

Value and Decision Theory (ISE 562)

Richard S. John, Ph.D.

Fall Semester, 2008

Class meets: OHE 136; Tues and Thur, 5:00 PM - 6:20 PM

Instructor: Richard John, Ph.D.

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Office Hrs. Tuesday and Thursday, 11:00 AM – 12:00 noon

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Required Texts:

Clemen, R. T. & Reilly, T. (2002-2004). ***Making hard decisions with DecisionTools.*** Duxbury: Belmont, Ca.

Course Description:

This is a course in modern decision analysis for the purpose of gaining insights about complex decision problems. Methods will be studied for structuring decision problems, including influence diagrams, decision trees, event trees, and objectives hierarchies. Methods for constructing subjective representations of uncertainty and value will be emphasized, including discussion of judgment heuristics and biases. Methods for enhancing creative decision making, including value focused thinking, will be covered. Modeling techniques will include sensitivity analysis methods for decision trees. Bayesian approaches for decision making under uncertainty using both theoretical and empirical probability models will be covered. Risk analysis models using Monte Carlo simulation methods will be highlighted. Methods for conducting value of information analysis will also be covered. Applied methods for assessing both single-attribute and multi-attribute utility functions will be demonstrated. The course will include discussion of utility axioms (and tempting violations) and relationship between various independence conditions and the functional form of the multi-attribute utility model.

Suggestions for success:

- Participate in class; ask questions in class and after class either by email or during office hours.
- Read the text at least once before the lecture and review after the lecture.

Course Prerequisite: ISE 220, 225, and working knowledge of Calculus.

Course Goals: The main goal of this class is to equip students with an array of methods and tools to structure and analyze complex decision problems for the purpose of gaining insights. Throughout the course practical methods will be emphasized, including use of state of the art software tools for applying decision analysis.

Grading: Grades will be based on 4 "mini-project" assignments and the final term project. All assignments are due at 5:00 P.M. on the date indicated. Late submissions will be penalized 15% per day.

Academic Integrity

"The Viterbi School of Engineering adheres to the University's policies and procedures governing academic integrity as described in SCampus. Students are expected to be aware of and to observe the academic integrity standards described in SCampus, and to expect those standards to be enforced in this course".

Disability Accommodation

"Any Student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213)740-0776".

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Course Outline

<i>Date</i>	<i>Day</i>	<i>Topic</i>	<i>Reading</i>
26-Aug	Tues	What is decision analysis good for? Subjective Judgments are Data; Requisite Decision Models	1
28-Aug	Thur	Complexities of hard decisions: Conflicting objectives, uncertainty, time	2
2-Sep	Tues	Structuring: Means-Objectives Networks and Fundamental-Objectives Hierarchies	3
4-Sep	Thur	Structuring: Influence Diagrams and Decision trees	3
9-Sep	Tues	Structuring Problems: Clemen (ch. 3) and Cases: Cold Fusion, Prescribed Fire, SS Kuniang	3
11-Sep	Thur	Building IDs and DTs in PrecisionTree Solving DTs and Calculating EMV for DTs; Texaco	3 4
16-Sep	Tues	Expected value, dominance, & risk profiles; Cases:	4
18-Sep	Thur	GPC, Southern Electronics, Stenlar, SS Kuniang	4
18-Sep	Thur	Making decisions with multiple objectives Alternatives by attributes matrix; Trade-off weights	4
23-Sep	Tues	Decision Analysis with PrecisionTree DTs, IDs, and Multi-attribute models	4
25-Sep	Thur	Sensitivity analysis: Worst/Best Case; Sliders; 1-way and 2-way analysis; tornado diagrams	5
30-Sep	Tues	Sensitivity Analysis with TopRank and PrecisionTree	5
		Cases: Stocks, Heart Disease, Dumond, Strenlar	
2-Oct	Thur	Review of probability; Bayes' Theorem Cases: Wildcatting, Hinckley Trial	7
7-Oct	Tues	DA software for Bayes' Theorem; Cases: DA Monthly, Cancer Screening, AIDS, Death Penalty	
9-Oct	Thur	All probabilities are subjective! Heuristics & biases; Probability assessment	8
14-Oct	Tues	Decomposition; use of experts; aggregation Using Riskview to construct probability distributions	8
16-Oct	Thur	Modeling uncertainty; Useful discrete and	9

		continuous probability distributions	
21-Oct	Tues	Theoretical distributions in Riskview; Cases: Overbooking, Earthquake Prediction	9
23-Oct	Thur	Fitting Distributions to Data with BestFit; Using data to model Relationships; Regression	10
25-Oct	Tues	Conjugate Distributions; Cases: Taco Shells, Sales Forecasting, Overbooking	10
29-Oct	Thur	Monte Carlo Simulation using @Risk; Selecting Input Distributions and Parameters	11
4-Nov	Tues	Modeling Parameter uncertainties; Modeling Input Variable Dependency; Cases	11
6-Nov	Thur	Value of Information Analysis; Cases; Using PrecisionTree to calculate EVPI & EVII	12
11-Nov	Tues	Risk Attitudes; Expected Utility, Certainty Equivalents	13
13-Nov	Thur	& Risk Premiums; Utility Function Assessment Risk Tolerance and Exponential Utility; Using PrecisionTree to model preferences; Cases	
18-Nov	Tues	Multi-attribute utility (MAU) analysis; Trading off Conflicting Objectives; Assessing Weights	15
20-Nov	Thur	Software for MAU analysis; Problems & Cases	
25-Nov	Tues	Creativity & Value Focused Thinking; Creating Alternatives; Enhancing Creativity	6
27-Nov	Thur	Thanksgiving Day No Class	
2-Dec	Tues	Axioms for Expected Utility; Paradoxes; Implications for Utility Assessment; Cases	14
4-Dec	Thur	Value Dependency in MAU models; Non-additive Models; Substitutes and Complements	16
11-Dec	Thur	4:30-6:30 p.m. Presentation of final projects	