CHAPTER 0a.

Introduction to Decision Analysis for Engineering

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

FALL 2003

By Dr. Ibrahim. Assakkaf

ENCE 627 – Decision Analysis for Engineering
Department of Civil and Environmental Engineering
University of Maryland, College Park

Instructor

Dr. Ibrahim A. Assakkaf
Center for Technology and Systems and Management
Department of Civil Engineering
University of Maryland
0305 Glenn L. Martin Hall (EGR)
College Park, MD 20742
Tel: (301) 405-3279 UMCP
E-mail: assakkaf@eng.umd.edu
URL: http://ctsm.umd.edu/assakkaf
Fax: (301) 405-2585 UMCP
Office Hours: Tu W 1:00 am - 3:00 pm
F 2:30 noon -4:30 pm, and by appointment
Textbook


References

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.

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

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic of Discussion</th>
<th>Source</th>
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<tbody>
<tr>
<td>1</td>
<td>September 2</td>
<td>Introduction to Course (General Overview)</td>
<td>Chapter 1</td>
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<td>Introduction to Decision Analysis and Decision Making</td>
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<td>2</td>
<td>September 9</td>
<td>Probability Basics</td>
<td>Chapter 7</td>
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<td>3</td>
<td>September 16</td>
<td>Subjective Probability</td>
<td>Chapter 8</td>
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<td>4</td>
<td>September 23</td>
<td>Theoretical Probability Models</td>
<td>Chapter 9</td>
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<td>5</td>
<td>September 30</td>
<td>Using Data</td>
<td>Chapter 10</td>
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<th>Week</th>
<th>Date</th>
<th>Topic of Discussion</th>
<th>Source</th>
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<tr>
<td>6</td>
<td>October 7</td>
<td>Elements of Decision Problems</td>
<td>Chapter 2</td>
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<td>7</td>
<td>October 14</td>
<td>Structuring Decisions</td>
<td>Chapter 3</td>
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<td>8</td>
<td>October 21</td>
<td>Making Choices</td>
<td>Chapter 4</td>
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<td>9</td>
<td>October 28</td>
<td>Sensitivity Analysis</td>
<td>Chapter 5</td>
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<td>MIDTERM EXAM</td>
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<td>10</td>
<td>November 4</td>
<td>Creative Decision Making</td>
<td>Chapter 6</td>
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Schedule

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<th>Date</th>
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<tr>
<td>11</td>
<td>November 11</td>
<td>Monte Carlo Simulation</td>
<td>Chapter 11</td>
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<td>12</td>
<td>November 18</td>
<td>Value of Information</td>
<td>Chapter 12</td>
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<td>13</td>
<td>November 25</td>
<td>Multiattribute Decision Making, Risk Attitude</td>
<td>Chapter 13 Handout</td>
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<td></td>
<td>November 27-30</td>
<td>*** THANKSGIVING BREAK (NO CLASSES) ***</td>
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<tr>
<td>14</td>
<td>December 2</td>
<td>Review Project Presentations</td>
<td></td>
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<td>15</td>
<td>December 9</td>
<td>Project Presentations</td>
<td></td>
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<tr>
<td>16</td>
<td>Dec. 15 - 20</td>
<td><strong>FINAL EXAMS</strong></td>
<td>Date, time, and location will be announced</td>
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Course Website

- Students are encouraged to access the course website 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 website. 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 website to the instructor. For technical problems of the website, contact the Instructional Technologies staff 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**