Decision Making Under Uncertainty

Systems and Industrial Engineering
University of Arizona
SIE 422/522

Instructor
Dr. Donald Bruyère
phone: US 520-621-2298
E-mail: dbruyere@email.arizona.edu
Office Hours: Monday and Wednesday from 10:30 to 12 noon

Teaching Assistants
Chengbin Xu
E-mail: chengbinxu.email.arizona.edu
Office hours: Tuesday and Thursday 11am to 12:30pm.

Class Meetings: Mon, Wed, Fri, 2:00–2:50pm, ILC Room 150

Catalog Description

Application of principles of probability and statistics to the design and control of engineering systems in a random or uncertain environment.

Prerequisites: Introduction to Probability and Statistics

Text Book: Clemen and Reilly, *Making Hard Decisions,* South-Western Cengage Learning, 3rd edition. ISBN: 0-538-79757-6

Software: Decision Tool Suite which can be accessed remotely as indicated by going to https://arizona.apporto.com and selecting "Desktop UArizona" or downloading a student edition from:

http://www.palisade.com/academic/students.asp

Course objectives

- Develop the skills to identify, define, scope, model, and analyze complex decision problems
- Identify sources of variability, and address variability in decision making, including sensitivity analysis
- Include pertinent information and decision maker preferences in decision-making and incorporate these elements in decision analyses
- Develop ability to effectively communicate decision recommendations, including analysis

Evaluation:

This class will follow an interactive, collaborative learning format, thus participation is expected and required for success.

1. Videos from University of Arizona professor are available on-line and should be viewed by students prior to class

2. Class discussions opportunities about text and video content will be provided throughout the course.

3. Assignments applying class principles will be started during class time under the supervision of the on-site instructor. Any assignments not completed in class can be completed outside of class and submitted through the Desire to Learn (D2L) website.
   a. Timeliness: In real-world situations a partial answer on time is more valuable than a 100% correct answer that arrives late. If you cannot turn work in on time, you must negotiate an extension with the instructor prior to the due date.
   b. Academic integrity: I expect each of you to uphold the University of Arizona academic integrity policy.
   c. Quality: In submitted work pay attention to detail and logic in written assignments. Make sure that you label and title plots appropriately.

Project. This course will include a final project, to be defined.

Exams. This course includes two exams and a final. Examity ® will proctor all exams. Students should refer to the "Examity_UA_D2L_Student_Quick_Guide.PDF" in the by "D2L>Contents>Start Here>Syllabus" folder for specifics. Resources allowed will be clearly specified at the time of the exam.

Grading:

	Reading Checks (3%)	
Assignments	Lecture Discussions (5%)	20%
	Weekly Collaborations (12%)	
Exam1		20%
Exam2		20%
Project		20%
Final		20%

D2L Website:

You will access this site by going to http://d2l.arizona.edu and logging in with your UA Net ID. If you need assistance with D2L you should contact D2L Help (http://help.d2l.arizona.edu); you may also try the 24/7 IT Support center on campus (http://the247.arizona.edu), which is available 24 hours a day, 7 days a week. When you log on to D2L, this course will be listed on the welcome page under "My Courses". Announcements, class notes, PowerPoint files, spreadsheets used in class, homework assignments and solutions, discussion questions, and links to news items of interest will be posted to this website. You must be registered for the class to be permitted entry to the site.

General Policies:

- Assignments and Exam: Most of the on-line assignments and exams will be automatically graded. However, some of the questions will require written responses by students that will be graded by myself and a Grader. We will do our best to ensure fairness and consistency in our homework and exam grading policies. If you feel that your work has not been graded fairly, please contact me within a week of the date in which the test was returned. However, this does open the possibility of having the entire homework or exam re-graded, which may or may not be in your favor.

- Special Needs and Accommodations: Let me know immediately if you have any special needs which require accommodation. Students needing special accommodations should contact SALT, 1010 N Highland Ave., or the Center for Disability Related Resources, 1224 E. Lowell Street, for documentation of special needs.

- Inclusive Excellence is a fundamental part of the University of Arizona's strategic plan and culture. As a part of this initiative, the institution embraces and practices diversity and inclusiveness. These values are expected, respected and welcomed in this course.

8/23 Lecture 1 (Ch 1)	Lecture 2 (Ch 2)	Lecture 3 (Ch 3)
Course Overview	4 Elements of Decisions & Time Value of Money	Structuring Objectives
8/30 Lecture 4 (Ch 4)	Lecture 5	Lecture 6
Structuring Decisions Using Influence Diagrams	Structuring Decisions Using Decision Trees	Understanding Risk
9/6 Labor Day	Lecture 7	Lecture 8 (Ch 5)
No-Class	Practical Example of Decision Analysis	Sensitivity Analysis
9/13 Lecture 9	Lecture 10 (Ch 6)	Lecture 11
2 Way Sensitivity Analysis	Corporate Decision Making	Presentation from Guest Speaker
9/20 Lecture 12	No Lecture	Lecture 13
Review	Exam 1	Release Term Project
9/27 Lecture 14 (Ch 7)	Lecture 15	Lecture 16
Axioms of Probability	Conditional Probability	Bayes Theory & Total Probability
10/4 Lecture 17	Lecture 18 (Ch 8)	Lecture 19
Mean and Variance	Covariance and Correlation	Subjective Probability
10/11 Lecture 20 (Ch 9)	Lecture 21	Lecture 22
Discrete PDFs	Continuous PDFs	The Normal Distribution
10/18 Lecture 23 (Ch 10)	Lecture 24	Lecture 25
Creating CDFs from Data	Linear Regression Modeling	Examples of Linear Regression Modeling
10/25 Lecture 26	No Lecture	Lecture 27 (Ch 11)
Review	Exam 2	Simulation
11/1 Lecture 28	Lecture 29	Lecture 30 (Ch 12)
Optimization Using Simulation	Using Simulation for Sensitivity Analysis	Simulation Case Study
11/8 Lecture 31	Veterans Day	Lecture 32
Value of Information	No-Class	The Value of Perfect Information
11/15 Lecture 33 (Ch 13)	Lecture 34	Lecture 35
The Value of Imperfect Information	Valuing Options	Financial Options
11/22 Lecture 36 (Ch 14)	Lecture 37	Thanksgiving Day
Valuing Real Options	Risk Preferences	No-Class
11/29 Lecture 38	Lecture 39	12/3
Utility Theory	Biases	Class Presentations
12/6	Lecture 40	12/10
Class Presentations	Review	Final 1:00 – 3:00 pm