

Department of Industrial & Management Systems Engineering

EIN 6935 Risk & Decision Analysis

Fall 2009

Time & place	MW 11:50 am - 01:05 pm, room ENB 228A.
Instructor	Dr. Alex Savachkin, ENC 2201, savachki@eng.usf.edu , 813-974-5577.
Office hours	Tuesday 08:00 am - 10:00 am. <i>Feel free to drop by at any time.</i>
Textbook	No textbook per se. A compilation of instructor's notes and other sources will be used.
References	<i>Introduction to Statistical Decision Theory</i> , J. W. Pratt <i>et al.</i> , 2008. <i>Decisions with Multiple Objectives</i> , R. L. Keeney <i>et al.</i> , 1993. <i>Decisions under Uncertainty</i> , I. Jordaan, 2005. <i>Making Hard Decisions</i> , R. T. Clemen <i>et al.</i> , 2004. <i>Dynamic Programming: Models and Applications</i> , E. V. Denardo, 2003. <i>Introduction to Probability Models</i> , S. M. Ross, 2007.
Pre-requisites	A good knowledge of basic probability theory.

Course Motivation

Uncertainty is an essential and inescapable part of life. Engineers inevitably make a long series of decisions under uncertainty - and suffer the consequences. In order to make decisions, we weigh our feelings of uncertainty and express it as a probability measure of (very complex) events. Decision making involves quite naturally another concept - that of utility, a measure of the desirability of the various consequences of our actions. The two concepts form a basis of decision making under uncertainty and risk. This course will give an introduction to modern decision theory. Exposition to technical formalism will be diluted with discussion of best practices of layman decision making. This is an introductory graduate course. A course in advanced topics in risk and decision theory will be offered in the future.

Course Objective: Build foundations for analytics underlying decision making under uncertainty and risk.

Grading Policy: Quizzes - 25%; Midterm I, II, III - 25% each.

Miscellaneous Policies

If a test/quiz is missed, you must have a *written authorized* excuse to be able to have a make-up. Academic misconduct will not be tolerated; violations of academic honesty will be dispatched in accordance with the University policy.

Topics

1. Crunch review of related probability concepts

Elements of set theory; events and probability spaces; partitions and elementary Bayesian concepts; statistical independence; random variables, vectors, and functions; transformation of distributions.

2. Elements of sequential decision making

Dynamic models; principle of backward recursion; principle of optimality; stochastic dynamic programming.

3. Decision making under strict uncertainty

Dominated actions; properties of decision criteria; decision criteria: Wald's maximin, Savage's minimax regret, Hurwicz α index, Laplace's principle of insufficient reasoning; mixed strategies.

4. Introduction to decision making under risk

Expected monetary value (EMV); decision flow diagrams; expected value of sample information (EVSI); expected opportunity loss; expected value of perfect information (EVPI); prior expectation of posterior EVPI; uncertain rewards and inaccurate information.

5. Decision making under risk. Utility theory (UT)

Binary relations and preference orderings; risk profiles; stochastic dominance of reward distributions; concept of utility; response functions; transformation of state distributions; utility functions: properties and assessment; certainty equivalence & risk premium; risk attitudes; risk tolerance; underlying axioms of UT; behavioral paradoxes.

6. Construction of utility functions

Common families of utility functions; decreasingly/increasingly/constant risk averse utility functions.