

SYST 473

Decision and Risk Analysis

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Course Description

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The intent of this course is to provide a modern perspective on analytical methodologies to support decision-making. Decision analysis offers a set of structured procedures that assist decision-makers in structuring decision problems and developing creative decision options, quantifying their uncertainty (this includes combining available statistics with expert judgments, and their own beliefs to arrive at estimates of the probabilities of various outcomes), quantifying their preferences (this includes structuring their value tradeoffs and examining their attitude towards risk), combining their uncertainty and preferences to arrive at “good” decisions. This course provides an introductory treatment of decision analysis. The intended participants are students who want to learn more about decision making under uncertainty and tools that can be used to support it.

Course Outline:

Topic	Reading Assignment*
Introduction	Chapters 1-2
Introduction and Review of Probability	Chapters 7-8-9
Value Focused Thinking, Value Hierarchies	Chapter 6
Value Functions and Weight Elicitation	Chapter 12
Sensitivity Analysis	Chapter 5
Influence Diagrams, Decision trees	Chapters 3-4
Utility Functions, Risk	Chapters 13-14

* Homework sets will be assigned on a weekly basis from appropriate problems in the textbook and on handouts.

Class Details

Prerequisites

* *STAT 344 or STAT 346 or MATH 351 or grade of C or better in STAT 250.*

Classes

- * Room 4457 of the Engineering Building.
- * Tuesdays and Thursdays, from 9:00 a.m. to 10:15 a.m.

Office hours

- * Room 2227 of the Engineering Building.
- * Tuesdays and Thursdays, from 10:30 a.m. to 11:30 a.m., or by appointment.

Administrative

- * Registration deadline: Sep 15.
- * Drop without Tuition Penalty Deadline: Sep 15.
- * Drop with Tuition Penalty dates: Sep 16 to Oct 02.
- * Final Drop deadline: Oct 02.

Logistics and Expected Behavior

1. All communication, file exchanges, and submissions must be done using the Blackboard System! Yet, you are welcomed to use my email directly as a backup or to address aspects not related with the course content.
2. You are allowed to enter or leave at any time, provided you do your best to avoid disrupting the activity going on.
3. Please make sure you have your cell phone, pagers, pda, etc., in silent mode. Should you see yourself in extreme need to answer an incoming call, just leave the room to do so.
4. Attendance in class is very important. Information will be presented that will not necessarily be in the book that will show up on the midterm and final.
5. Academic Policy: All academic policies as given in the Honor System and code will be strictly followed. Visit URL:
<http://catalog.gmu.edu/content.php?catoid=5&navoid=104>
6. Exams will only be given at the predetermined dates. Early or late exam taking will not be allowed, except for very special cases.
7. In any work you do, always *show all the steps* you used to get your answer. If the answer is wrong, you may still get a great deal of partial credit if I can follow your logic. This is especially important in the exam.

This is an intensive course. To succeed, you must exercise planning, be proactive and do your best to stay ahead of schedule.

Textbook and Software



[Making Hard Decisions with Decision Tools Suite Update Edition](#), Robert Clemen and Terence Reilly. , South-Western College Pub; 1 edition (December 8, 2004). ISBN-10: 0495015083.



[Logical Decisions v6.1](#) (LDW) decision support software. This can be bought from <http://www.logicaldecisions.com/> (Student version). The bookstore **does not** carry a copy of this software.

Students are encouraged to also refer to the following resources:

- [Value-Focused Thinking: A Path to Creative Decisionmaking](#) (Paperback), Ralph L. Keeney, Harvard University Press, 1996. ISBN-10: 067493198X.
- [Strategic Decision Making](#), Craig W. Kirkwood, Duxbury Press, 1997. ISBN-10: 0534516920.
- [Spreadsheet Modeling & Decision Analysis](#), 5th Edition, Cliff T. Ragsdale, Thomson; South-Western, 2007. ISBN-10: 0324312504.

Disclaimer: the links to alibris.com and amazon.com above were provided solely as a reference to facilitate students in their research (e.g. via the University's library system). Neither the instructor nor GMU are recommending this store or any other.

Lecture Notes

Lecture notes for each chapter will be made available from the Blackboard course page either before class or just after it. You will need to [download Adobe Acrobat Reader](#) to read these lecture notes.

Grading

The grading structure of this course is as follows:

- Homework (10% of grade)
- Class Quizzes (15% of grade)
- Midterm (30% of grade)
- Project (15% of grade)
- Final Exam (30% of grade)

Homework

There will be homework problem sets just about every class. These will be collected each week. I will not grade them in detail, but I will keep track of students that do not hand them in. I will also use them to gain insight into the understanding of the students. Invest the time to do the problem sets. You are not prevented to work with your peers on the exercises, and are even encouraged to do so. However, each student must provide his/her own answers, and I might verify whether he/she actually worked in his/her respective exercise and understood the solution provided. In any case, past experience consistently shows that students who didn't follow the homework had a hard time with the exam material.

