COLUMBIA
BUSINESS
SCHOOL

B6015: Decision Models
Summer 2000

Course Description

This course provides an introduction to computer-based models for decision making. The emphasis is on models that are widely used in diverse industries and functional areas, including finance, accounting, operations, and marketing. Applications will include production planning, supply chain management, foreign exchange and commodity trading, asset-liability management, portfolio optimization, corporate risk management, and yield management, among others. The aim of the course is to help students become intelligent consumers of these methods. To this end, the course will cover the basic elements of modeling -- how to formulate a model and how to use and interpret the information a model produces. The course will attempt to instill a critical viewpoint towards decision models, recognizing that they are powerful but limited tools.

The applicability and usage of computer-based models have increased dramatically in recent years, due to the extraordinary improvements in computer, information and communication technologies, including not just hardware but also model-solution techniques and user interfaces. Twenty years ago working with a model meant using an expensive mainframe computer, learning a complex programming language, and struggling to compile data by hand; the entire process was clearly marked "experts only." The rise of personal computers, friendly interfaces (such as spreadsheets), and large databases has made modeling far more accessible to managers. Information has come to be recognized as a critical resource, and models play a key role in deploying this resource, in organizing and structuring information so that it can be used productively.

Texts

- Winston and Albright, 1997, Practical Management Science: Spreadsheet Modeling and Applications, Duxbury Press, Belmont, CA. (W&A)
- *Crystal Ball: Forecasting & Risk Analysis for Spreadsheet Users* (an add-in for Excel for creating simulations in a spreadsheet). Version 2000, Standard Edition. (Crystal Ball will be provided with the readings book).
- A *readings book* with cases, practice problems and articles, will also be handed out on the first day of classes.

Computer Software

We will use spreadsheets fairly extensively throughout the course. In the lectures we will refer to the *Excel 97* spreadsheet package for Windows 95/98. This spreadsheet has extensive optimization capabilities built in. *Crystal Ball* is an add-in for Excel which makes it much easier to run simulations in a spreadsheet.

Solutions to practice problems in Excel (*.xls*) format can be downloaded from the Decision Models course webpage: http://www.columbia.edu/cu/business/courses/
The webpage will be updated as the course progresses.

Review Sessions

Friday review sessions will be offered from 1:20pm to 2:40pm, room TBA. The first review session will be on Friday, July 14th. The review sessions will be used to answer questions, go over practice problems, and review the cases.

Course Work

There will be two computer homework assignments to be done individually and one main case to be done in groups. These will serve as a good way to stay on top of the material. The case can be done in groups of five or less and it is due Friday, August 11th. In addition for many of the class sessions, you will be asked to prepare for discussion in class.

	Weight
2 Individual Hand-In Assignments	20%
Main Case	30%
Final Exam	50%

Practice Problems

The readings book has a set of practice problems with solutions. Many of these practice problems were based on past midterm and final examination questions. Spreadsheets solutions (in Excel *.xls* format) to these problems can be downloaded from the webpage. None of these practice problems will be collected. However, since the best way to learn the material is through practice, it is highly recommended that you work through these practice problems (*without* looking at the solutions first!). The TA will go over the solutions to selected problems during the Friday review sessions or during office hours. See the timetable at the end of the syllabus for details. Additional practice problems can be found throughout the W&A text.

Exam

The final exam will be given on Thursday, August 17 9AM. There will be four hours for the final exam, although most students should be able to finish in three hours or less. The exam will be open book and open notes. A common final exam will be used for all sections of the course. Notebook computers will be needed in the final exam. Think of the computer as a fancy calculator: it is useful for checking one's work and for some questions the computer will be needed to get final answers. However, the *majority* of the points on the exam will be given for correct methods and analysis; correct numbers will only count for a small portion of the points. Printing will not be allowed in the final exam. Any answers from the computer must be transcribed into the answer book.

Notebook PCs

Notebook PCs will be used in this course, but students are not required to bring them to each class. It is recommended that students bring their notebook PCs to the Friday review sessions for software-related questions. Students will be required to bring notebook PCs to Lecture 8. Also, notebook computers will be needed for the final exam.

