Analytical Techniques
Rutgers University
International EMBA Program
Beijing, December 2009

All class policies subject to change at instructor's discretion.

Quick Overview:

- **Instructor**: Jonathan Eckstein
- **E-mail**: jeckstei@rci.rutgers.edu
- **Class websites**: To be announced
- **Office in USA**:
  - 255 J. H. Levin Building, 94 Rockafeller Road, Rutgers University, Piscataway NJ 08854
  - Alternate: 155 RUTCOR Building, 640 Bartholomew Road, Rutgers University, Piscataway NJ 08854
- **Telephone in USA**: Permanent: (732) 445-0510, (732) 445-3272.
- **Textbooks**
  - *Spreadsheet Modeling and Decision Analysis*, 5th edition revised, by Cliff T. Ragsdale, Thomson/South-Western
  - Additional course pack material and cases
- **Software**:
  - Optimization: Excel and the Solver add-in (already installed in Excel, or use "premium" version from the textbook software disk)
  - Decision trees: optionally, you may use Excel combined with the TreePlan add-in (from the textbook software disk), or you may simply use a calculator
  - Simulation: Excel with the YASAI add-in (free on web).

Course Content

This course is designed to familiarize you with fundamental quantitative tools for business decision-making and planning, and to help you think quantitatively about decision and planning problems. It is not possible to cover every relevant quantitative technique in the time available, so we will focus on a relatively small number of generic, commonly-used methods that form the foundations of many others. All the techniques we will cover are based on:

- Constructing a *mathematical model* of the planning or decision problem (in this course, usually via a computer spreadsheet), and then
- Analyzing this model with the aid of computer tools (for this course, all spreadsheet-based), to obtain a suggested course of action.

The first part of the course will be about *optimization modeling*, in situations where the problem data are known without significant uncertainty. Even relatively simple problems of this kind are hard for people to solve by intuition or "back-of-the-envelope" calculations, but many yield easily to mathematical and computer modeling and analysis. Within this topic, we will briefly explore a variety of subtopics, and try to
impart an understanding of the situations in which they arise:

- Linear programming
- Integer programming
- Nonlinear programming
- Trade-offs between multiple objectives.

In the second part of the course, we consider decision making under uncertainty. Planning systematically under uncertainty requires the mathematics of uncertainty, called probability theory, also used in statistics. We consider two techniques for planning under uncertainty: first, when the situation is simple enough (or has been sufficiently simplified by your model) that it is possible to explore every possible contingency, one may apply decision trees, also called decision analysis. After decision trees, we will cover a very general, powerful technique: probabilistic simulation modeling.

As we cover these topics, we will also review some relevant microeconomic concepts, including sunk costs, fixed costs, allocated costs, and net present value. Finally, we will work throughout the course on enlarging and sharpening your spreadsheet modeling skills.

**General Information**

**Course Work and Grading**

Your grade will be based on the following, in order of importance

- Two exams, scheduled for the first half of class on Thursday, December 10, and the last class segment on Sunday, December 13.
- Homework case study analysis assignments due Tuesday, December 8 and Saturday, December 12.
- Perhaps some weight to class participation, to be determined.

Because quantitative material must be learned at least partially by solving problems oneself, and the class format leaves very limited time for homework assignments, portions of the class meeting time will be used for in-class problem solving, either individually or in small groups. During these periods, I will remain in the classroom to assist students. I will not formally grade such in-class work, but might consider the in-class problem sessions as part of "class participation". Students may collaborate during in-class problem-solving sessions, but not on exams or homework.

I anticipate a grading weight of 15% for each homework assignment, and 35% for each exam, subject to change. If I decide to assign some weight to class participation, the weight assigned to some or all of the homework assignments and exams will be reduced somewhat to compensate.

**Software**

You must have a laptop computer running Windows and Microsoft Excel 2003 or 2007. Some older versions of Excel may also work. The Macintosh version of Excel cannot be used (this not an issue with the Mac itself, but because Microsoft Office for the Macintosh is not fully compatible with Windows Office). If you have a Mac, you can use it to run Windows and Excel via VMWare Fusion or BootCamp (I recommend VMWare Fusion). Do do this, however, you should have legal copies of VMWare Fusion, Windows, and Excel.

In the first half of the course, we will use the Solver add-in. Microsoft supplies a version of this add-in with Excel, although sometimes it is not automatically installed. Thus, it may already be available by enabling it in
Excel's the Tools->Add-in dialog box, or installable from your Microsoft Office installation disk(s). If not, the textbook contains a CD-ROM from which you may install a "premium" version of Solver.

In the decision tree section of the course, you may use the TreePlan add-in, although you may find the problems simple enough to work through by hand with the aid of a calculator.

In the simulation portion of the course, I plan to use the free YASAI add-in (which I designed myself, and programmed portions of). The book includes a copy of the commercial Crystal Ball add-in, which is also included on the textbook software disk. The two add-ins are very similar in purpose, but YASAI is much simpler, and in my experience causes far fewer software problems.

**Detailed Syllabus**

On the following page is my detailed plan for this course, *which is subject to change.*