DECISION SCIENCE
SYLLABUS
FALL TERM, 2007

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Objectives

This course provides an introduction to the concepts and methods of Decision Science, which involves the application of mathematical modeling and analysis to management problems. It also provides a foundation in modeling with spreadsheets. The primary goal of the course is to help you become a more skilled builder and consumer of models and model-based analyses.

Another important goal is to encourage a more disciplined thinking process in the way you approach management situations. As a result of this course you will become more confident in understanding and using models, both in other courses and on the job.

More specifically, the course will:

* Show you how to use Excel spreadsheets effectively for business analysis. You will learn a comprehensive set of spreadsheet skills and tools, including how to design, build, test, and use a spreadsheet.

* Introduce you to the basic principles and techniques of applied mathematical modeling for managerial decision-making. You will learn to use some of the more important analytic methods, to recognize their assumptions and limitations, and to employ them in decision-making. These methods will be applied to problems arising in a variety of functional areas of business, including economics, accounting, marketing, operations, and capital markets.

* Sharpen your ability to structure problems and to perform logical analyses. You will practice translating descriptions of business situations into formal models, and you will investigate those models in an organized fashion.

* Expose you to settings in which models can be used effectively. You will apply modeling concepts in practical situations. You will learn to extract insight from models, and to use those insights to communicate, persuade and motivate change.

Materials

Readings

The text for this course is *Management Science: The Art of Modeling with Spreadsheets*, (Second Edition 2007), by Powell and Baker. When reading the book in preparation for class it is essential that you take an *active* approach. This means that you open the spreadsheets that are being discussed in the book and work through them as you read. (Note: These spreadsheets are available in the course folder under Spreadsheets from Text.) When a new method is presented, first repeat the example in the book and then try two or three new examples on your own. In class, we will often discuss new applications of the methods presented in the book, and we will assume you are familiar with the material in the reading. The best prepared student is often the one who comes to class with questions about how the concepts and methods can be applied. Finally, you should expect to return to the book after class or while reviewing, in order to refine and consolidate your knowledge.

In addition to the text, some required readings have been selected from other sources and will be distributed separately. There are many textbooks in the library that contain alternative readings, examples and exercises for practice. Five of these have been placed on reserve:

Francis J. Clauss, *Applied Management Science and Spreadsheet Modeling*, Duxbury.
Jeffrey D. Camm and James R. Evans, *Management Science: Modeling, Analysis, and Interpretation*, South-Western.

Cliff Ragsdale, *Spreadsheet Modeling and Decision Analysis*, South-Western.

Wayne L. Winston and S. Christian Albright, *Practical Management Science: Spreadsheet Modeling and Applications*, Duxbury.

Jeffrey Moore et al., *Introductory Management Science*, Prentice-Hall.

Homework

Homework exercises provide you with opportunities to practice the skills of modeling and analysis introduced in the course. Homework emphasizes the quantitative aspects of the course material and provides you with feedback on how well you are mastering analytic techniques. There are two types of assignments, individual and team. Solutions to both types of homework should be submitted in-class, before the beginning of class, on the assigned due-dates. Late homework will not be accepted.

Individual Assignments

You should attempt each exercise on your own before discussing it with your team. Each individual will submit a hardcopy solution in class and save a spreadsheet file in their personal folder in the Individual Homework Drop Folder. Please format your work according to the format guide distributed in class. All work handed in for grading must be your own. You may use ideas suggested by members of your group, but the organization, analysis, and presentation of the work must be your own.

Team Assignments

Team assignments should be collaborative work among the students on the team. Every team member is expected to contribute substantially to every team assignment. Do not put your name on a team assignment to which you have not contributed substantially. Each team will submit a single hardcopy of their Power Point presentation in class and save both Power Point

and spreadsheet files in the team's folder in the Team Assignment Drop Folder. Both your Power Point slides and your spreadsheet should list the names of group members who contributed substantially to the assignment. Team assignments are based on cases that provide descriptions of practical situations where modeling and analysis can play an important role. The cases provide you with opportunities to practice translating situations into problem structures and to consider the implications of your analysis for a particular situation. For many of the cases you will also be expected to present your ideas to an audience interested in the implications of your analysis. Note that every member of your team should be prepared to present the case.

If you have any questions about the policies and procedures governing homework, you should feel free to talk with Professor Powell or Shumsky.

Software

Software for the course is Microsoft Excel 2007, along with three add-ins: Premium Solver, Crystal Ball 7 Academic, and the Sensitivity Toolkit. The add-ins are part of the standard Tuck software.

Policies

Honor Principle

The Tuck Honor Principle represents a contract among students and instructors about behaviors that are appropriate in the learning process. This course is structured to promote learning by a combination of individual and team efforts. This structure encourages certain group interactions because they enable you to use time efficiently or because they improve your understanding of the material.

Collaboration on daily preparation for class is always encouraged. On a number of days during the course, team preparation will be essential, because a team member will be expected to present the team's analysis in class. Class discussion should be based on individual and team preparation, but not on the information produced by other sections of the course earlier in the day.

With respect to individual homework, some amount of discussion and sharing within the team is desirable, with the understanding that each student is responsible for learning all the material on the assignment. Each student is expected to complete each homework exercise individually, using the team mainly to help resolve open issues.

For both team and individual homework, while collaboration within a team is encouraged, discussions *between teams* should be limited to general concepts and should avoid the exchange of approaches or solutions to specific homework exercises or cases.

Conversations with second-year students other than Teaching Assistants about specific assignments before their due-dates are a violation of the Honor Principle. It is also a violation of the Honor Principle to use information from previous years' homework in doing the assigned exercises or cases. Finally, it is a violation of the Honor Principle to hand in for grading work that is not your own.

