter 8/5, Dehli analysis, Portfolio exercise

Class #12
Binary Choice Models
Readings
Chapter 6.4-6.6
Assignments
Chapter 6/6, 7, 9

Class #13
Logical Constraints
Readings
Chapter 7.1 - 7.3
Assignments
Chapter 6/8, 10

Class #14
Location Models
Readings
Chapter 7.4
Assignments
Chapter 7/1, 3, 4

Class #15
Traveling Salesperson Problem
Readings
Chapter 7.5-7.6
Assignments
Chapter 7/5, 6, 7

Class #16
The Evolutionary Solver
Readings
Chapter 9
Assignments
Chapter 7/8, 9, SNE

Class #17
Cluster Analysis
Assignments
Chapter 9/1, 2, 3, 4

Class #18
Case: Colgate Wave
Readings
See Chapter 9
Assignments
Chapter 9/11, 12

Exam Period
Final Exam due