ORI 397
INTRODUCTION TO DECISION ANALYSIS
SPRING 2009

1. Teaching Team

Instructor
J. Eric Bickel, PhD
Assistant Professor
ETC 5.128D
232-8316
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Office Hours
Monday and Wednesday from 11:30 AM – 12:30 PM or by appointment. If you need to talk with me outside of office hours, please send an e-mail stating the specific problem or topic you wish to discuss.

Teaching Assistant (part-time)
Luis Montiel
lvm92@mail.utexas.edu

Office Hours / Problem Session
TBD

2. Course Description and Objectives

Principles and application of techniques for the logical illumination of complex decision problems within any context. Topics include utility theory, probability as a statement of belief, risk preference, value of information and control, probability assessment, influence diagrams, risk sharing/scaling, and life and death decision making. Prerequisite: Graduate standing, an introductory course in probability and statistics (e.g., ORI 390R.1), or consent of instructor.

Everyone makes decisions, but few people think about how they do it. Yet, psychological research shows that we are prone to many different errors of thought that degrade our decision making ability. In this course we will discuss the principles and fundamental concepts for the normative theory of decision making under uncertainty. We will develop a language, set of theories, and tools to transform complex decisions into ones where the course of action is clear.

This course is intended to provide students with the ability to:

- Bring engineering principals to bear on decision making
- Appreciate the challenges we face when making decisions, particularly decisions that must be made in the face of uncertainty
- Make better decisions in their personal and professional lives
- Play an active role in helping their employers and society make better decisions
- Communicate their choices and recommendations clearly
- Decide on possible career in decision analysis (industry or academia)

3. Text

- Instructor notes
- Ron Howard's *Manuscript in Progress*
- Selected Readings that will be posted on Blackboard

- *Making Hard Decisions*, Robert Clemen and Terence Reilly (optional)

The *Manuscript* is to be purchased from the University Co-op.

4. Course Calendar
Class will meet every Monday and Wednesday from 10:00 – 11:15 AM, except for University Holidays. We will conform to the University Academic Calendar (http://registrar.utexas.edu/calendars/08-09/index.html).

If a class needs to be canceled for any other reason, you will be notified at least 1 week in advance—if at all possible.

5. Course Website and Handouts
All course material will be posted on Blackboard.

6. Coursework

Homework
There will be a weekly homework assignment (approximately 12 in total), which will be distributed on Wednesday and will be due at the start of class the following Wednesday. If the following Wednesday is a University holiday, the assignment will be due the following Monday at the start of class. The teaching team will strive to grade your homework and return it during class on Wednesday. **Late homework will not be accepted.** We will however, drop your lowest homework score.

Consideration for University Authorized Absences will be made. Out of respect for your instructor and fellow students, please give advance notice of any absences if possible.

Your homework must be clear and neat. You may work on homework in at most teams of **two to three**. However, any work you submit must be your own (i.e., you must fully understand what you submit).

Homework extra credit!! We will give up to 10 points (out of 100—so 10%) of extra credit on each homework assignment if you provide an example that appeared in a newspaper or magazine that would benefit (or require) the use of the principles we discuss in this class. Note: it could be any of the principles we have discussed—not just what is covered on that assignment. To receive credit you need to provide a copy of the article and a brief write-up (less than 1 page) with what decision analysis concepts/tools you would use for this problem. You don't have to solve the problem (since you may not have enough information), but you need to demonstrate that you understand how what we are learning in class could apply. We will provide an additional 5 points (15 points total) if you provide an example where the writer has confused the quality of the decision with the quality of the outcome. **Note that this portion of your homework needs to be worked on an individual basis.** In addition, we will provide 5 points of extra credit (20 points maximum on any assignment) if you provide a quote by a famous person that has to do with probability and/or decision making. The extra credit portion of your homework should be separate from your main homework so that we can save your examples, while still returning your assignment.

Weekly Take Home Quizzes
There will be a weekly take home quiz consisting of a single problem, which will be distributed and collected according to the homework schedule above. **You may not work together on the**

take home quizzes. Failure to follow these rules will be considered a violation of the Honor Code. **Late quizzes will not be accepted.** We will however, allow you to miss one quiz—which may not be your lowest score—more on that later.

