

DECISION 410 -- Decision Analysis
Fuqua School of Business
Duke University
Spring Term 3, 2003-2004

Uncertainty, multiple objectives, and complexity make many decisions difficult. To cope with difficult decisions, managers must make effective use of various types of information that are available, for example past data, forecasts regarding future events, decision alternatives now and in the future, attitudes toward risk, tradeoffs among objectives, and predictions of competitors' actions. Sometimes it is important to seek additional information as well.

Building on the analytical tools and concepts introduced in the Decision Models core course, the goal of the elective is to study aspects of decision analysis in depth, using a variety of modeling methods. Assignments and classroom discussions will help students develop decision-analysis modeling skills by focusing on the development and evaluation of models for complex and sometimes poorly defined problems such as evaluating capital expenditures, choosing an optimal portfolio of capital projects, hedging, downstream decisions and opportunities, and negotiations. We will also see how such models are used to support decision making in large organizations and consulting practice.

Decision Analysis is intended for MBA students who are interested in using formal models to support decision making regardless of functional area. The Decision Models core course (DECISION 312), or its equivalent, is a prerequisite for this course. We will not be learning new analytical tools *per se*; instead, the focus will be on the creation of appropriate models of the situation that can be analyzed with the tools we have (especially optimization and Monte Carlo simulation). How can we represent multiple objectives in an organization? How can we capture the value of downstream opportunities? How can we represent what a negotiator knows about the other parties in a negotiation? In all cases, ultimately we will want to be able to develop insights that can support the decision maker and help the decision maker understand what the appropriate action is and why.

The course will revolve around cases and readings to prepare for each class session. During classes we will discuss the cases and readings, students will present models, and we will have occasional lectures.

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Office hours: I do not plan to hold regularly scheduled office hours. However, I will be in my office and available as much as possible, especially before assignments are due. If you find me in my office, I will try to make time on the spot to consult with you. Feel free to call or email in advance to make sure that I will be available. If you do not find me in my office, it is a safe assumption that I am working at home, probably preparing for class or taking care of other professional and personal responsibilities.

Course web site: <http://faculty.fuqua.duke.edu/~clemen/DA2004/>. You will be able to download a variety of course materials from the web site.

Deliverables: Your grade will be based on three submitted assignments, two peer reviews, and your participation in class. Students may also boost their grade by doing a project of their own design (see below). Another option is to revise and re-submit one of the two peer-reviewed assignments. Details on all of these are given below. There are no exams.

- **Submitted Assignments.** You will complete three modeling assignments as indicated on the schedule. The first one (CBA Associates) will be available on the first day of class. Each of the others will be handed out two weeks before the due date. Weights for the assignments are shown on the schedule.

The assignments will be completed as Excel workbooks and will be submitted electronically (see below). Your job will be to prepare an Excel-based model that a sophisticated decision maker can use to get insights into the decision situation. A good submission will include an executive summary no more than 1000 words (bullet points work well), a well designed model, analysis results as needed, and adequate annotations so that a user can play with the model to develop understanding. Please note that I am not looking for whiz-bang Excel programming in the way of macros and buttons. The model should be as transparent as possible to the decision maker. For example, if you change a value in a cell, what are the impacts on the outputs, and what is the interpretation? Or if you graph a series of numbers, what do they reveal? Think of your client as a sophisticated Excel user who wants to play with the model; your submission should be set up to guide the client in what to play with and how to interpret the results he or she obtains.

A few notes about the submitted assignments:

- The submitted assignments are to be completed in teams of three students of your choosing. You should plan to work with these teammates for all three of the submitted assignments. You must have chosen your team members by the beginning of class on Monday, January 26. If you need help finding teammates, please let me know as soon as possible.
- All team members will receive the same grade for an assignment.
- You will be asked to evaluate your team members at the end of the term. Thus, if you feel that one of your team members has not contributed his or her share, you will have an opportunity to let me know. If I find that there is a significant problem, I may adjust grades accordingly.
- If you have clarification questions about an assignment, I encourage you to check your email. It is possible that the question has come up and has already been answered. If not, please feel free to ask (by email, phone, or by dropping by my office). If an assignment needs clarification or if I give special guidance to some students, I will do my best to make this information available to everyone as soon as possible.