With respect to the exams, group preparation is permissible, but the work done during the exam must be done without the help of other students. Quizzes and exams will have set time limits.

If situations arise where the application of the Honor Principle is unclear, students should seek the interpretation of the instructor or consult with a member of the Judicial Board.

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, in their assigned sections, except for optional sessions as designated by the instructors. 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.

Class participation

Class participation will be evaluated subjectively. As instructors, we value attendance, punctuality, familiarity with the required readings, and classroom questions or comments that are relevant and insightful. Differences in technical background or skill are not a criterion. In general, we evaluate classroom participation on the basis of the extent to which you contribute to a positive and effective learning environment (for yourself and others). Demonstrating mastery of advanced topics at inappropriate times does not contribute to a positive learning environment. Correcting us when we make a mistake, however, or asking what may appear to be a naive question, quite often contribute positively. ("Dumb" questions, which rarely are that, are usually shared by many students, and asking one can keep the class on track.)

Grading

Midterm Exam 30%

Final Exam 55%

Homework 15%

Class participation may be used to determine grades for students at the borderlines (for example, between S+ and H). All exams are open notes/open book exams. Computers are used on all exams.

Schedule

09/05/2007
Introduction to spreadsheet modeling and problem solving
Readings
Chapter 1, pp. 1-16; Chapter 2, pp. 17-34.

Assignment
Prepare *San Fernando Airport*. (You will find this problem in your course packet.)
Prepare Exercise 1, the Boeing problem, under the heading Influence Charts on page 51 of the textbook.
Hand in both these problems, attached together, at the start of class.
Individual assignment.

09/07/2007
Spreadsheet engineering
Readings
Read Chapter 5, pp.95-121.
Note: Spreadsheets used in the textbook are available on the course folder under Spreadsheets from Text.

Assignment
Prepare Exercise 5.3. (The description of the case is on page 482.)
For this and all future individual assignments please use the Format Guide based on *San Fernando Airport* that was distributed on the first day of class.
Individual assignment.

09/10/2007
Spreadsheet analysis
Readings
Read Chapter 6, pp. 123-137.

Assignment
Prepare Exercise 6.3.
Individual assignment.

09/12/2007
Modeling and Prototyping
Readings
Chapter 2, pp. 34-49.
Work through *Practice with Advanced Excel Functions.* Note: this is not to be handed in. If you are comfortable with using Excel functions such as IF, AND, OR, NPV and VLOOKUP, then consider this assignment optional.

Assignment
Prepare Superchem, Inc. Place your Superchem Excel spreadsheet model in your drop folder on the P-drive and bring your influence diagram to class. Be prepared to discuss your model. You will not, however, submit a hard-copy of your model, and your Superchem model will not be graded.
Individual assignment.

09/14/2007
Data analysis
Readings
Read Chapter 7, pp. 140-150.

(While all the tools described here are part of Excel 2007, certain Excel commands in Excel 2007 are slightly different from those in the book. As you read, explore Excel and find the appropriate tools. We will also discuss these differences in class.)

Assignments
Hand in Exercise 6.5. Begin by constructing the spreadsheet described in Exercise 5.5 (the relevant case is on page 483). After constructing the spreadsheet, answer all questions in Exercise 6.5.
Individual assignment.

09/17/2007
Modeling in Practice
Assignments
Prepare *The ERP Decision*.
Team assignment.

09/19/2007
Introduction to Optimization and Solver
Readings
Read Chapter 10, pp. 214-238.

Assignments
Exercise 10.5 for practice (not to be handed in).
Hand in Exercise 10.3. (You are not required to use the Excel regression tool in part a.)
Individual assignment.

09/21/2007
Midterm Exam
1:30 p.m. to 4:30 p.m.

09/24/2007
Creating optimization models
Readings
Read Chapter 11, pp. 246-260.

Assignments
Exercise 11.4 for practice.
Hand in Exercise 11.7.
Individual assignment.

09/26/2007
Optimization models and sensitivity analysis
Readings
Read Chapter 11, pp. 260-265.

Assignments
Hand in Exercise 11.8. Before starting the exercise read *Preparation for Exercise 11.8* from the course packet.
Individual assignment.

09/28/2007
Production planning
Assignments
Preparation: *Cox Cable Company*. Review *Preparation for Cox Cable*.
Team assignment.

10/01/2007
Revenue management
Assignments
Prepare *SkyJet (A): Network Revenue Management*.
Team assignment.

10/03/2007
Sales force sizing and allocation
Readings

Assignments
Prepare *Syntex Laboratories (A)*. Review *Preparation for Syntex*.
Team assignment.

10/05/2007
Introduction to simulation
Readings
Read Chapter 15, pp. 370-383.

Assignment
Exercise 15.12 for practice.
Hand in Exercise 15.15.
Individual assignment.

10/08/2007
Simulation techniques and examples
Readings
Read Chapter 15, pp. 383-398.

Assignment
Exercise 15.5 for practice.
Hand in Exercise 15.17.
Individual assignment.

10/10/2007
Simulation modeling and analysis
Readings
Read Chapter 15, pp. 398-415.

Assignment
Hand in Exercise 15.13.
Individual assignment.

10/12/2007
Managing risk with insurance
Assignment
Prepare *Sigma Risk Management*. Review *Preparation for Sigma Risk Management*
Team assignment.

10/17/2007
Optimization in simulation-
Readings
Read Chapter 16, pp. 436-444.
Hand in Exercise 16.3.
Individual assignment.

10/18/2007
Assessing acquisition value with simulation
Assignment
Prepare *Genzyme/Geltex Pharmaceuticals Joint Venture*.
Review *Preparation for Genzyme/Geltex Pharmaceuticals Joint Venture.*

10/23/2007
Final Exam
9:00 a.m. to 12:00