



Introduction to Decision Analysis for Engineering

A. J. Clark School of Engineering • Department of Civil and Environmental Engineering

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By
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ENCE 627 – Decision Analysis for Engineering

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University of Maryland, College Park



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Office Hours: Tu W 1:00 am - 3:00 pm

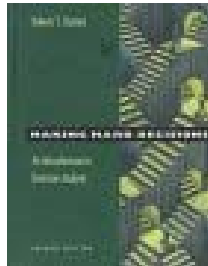
F 2:30 noon -4:30 pm, and by appointment





Textbook

- “*Making Hard Decisions with DecisionTools*,” by Robert T. Clemen and Terence Reilly, 2nd edition (revised), Duxbury Press, NY, 2001.



References

1. “Decision Making and Forecasting,” by Marshall, K. T. and Oliver, R. M., McGraw Hill, NY, 1995.
2. “Statistics and Reliability for Engineers,” by Ayyub, B.M., and McCuen, R., CRC Press, FL, 1997.
3. “Probability Concepts in Engineering Planning and Design,” Volume II, by Ang, and Tang, John Wiley and Sons, NY, 1975.
4. Instructor’s notes.





Grading

- Homework (25%)
- Project (25%)
- Midterm Exam (25%)
- Final Exam (25%)



General Course Description

- Probability basics, subjective probability, using data, introduction to decision analysis, elements of decision problems, structuring decisions, making choices, sensitivity analysis, Monte Carlo simulation, value of information, risk-based decision making, multiobjective problems, stochastic dynamic programming. Applications in engineering and economics.



Course Objectives

The objective of this course is it to develop the needed working background in the areas of model building, and analysis for decision making in engineering in an environment of uncertainty leading towards risk-based decision making.



Course Objectives

1. Provide understanding of the purpose of studying decision-analysis techniques.
2. Represent real-world engineering and management problems using models that can be analyzed to gain insight and understanding.



Course Objectives

3. To help a decision-maker think systematically about complex problems and improve the quality of the resulting decisions.
4. To help a decision-maker think hard about the specific problem at hand, including the overall structure of the problem as well as his or her preferences and beliefs.



Course Objectives

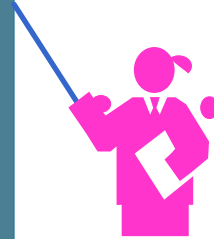
5. Provide both an overall paradigm and a set of tools (influence diagrams and decision trees) with which a decision-maker can construct and analyze a model of a decision situation.
6. Provide the framework within which a decision-maker can construct a requisite decision model.



Course Outline

The course will include the following main items:

1. Introduction to Decision Analysis
2. Modeling Uncertainty: Probability
3. Using Data
4. Decision Models and Analysis
5. Model Building: Influence Diagrams
6. Model Building: Decision Trees
7. Making Choices and Sensitivity Analysis
8. Creativity and Decision Analysis
9. Monte Carlo Simulation
10. Value of Information
11. Multiattribute Decision Making



Course Objectives

7. To be able to represent real-world problems with associated uncertainties.
8. To be able distinguish between a good decision and a lucky outcome.



Schedule

Week	Date	Topic of Discussion	Source
1	September 2	Introduction to Course (General Overview) Introduction to Decision Analysis and Decision Making	Chapter 1
2	September 9	Probability Basics	Chapter 7
3	September 16	Subjective Probability	Chapter 8
4	September 23	Theoretical Probability Models	Chapter 9
5	September 30	Using Data	Chapter 10



Schedule

Week	Date	Topic of Discussion	Source
6	October 7	Elements of Decision Problems	Chapter 2
7	October 14	Structuring Decisions	Chapter 3
8	October 21	Making Choices	Chapter 4
9	October 28	Sensitivity Analysis MIDTERM EXAM	Chapter 5
10	November 4	Creative Decision Making	Chapter 6



Schedule

Week	Date	Topic of Discussion	Source
11	November 11	Monte Carlo Simulation	Chapter 11
12	November 18	Value of Information	Chapter 12
13	November 25	Multiattribute Decision Making, Risk Attitude	Chapter 13 Handout
November 27-30 **** THANKSGIVING BREAK (NO CLASSES) ****			
14	December 2	Review Project Presentations	
15	December 9	Project Presentations	
16	Dec. 15 - 20	FINAL EXAMS Date, time, and location will be announced	



Course Website

- Students are encourage to access course the web site at: <http://www.ajconline.umd.edu> to download course materials such as class notes, homework sets, and solutions. Timely information will also be posted on the web site. At initial login, use your wam account name as the username, and your SID as the password. You are advised to change your password after your first login. Report any problem with the course web site to the instructor. For technical problems of the web site, contact the Instructional Technologies staffs at 0123 Martin Hall



Homework Assignments

- The homework assignments are due one week after they are assigned. Homework will be assigned as the material is covered and will be collected every Tuesday at the beginning of the lecture period.
- Solutions will be available from the TAs and on the class website after the problems are returned.



Homework Assignments (cont'd)

- No assignment will be accepted after the answers have been posted. Students are encouraged to discuss and formulate solutions to the problems by working in teams.
- However, assignments must be completed and submitted individually.
- General guidelines for homework are given in your syllabus.



Exams

- All students must take all quizzes and exams including the final exam. Only extenuating circumstances will be accepted as excuse for missing an exam. Health related excuses require medical reports and the signature of a physician that provided treatment



Project & Case Studies

- Individuals or teams of two (max) are required to work on a research study on a selected topic in decision and uncertainty analyses, perform needed tasks, and submit the following as applicable:



Project & Case Studies (cont'd)

- Title Page
- Executive Summary
- Table of Contents
- Objectives and scope
- Data and Simulation if needed
- Additional Items if Needed
- Methodology summary
- Applications
- Conclusions
- References and Appendices



Project & Case Studies (cont'd)

- Professional presentation of the project report is required that should consist of neat and organized solutions on one side of 8.5"x11" papers.
- Computer-generated plots and printouts are required for all sample, and summary calculations. **The project is due on the last day of classes**