- You are welcome to include in your submission results from various analyses, provided that these results actually help the decision maker. Please do not include reports or results “just for completeness” unless you actually refer to them and use them to help the decision maker gain insight. Adding pages of Crystal Ball reports without any annotations or interpretation, for example, will not help your grade.
- Please be careful of “overinterpretation.” I’ll read whatever you include. If you include two different interpretations of a result in hopes that one of them is correct, don’t assume that you will get credit. If you aren’t sure how to interpret something, the appropriate response – what is most helpful for your decision maker – is to indicate the different possibilities, state that you are not sure which is most applicable, and suggest additional work that might resolve the issue.
- Finally, please realize that grading your assignments is largely a subjective exercise. I will, of course, be looking for some general features, and I will do my best to give adequate guidance in this respect. However, when it comes to assigning points, I will carefully rank the submissions relative to each other in terms of how well they accomplish the assignment’s objectives. Thus, it will not do much good to come to me and “argue” for additional points, as any adjustment would require me to reconsider not just your assignment but potentially many others. The one exception is a clerical error. If you believe that I overlooked something that is *both crucial and obvious* on your assignment, I will be glad to look again and reconsider.
- **Peer Reviews.** One of the key learning objectives of the course is for you to learn to critique a model. One way we will accomplish this is to build and evaluate lots of models in class. In addition, you will review and provide brief comments on the first two assignments submitted by your classmates. Each of you will be assigned to review a specific model. The review will follow a specific format, will be available to the creators of the model reviewed, and will be graded. Please take these reviews seriously! You will learn a lot by thinking hard about how someone might improve their model and the presentation thereof, and the creators of the model will likewise learn a lot about how they might improve!
- **Class Participation.** Class participation is crucial for this course. Students must come to each class prepared to discuss the assignments and may be asked to share their models with the class. We will be critiquing each others’ models, and it will be important to do so in positive and constructive ways. We will all be learning about model construction and analysis, and as we do so, we should do so within an environment that is supportive for all students. I will try to provide guidelines to help us establish and maintain such an environment.

For each class, I will try to keep notes on participation. Please do what you can to help me learn your names! If I can’t attribute a positive comment to you, I won’t be able to give you the credit that you deserve!

Electronic Submission System: We will be using an electronic system developed by Fuqua's Center for Excellence in Business Education. This system is integrated into our course website. You will submit the three main assignments, retrieve the assignments you are assigned to review, and submit your peer reviews using this system. The system is easy to use and includes a help facility. If you need assistance in using it, please let me know as soon as possible.

Your assignments will be due as indicated on our schedule, and all submitted assignments will have a "time stamp" indicating the precise time of submission. You may submit assignments late, although doing so may incur a penalty (including the possibility of no credit) unless prior arrangements have been made.

Please be sure that you (and each of your team members) have a final copy of your submission available on the Fuqua network in case you are asked to present your model and analysis to the class.

Honor Code: In general, students are expected to abide by the Fuqua Honor code in all aspects of the course. Particular aspects of the Honor Code that apply to the assignments are described below. Failure to comply with any aspect of these will constitute an Honor Code violation:

- In doing the assignments, each team must do their own work (build their own models, perform their own analysis, and draw their own conclusions). You may discuss concepts covered in class with anyone, but you are not to discuss their specific application to assignments with anyone who is not on your team. You may not share spreadsheets or write-ups or "check" your results with others before turning in the assignment.
- You may not read or use materials or solutions prepared for previous versions of this course.
- You may not share any of the assignments or solutions with anyone who may take the course in the future.
- Each assignment may include additional Honor Code stipulations specific to that assignment.