Each HW is out of 10 points. Late HW policy: (Late by 1 class: you can earn a max of 10 points out of 20, provided you have all correct answers. If late beyond 1 class then it will not be graded). Check for grades on Blackboard. If you don't see the grade, report to me by the next class after HWs have been returned. I will not entertain missing grade requests that come later in the semester.

Class Quizzes

Some classes will include a quiz, which is basically one or two problems covering the material taught up to that class. Students will have between 10 to 20 minutes to solve the quiz, depending on how complex it is.

Midterm Exam

The midterm exam will be held on Sept 1st, at the Engineering Building r. 4457. Further details about the exam will be posted during the course.

Course Project

Overview. Students are required to divide themselves in small groups (3-5 people). Each group will perform a decision analysis for a problem of their choice. Group rosters must be submitted via blackboard no later than the third week of class (deadline: 9/17 – 11:30 a.m.); just one student of the group should submit the roster.

Project assignments must be made by the fourth week of classes (deadline: 9/24 – 11:30 a.m.); just one student of the group should submit the assignment. By assignment I mean a project title and short description of the problem being addressed.

Groups may meet in person as often as necessary and are encouraged to interact virtually between meetings. The problem you choose is entirely up to you, but all groups should perform the following steps:

- 1) Choose a decision-making problem.
- 2) Show the decision tree or influence diagram.

- 3) Elicit weights (probabilities) using AHP, swing weights or tradeoff methods (Use LDW software if necessary).
- 4) Collect data (values) for the alternatives.
- 5) Determine your decision using the additive value function and solving the decision tree or influence diagram.

The project will include both a written report and an oral presentation. We will have an “in progress review” after the midterm where the groups will brief the problem statement and proposed approach. The project presentations will be held at the end of the semester. Students in senior design are encouraged to use their senior design project for the SYST 473 class project.

Oral presentations. Each group will have 15 minutes to present 4-6 slides describing their work and conclusions, while at least 5 minutes will be reserved for questions. Slides must be submitted via Blackboard no later than 2 p.m., Eastern Time, of **the day before the presentation!** It is tolerable to make changes to your presentation after submitting it, although you are expected to handle a reasonably “close-to-final” version of the actual presentation.

All group components *are expected to present and to be available for questioning.* Groups that don’t meet that criterion will be penalized by up to 20% of their grade per each component that doesn’t attend and present their work.

Final report. A written report is due on Thursday 12/10, 10:30 a.m. Eastern Time. It should be submitted via the Blackboard system, and must contain the following structure:

- 1) Title
- 2) Group Members
- 3) Objective
- 4) Data collection method for values
- 5) Results for weights calculation
- 6) Decision outcome by solving the decision tree or influence diagram

Group Grading. The Group Project grading is structured as follows:

- Progress report (5%);
- Oral presentation (45%); and
- Final report (50%).

Individual Grading. Your grade on this project will be partly a group grade and partly an individual grade based on your self and peer evaluations. Your team should rate each person on a 10-point scale. The rating scale is as follows:

- **10 (A)** Participated enthusiastically, exhibited strong leadership, attended regularly and was essential to meetings, performed tasks responsibly and on

time, work was extremely high quality, took excellent initiative and was highly self-motivated;

- **9 (A-)** Good participation, attended and contributed to meetings, exhibited leadership, performed tasks responsibly and on time, work of dependable high quality, took good initiative and was self-motivated;
- **8 (B)** Adequate participation, usually attended and contributed to meetings, exhibited some leadership, performed tasks responsibly and usually on time, work of dependable good quality, took reasonable initiative and was reasonably self-motivated;
- **7 or 6 (B-)** Participation could have been better, performed tasks when asked but may have been late and/or needed reminders, quality could have been better, needed guidance and usually did not take enough initiative;
- **5 or below (F)** Participation was minimal or non-existent; any work that was turned in was of inadequate quality.

Your evaluations should reflect a consensus of your group. A suggested process to follow is for each person to rate all group members (including him or herself) anonymously, and then collate the ratings and discuss them among you. I am available to mediate any serious conflicts. If your group cannot reach consensus, I will listen to all sides and make my own evaluation, but there will be a penalty to your grade for not reaching consensus. There is no penalty for asking my advice or requesting that I serve as a mediator. The only penalty is if you cannot ultimately resolve the conflict on your own.

If the evaluations are not included in the final report, all team members will receive equal group grades, and there will be a penalty for not including a required part of the report.

Final Exam

The final exam will be held on Dec 15; from 7:30 to 10:15 a.m. Further details about the exam will be posted during the course.

BEST WISHES FOR A GREAT SEMESTER!!!

Fairfax, August 31, 2009.