Course Schedule

For session 1, read Chapter 1 in the W&A text.

I. Optimization Models

Lecture 1: (June 26)
- Course overview.
- Introduction to decision models; scale and complexity.
- Linear programming formulation.
- Demonstration of the spreadsheet optimization method.

For next class:
- Formulate and solve the "Shelby Shelving" case on pp. 68-69 in the W&A text. Prepare to discuss the case in class, but do not write up a formal solution.
- Readings "An Introduction to Spreadsheet Optimization Using Excel" in the readings book. Also read Chapter 2.1-2.4, 2.6, 2.8, 4.1-4.2 in the W&A text.
- *Optional readings*: "OR Brews Success for San Miguel", "Logistics Steps Onto Retail Battlefield" in the readings book.

Lecture 2: (June 28)
- Two Formulation Examples
- Shelby Shelving case

For next class:
- Read and try question (a) of the case: "Petromor: The Morombian Oil State Company" in the readings book. (Prepare to discuss the case in class, but do not write up a formal solution.)
- Read Chapter 4.4 in the W&A text.
- *Optional reading*: "Graphical Analysis" in the readings book.
- *Homework Assignment #1 is handed out here.*
- Install the SolverTable add-in to Excel. See the course web-page for instructions.

Lecture 3: (July 10)
- Sensitivity Analysis (on Shelby)
- Bidding/Assignment Problems

For next class:
- Read Chapter 2.9 and 3.7 in the W&A text.

Lecture 4: (July 12)
- Multi-period Planning
- Cash Flow Matching LP, Project funding example

For next class:
- Read Chapter 5.1 and 5.5 in the W&A text.
- Read pages 310-313 and 6.11 in the W&A text.
- *Optional reading*: "Improving Gasoline Blending at Texaco"

Lecture 5: (July 14)
- Integer Programming: plant location example
- Portfolio Optimization - I

For next class:
- *Optional readings*: "Exploring the New Efficient Frontier" and "Asset Allocation in a Downside-Risk Framework" in the readings book.

Lecture 6: (July 17)
- Portfolio Optimization – II
- *Homework Assignment #1 is due!*

For next class:
- Solve the "GMS Stock Hedging" case, pp. 330-331 in the W&A text. (Prepare to discuss the case in class, but do not write up a formal solution.)
- Read Chapter 7.3 in the W&A text.

Lecture 7: (July 19)
- Portfolio Optimization – III
- GMS Stock Hedging
- Introduction to Retailer Simulation
- *Homework Assignment #2 is assigned*

For next class:
- Read the case "Retailer: A Retail Pricing Simulation Exercise" on pp.529-534 in the W&A text. Download the Retailer files from the course webpage. (Put all of the Retailer-related files into a directory C:\RETAIL on your computer.)
- In your group, analyze the historical data in the spreadsheet RETAIL.XLS and prepare a pricing strategy for next class.
- *Optional readings*: "His Goal: No Room at the Inns," "Computers as Price Setters Complicate Travelers' Lives," "Making Supply Meet Demand in an Uncertain World," and "Yield Management at American Airlines" in the readings book.

II. Simulation Models

Lecture 8: (July 24) Bring Notebook PCs to this class!
- Retailer case
- Retailer analysis

For next class:
- Read Chapter 12, pp. 581-594 in the W&A text.

Lecture 9: (July 26)
- Introduction to Simulation
- Introduction to Crystal Ball
- Risk Management Simulation Example

For next class:
- *Optional reading*: Chapter 12.5-12.12 and Chapter 13 in the W&A text.

Lecture 10: (July 28)
- Ski Jacket case

For next class:
- Read "Identifying, Measuring and Hedging Currency Risk at Merck," "Merck's 1995 Annual Report," and "Managing Risk" in the readings book.

Lecture 11: (July 31)
- Risk Management at Merck
- Using Simulation for Foreign Currency Risk Management
- *Homework Assignment #2 is due!*

Lecture 12: (August 2)
- Introduction to Value at Risk
- Bond Applications
- Course Review and Wrap-up.

Final exam: Thursday, August 17