Options for Extra Credit. There are two ways you can boost your grade:

1. **Project:** You may complete a project of your own design. There are a variety of options available for a project, including (but not limited to):
 - Model and analysis of a real decision problem (personal or managerial) that you are familiar with.
 - An analysis of an important decision problem (again, real) "in the public domain."
 - A significant elaboration or extension of one of the problems that we consider in class.
 - Collection and analysis of some data to address a decision-making issue or performance of a decision-analytic tool.
 - A review or "position piece" on an area related to decision analysis.

Projects may be done individually or in teams. The grade and weight assigned to the project will be based on the scope and quality of the project as well as the number of people involved. To boost your grade, the project must be done at a level of quality consistent with the next grade level. If you do a project, you are expected to make a presentation to me prior to the end of the term. All members of the team are must be present for the presentation. I consider the presentation and subsequent discussion to be an important part of the project experience, so expect to spend 45-60 minutes. If you are not available for the project presentation, you will not receive credit for it.

DEADLINES:

- In order to ensure that you have adequate time to complete a suitable project, I will accept a project from you only if you and I have agreed on your topic and who is on your project team by 5:00 PM, **Friday, February 27**. The earlier you contact me about your project, the better!
 - All project presentations must be completed by 5:00 PM on **Thursday, March 4**. No exceptions.
2. **Revise and Resubmit Assignment 1 or 2.** I want to encourage you to improve your modeling skills and especially to make use of the feedback you receive. To this end, you may revise and resubmit either Assignment 1 (*CBA Associates*) or Assignment 2 (*Merck & Co*), but not both. Your grade for the assignment will be the average of your grades on the original and revised versions. The revised assignment must be submitted electronically no later than 5:00 PM on **Thursday, February 26**.

A few additional notes:

- **Special Guests:** Please note two special events on our schedule:
 - **Tuesday, Feb 3: Nick Pudar, General Motors Strategic Initiatives.** Nick will be speaking about the use of modeling for strategic decision making at GM. His talk will be during the “Distinguished Speaker” slot from 10:30-11:30. You are required to attend his talk. On Thursday we will have a short class during which we will discuss issues raised during his talk as well as the models described in the article about the development of the OnStar system assigned for that day.
 - **Thursday, Feb 12: Gregg Talbert, Eli Lilly Company.** Gregg will be present to hear your presentations and discussion about the Merck case and will discuss some of his experiences related to negotiating joint ventures between start-up companies and Eli Lilly. Please come to class that day especially well prepared!
- **Coursepack:** The coursepack has all of the required readings, including required material from the optional text described below.
- **Text:** There is no required textbook for the course. An **optional** text is *Making Hard Decisions: An Introduction to Decision Analysis* by Robert T. Clemen (yours truly!), 2nd Edition, Duxbury Press, Pacific Grove, CA, 1996), available at the Duke

bookstore and fondly called *MHD*. Three copies are on reserve at the Fuqua library.

Generally speaking, the text is written at a level that is somewhat higher than Decision Models, but not quite at the level of our course. Thus, for certain topics, you will find good, basic information in *MHD*. Many of our topics, though, fall outside of the scope of the text (e.g., portfolio optimization, real options, negotiations, hedging). Regardless, *MHD* is widely used as a basic decision analysis reference. If you intend to use decision analysis in your career, you might find *MHD* to be a useful addition to your library.

The solution manual for *MHD* is also available on closed reserve in the Ford library.