These quizzes will consist of a single multiple choice question with four possible answers. They will be graded as described in Handout 2 (Probabilistic Grading Information).

Individual Projects

Each student is required to complete an individual decision analysis project. This project could be the application of decision analysis to a personal or professional decision or it could be the beginnings of a research paper (PhD students are highly encouraged to write a research paper). Please see HO #3 for more detail.

Examinations

There will be a midterm and a final, according to the following schedule:

Midterm
11 March 2008, during our regularly scheduled class. This will be a unique multiple choice exam similar to multiple choice questions on your quizzes (see Handout #02 for scoring).

Final Exam
14 May 2008
2:00 – 5:00 PM
(According to the University Exam Schedule
http://registrar.utexas.edu/schedules/092/finals/index.html)

If you have another exam that interferes with this time you must let me know within four weeks of the first lecture. No exceptions will be made after this date.

This exam will be a standard "problem solving" type of exam. However, it may include some multiple choice questions similar in format to the quizzes and midterm.

There will be no "pop" quizzes.

Consideration will **only** be made for University Authorized Absences.

Exams will cover material from the Manuscript, readings, homework, **and** lecture. Exams will be closed notes.

You may use a calculator on the exams. This includes financial calculators and Pocket PCs/Palm Pilots with spreadsheets. **However, you must clearly show your work**. Your work needs to be such that someone could reproduce your answer without the use of a financial calculator or spreadsheet. No credit will be given for a problem where this is not the case.

7. Attendance

We will not take attendance. This course is about decision-making. As such, you face a decision on whether or not to attend class. You will have to weigh the benefit of attending class (e.g., deeper understanding, great lectures, etc.) against its cost (e.g., the time you will spend). We are confident you will find the lectures both helpful and entertaining. Choose wisely. If you choose to attend class, we expect you to participate fully and act professionally.

8. Letter Grades

Your exams and homework will be weighted as follows:

Homework: 20%
Quizzes: 20%
Individual Project: 20%
Midterm: 20%
Final Exam: 20%

Your weighted average score for the course will be rounded up to the **nearest integer** using Microsoft Excel's® Roundup function. For example, if your weighted average score for the course was 90.3, it would be rounded to 91. A final score of 89.5 would be rounded to 90. Rounding up will take care of any "close calls" and further adjustments will not be made.

Your scores on individual exams, homework, project and the quizzes not be rounded.

Total points will map to letter grades according to the following schedule:

A = 85% or greater
B = 70% to < 85%
C = 55% to < 70%
D = 40% to < 55%
F = < 40%

The instructor reserves the right to increase your total score by "curving" or some other method. However, these changes will never lower your grade. It is my hope that everyone will earn an A!

9. Course Topics

Please note: We may not cover all these topics and the order may be slightly different. We will adjust based on class performance and interest.

- Probability
- Probability as a measure of belief
- Bayes theorem
- Probabilistic relevance
- Axioms of choice under uncertainty
- Utility theory
- Risk preference
- Normative vs descriptive theories of decision making
- Certain equivalents
- Value of perfect information
- Value of imperfect information
- Value of control
- Probabilistic assessment
- Decision diagrams
- Decision trees
- Options
- Probabilistic sensitivity analysis
- Experimentation
- Heuristics and biases in decision making

- Risk Sharing/Scaling
- Life and Death Decision Making

10. Learning Environment

Asking Questions

I want you to do well and am concerned about your performance. This material is important. Really!

It is vital that if, during a discussion, there is something you do not understand or the explanation is poor, PLEASE stop me and ask questions. I would prefer that we have a dialog during class sessions and not simply lectures.

Treating Each other with Respect

In order to develop a safe learning environment, I expect everyone to be treated with respect and dignity. Failure to do so will negate your ability to attend lecture.

