

BA502 (QMETH): Decision Support Models

Winter 2005

Instructor: Mark Hillier

Office: Mackenzie 211

Office Hours: Mondays 9:30-10:30 and 12:30-1:30, and by appointment

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Course Description

This course introduces you to the concepts and methods of management science, which applies mathematical modeling and analysis to management problems. Our principal interest is to help you develop the skills necessary to build and evaluate models and to understand the reasoning behind model-based analysis. Spreadsheet packages now have features that allow managers to perform sophisticated quantitative analysis in the comfortable and intuitive environment of the spreadsheet. This gives managers the power of quantitative analysis tools without forcing them to use unfamiliar mathematical notation.

Required Materials

Hillier and Hillier, *Introduction to Management Science*, 2nd Edition, McGraw-Hill/Irwin, 2003.

Course Packet includes copies of class transparencies and problem sets. Available at Balmer Copy Center.

Course Packet

I have prepared extensive course notes that I use as overheads during lecture. These course notes include examples that we will work together in class and other lecture material. The course notes are not intended as material that you use to prepare for class; my intent is for them to make it easier for you to listen, ask questions, and participate in class, rather than take lots of your own notes during the lectures.

Software

Microsoft Excel (including Solver), Solver Table (available on Blackboard), TreePlan (available on the textbook CD) and Crystal Ball (old version available on the textbook CD, new version will be available for download).

Grading Policy

The course grade will be based on problem sets and a final exam. The final grade will be based on the following weights:

Problem Sets:	25%
Final Exam:	75%

Problem Sets

There will be four graded problem sets to be prepared by each student. Working with others in your study group is encouraged, however it is expected that you will make every effort to complete each assignment relying primarily on your own understanding of the material. The study group should be used to resolve difficulties that you cannot manage on your own. Information sharing should be in the form of discussion and explanation, and should not include copying of computer files. Each student should turn in his/her own solution to each problem set on Blackboard no later than 10 a.m. on the day it is due. Please title the file as your lastname and first initial (e.g., HillierM). If possible, include all spreadsheets in a single workbook on separate tabs. The problem sets will be graded and returned electronically through Blackboard.

Exam

The final exam will be in two parts: in-class and take-home. The in-class portion will be closed book, closed notes, with one single-sided, letter-sized page of notes allowed. Please also bring a calculator to the in-class exam. The take-home portion will be open book, open notes, but must be completed individually, without assistance from any other person.

Topics

- Linear Programming
- Sensitivity Analysis
- Integer Programming
- Decision Analysis
- Simulation with Crystal Ball

Schedule

Tuesday, March 29: Session #1**Skim:** Text, Chapter 1

Modeling with Spreadsheets. In this session we will discuss the role of models in managerial decision making, including the use of spreadsheets, and provide an overview of the models and techniques to be covered in this quarter. We will then "jump right in" and develop a spreadsheet model that addresses a managerial decision to be made.

Thursday, March 31: Session #2**Read:** Text, Chapter 2

Introduction to Linear Programming. Through a hands-on example (using Lego building blocks), we introduce the linear programming model. We will then discuss the use of the Solver feature in Microsoft Excel for modeling and solving such problems. We discuss the benefits and pitfalls of modeling a problem as a linear model. Finally, we examine the process of solving linear programs and basic properties of their solutions.

Tuesday, April 5: Session #3**Read:** Text, Chapter 3**DUE: PROBLEM SET #1 (BY 10AM)****Prudent Financial Services Case Study**

The objective of this case study is to improve students' ability to develop models in spreadsheets. We discuss the process of modeling, some guidelines for building good spreadsheet models, and techniques for debugging spreadsheet models.

Thursday, April 7: Session #4**Read:** Text, Chapter 4**Formulation of Linear Programming Models**

In this session we learn to recognize the various kinds of managerial problems to which linear programming can be applied. We will formulate linear programs that address problems from a variety of different business areas

Tuesday, April 12: Session #5**Read:** Text, Chapter 5**DUE: PROBLEM SET #2 (BY 10AM)****Sensitivity Analysis**

We discuss the use of Solver output for performing post-optimality or sensitivity analysis for linear programs. This analysis is useful in testing the robustness of the solutions to a particular model, and also in providing valuable economic information about the problem being analyzed. The Solver Table add-in will also be discussed.

Thursday, April 14: Session #6**Read:** Text, Chapter 9**Integer Programming**

In this session we address problems where some or all of the decision variables are required to assume integer values. We discuss when rounding is appropriate and when it is not. We also discuss the application of binary variables to making "yes-or-no" type decisions.

Tuesday, April 19: Session #7**Read:** Text, Sections 12.1-12.3**DUE: PROBLEM SET #3 (BY 10AM)****Introduction to Decision Analysis**

We discuss an approach to making decisions when there is uncertainty or risk present. We will discuss different criteria for making decisions and introduce decision trees as a tool for framing these problems. The TreePlan Excel add-in for developing decision trees is demonstrated.

Thursday, April 21: Session #8**Read:** Text, Sections 12.4-12.11**Sequential Decisions, The Value of Information, Risk Attitude, and Utility Functions**

Here we will discuss methods for adapting decision trees to evaluate the value of information that might be gathered before a decision needs to be made. Then we introduce the concept of risk aversion and discuss the importance of incorporating risk attitudes in a decision analysis model. We will discuss the use of utility functions to model risk aversion.

Tuesday, April 26: Session #9

Skim: Text, Chapter 15

Read: Text, Chapter 16

DUE: PROBLEM SET #4 (BY 10AM)

Simulation and Crystal Ball

In this session we discuss and demonstrate the role of simulation as a tool for analyzing systems involving uncertainty or risk. We discuss the use of the Crystal Ball Excel add-in for performing Monte-Carlo simulation.

Thursday, April 28: Session #10

Applications of Simulation

In this session we continue discussion of Monte-Carlo simulation and the Crystal Ball Excel add-in and its application to various business problems.

Friday, April 29:

In-Class Final Exam

Anytime between April 26 and May 2 (but please refrain from any group interaction during the take-home exam period: April 29-May2):

RECOMMENDED: PROBLEM SET #5 (SELF-GRADED)

Monday, May 2:

DUE: Take-Home portion of Final Exam (by 10 a.m.)