- **Software:** Most of the assignments will require the use of a spreadsheet and many will benefit from the use of various add-ins for Microsoft Excel, particularly TreePlan, Solver, SensIt, and Crystal Ball. TreePlan and SensIt may be downloaded from our course website. Solver comes with Microsoft Excel. You should have a copy of Crystal Ball from Decision Models last year. (If you do not have a copy of Crystal Ball, please see me right away.)
- **Computers in class:** Because so much of our focus in class will be on modeling, you are welcome to bring your laptop to class. However, laptops may only be used for modeling and analysis purposes associated with the current topic of class discussion. Any other use will be considered a violation of the Honor Code. If you feel the need to check email, surf the web, or work on anything other than the current focus of the class discussion, please do that outside of the classroom.
- **Starting on time:** I will start class on time at the beginning of class and after the break (10 minutes!). I may make important announcements or pass out handouts at this time. Please make a commitment (to me, to your classmates, and to yourself!) to be in your seat and ready to begin. If you must arrive late on some occasion, the class will appreciate a quiet, non-disruptive entry.
- **Mid-course surveys:** I'll ask you to fill out two very brief mid-course surveys (on Jan 29 and Feb 12) just to check on how we are doing. Although it will be hard to make major changes in the course mid-stream, I hope to be able to fine-tune the materials, assignments, and delivery based on your feedback.
- **Newsgroup.** I will not be using a course newsgroup. (My feeling is that we will have enough to do without this additional feature!) If I need to make an announcement or communicate with you in some way, I will use email.

TENTATIVE Course Schedule

Date	Day	Topics	Preparation
1/20	Tue	<i>The Racquetball Racket</i> modeling problem, introduction to influence diagrams	See preassignment: Prepare <i>The Racquetball Racket</i> Read influence diagram problems, <i>Making Hard Decisions (MHD)</i> pp. 52-66.
1/22	Thur	R&D portfolio analysis	Prepare <i>R&D Portfolio Analysis</i> . Read Sharpe & Keelin, “ <i>How SmithKline Beecham Makes Better Resource-Allocation Decisions.</i> ”
1/26	Mon	Using expert judgments	Prepare <i>Beat The Bookies</i> . Read <i>MHD</i> pp 285-296. Be sure you know who is on your three-person team for completing assignments.
1/29	Thur	Assignment 1, CBA Associates	Prepare <i>CBA Associates</i> . Submit electronically no later than 10:00 AM, Jan 29.
2/2	Mon	Decision aids for multiobjective decision making	Prepare <i>Internet Decision Aids</i> . Read <i>MHD</i> , pp 127-133 and 532-552. Peer review for <i>CBA Associates</i> is due. Submit electronically no later than 10:00 AM, Feb 2.
2/3	Tues	Special Event: Nick Pudar, General Motors Strategic Initiatives	ATTENDANCE REQUIRED Geneen, 10:30-11:30 AM
2/5	Thur	Discussion of Nick Pudar’s talk and the role of modeling in the OnStar project	Short class (1hr, 15 min) Read Barraba, et al, “ <i>A Multimethod Approach for Creating New Business Models: The General MotorsOnStar Project.</i> ”
2/9	Mon	Negotiation analysis	Prepare <i>RCI-Southeastern</i> . Read Raiffa, et al., “ <i>Negotiation Analysis,</i> ” pp 249-262.
2/12	Thur	Assignment 2, Merck & Company Visitor: Gregg Talbert, Eli Lilly Company	Prepare <i>Merck & Co</i> . Submit electronically no later than 10:00 AM, Feb 12.
2/16	Mon	Downstream decision opportunities	Prepare <i>Port Security Specialists</i> . Read Amram, M., & N. Kulatilaka, “ <i>Disciplined Decisions.</i> ” Peer review for <i>Merck & Co</i> is due. Submit electronically no later than 10:00 AM, Feb 16.

2/19	Thur	<i>Kendall Power, Part A</i>	Prepare <i>Kendall Power A</i> .
2/23	Mon	Optimal hedging	Prepare <i>Hedging Problems</i> .
2/26	Thur	<i>Assignment 3, Kendall Power</i> Course summary, evaluations	Prepare <i>Kendall Power A, B, C</i> . Submit electronically no later than 10:00 AM, Feb 26. Last day to submit optional revision of <i>CBA Associates</i> or <i>Merck & Co</i> . Submit your revised assignment electronically no later than 5:00 PM Feb 26.
2/27	Fri	<i>Optional projects must be approved by 5:00 PM. No exceptions.</i>	
3/4	Thur	<i>Optional project presentations must be complete by 5:00 PM. No exceptions.</i>	