11. Honor Code

After you graduate and enter the workforce your boss will expect that you have been educated. In the "real world" there are no make up exams or partial credit. Therefore, cheating will hurt you in the long run. I expect everyone to follow the UT Honor Code, which states:

"The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community."

All suspected violations of the Honor Code will be referred to the Administration for adjudication.

12. University Electronic Mail Notification Policy
(Use of E-mail for Official Correspondence to Students)

All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at http://www.utexas.edu/its/policies/emailnotify.html.

In this course e-mail will be used as a means of communication with students. You will be responsible for checking your e-mail regularly for class work and announcements. Note: if you are an employee of the University, your e-mail address in Blackboard is your employee address.

13. Disability Statement

Students with disabilities who require special accommodations need to get a letter that documents the disability from the Services for Students with Disabilities area of the Office of the Dean of Students (471-6259 voice or 471-4641 TTY for users who are deaf or hard of hearing). This letter should be presented to the instructor in each course at the beginning of the semester and accommodations needed should be discussed at that time. Five business days before an exam the student should remind the instructor of any testing accommodations that will be needed.

See website below for more information:
http://deanofstudents.utexas.edu/ssd/providing.php

14. Blackboard Use

This course uses Blackboard, a Web-based course management system in which a password-protected site is created for each course. (Student enrollments in each course are updated each evening.) Blackboard can be used to distribute course materials, to communicate and collaborate online, to post grades, to submit assignments, and to take online quizzes and surveys.

You will be responsible for checking the Blackboard course site regularly for class work and announcements. As with all computer systems, there are occasional scheduled downtimes as well as unanticipated disruptions. Notification of these disruptions will be posted on the Blackboard login page. Scheduled downtimes are not an excuse for late work. However, if there is an unscheduled downtime for a significant period of time, I will make an adjustment if it occurs close to the due date.

Blackboard is available at http://courses.utexas.edu. Support is provided by the ITS Help Desk at 475-9400 Monday through Friday 8 am to 6 pm, so plan accordingly.

15. Course Feedback

Feedback is an important part of any kind of learning. Without feedback on how well you understand the material, it is more difficult for you to make significant progress. During this course you will give me feedback on your learning in informal and formal ways, such as assignments or exams. I want you to let me know when something we discuss is not clear. This kind of communication will enable me to provide additional information when needed or to explain a concept in different terms.

In addition to feedback on your learning, I will ask for feedback from you about how my teaching strategies are helping or hindering your learning. This kind of feedback is very important to me as I continually strive to be the best teacher I can be. Some of this feedback will be gathered from online anonymous surveys. I encourage you to respond to these surveys so that together we can create an effective teaching and learning environment.

16. About Your Instructor

Education

I am from Albuquerque, New Mexico. I attended New Mexico State University as an undergraduate and obtained a B.S. in mechanical engineering with a minor in economics (1992). I went to graduate school at Stanford University and hold a M.S and Ph.D. from the Department of Engineering-Economic Systems (1999). The Department of Engineering-Economic Systems recently merged with Industrial Engineering and Operations Research to form the department of Management Science and Engineering.

Work Experience: Public Sector

I have worked for Sandia National Laboratories in Albuquerque, New Mexico, and Livermore, California, where I performed research in robotics and combustion.

I worked as a decision analyst at Pacific Northwest Laboratories in Richland, Washington, where I analyzed processes to treat nuclear waste.

Work Experience: Private Sector

During graduate school and after, I worked for Strategic Decisions Group (www.sdg.com), where I was a senior engagement manager. At SDG, I applied decision analysis techniques to the most important decisions facing some of the world's largest corporations. I have worked in North America, South America, Europe and Asia. Industries included metals, building services, biotech, commodity and specialty chemicals, energy trading and marketing, insurance, oil and gas, power generation and transmission, printing and publishing, and packaging. In most cases, I worked directly with the CEO/CFO/COO, executive vice president, vice president, or business unit head.

Research Interests

Efficient modeling of dependence
Personal and corporate risk preference
Application of decision analysis to energy policy decisions
Applications of maximum entropy
Auditing and scoring of expert forecasts
Application of decision analysis to sport-especially baseball