

ISYE 475/575: Decision Analysis for Engineering

Syllabus

Term: Fall 2020

Credit hours: 3

Classroom: Online

Time: N/A

Instructor: Dr. Ziteng Wang

- **Office:** EB 240
- **Email:** zwang3@niu.edu

Office hour: by email appointment

Teaching assistant: See Blackboard

Course description: Elementary quantitative decision making when random factors are present. Decision trees, assessment of choices using expected utility, influence diagrams, and the value of information.

Prerequisites:

- ISYE 335 or STAT 350 or UBUS 223, or consent of department.
- Basic knowledge of probability and engineering economics.

Textbook: *Introduction to Decision Analysis: A Practitioner's Guide to Improving Decision Quality, 3rd Edition*, David C. Skinner, Probabilistic Publishing, 2009, ISBN-13: 978-0964793866.

Course objective: Upon completion of this course, a student should be able to do the following:

- Understand and recognize the uncertainty in a decision-making problem
- Structure a complicated decision problem and identify alternative solutions
- Apply analytical tools, models and techniques for decision-making under uncertainty
- Analyze and evaluate the results and propose recommendations
- Understand and facilitate a scalable decision process (SDP)

Relation to graduate program outcomes. This course contributes to the following outcomes of the graduate program:

- A. An ability to define and formulate Industrial and Systems Engineering problems.
- B. An ability to apply math and scientific tools to define, design, predict, improve, and optimize the system performance.
- C. An ability to independently learn advanced topics in Industrial and Systems Engineering.
- D. An ability to conduct research or project professionally and ethically.
- E. An ability to effectively communicate ideas/concepts and research findings through technical reports and professional presentations.

Course topics: The following topics will be covered in this course:

- Introduction to decision analysis
- Making compelling decisions under uncertainty
- The scalable decision process
- Decision models: influence diagrams and decision trees
- Probability and simulation
- Sensitivity analysis
- Value of information
- Risk attitude and utility
- Portfolio analysis and management

Grading:

- Homework: 20%
- Project: 20% (project proposal 5% + final report 15%)
- Midterm exam: 30%
- Final exam: 30%
- Each student will receive a letter grade based on his or her cumulative percentage score according to the following scales:
 - A 95 – 100
 - A- 90 – 94.99
 - B+ 85 – 89.99
 - B 80 – 84.99
 - B- 70 – 79.99
 - C+ 60 – 69.99
 - C 50 – 59.99
 - C- 40 – 49.99
 - D 30 – 39.99
 - F 0 – 39.99

Homework:

- Homework must be completed individually.
- No late homework will be accepted.

Project:

- Students may complete a project individually or by a team of two. The objective of the project is to apply what is learned in this course on a practical problem. Students are expected to identify a problem, conduct decision analysis, and report the results.
- A project proposal is due on **Sunday October 11, 2020 11:59 pm**. No late work will be accepted.
- A final report is due on **Thursday December 10, 2020 11:59 pm**. No late work will be accepted.
- For teams of two, please designate one student each team to be the person to submit the proposal and report.

Exams:

- Midterm exam: **Saturday October 17, 2020 9:00 am – Sunday October 18, 2020 11:59 pm**

- Final exam: **Sunday December 06, 2020 9:00 am – Monday December 07, 2020 11:59 pm**
- Exam policies:
 - Both exams are take-home exams. Students must complete the exams individually. Receiving help from others or giving help to others is prohibited. Allowed resources include textbook, notes, lectures, calculator and computer with Internet access. No late work will be accepted.
 - Students must contact the instructor ahead of time if unable to take an exam within its specified time frame except for medical or other emergencies after which proper documentation will be required.
 - No make-up exams will be allowed without instructor's approval.

Tentative course schedule:

Week	Date	Topics/Content	Textbook chapter	Assignments and Due Dates
1	08/24 – 08/30	Course overview; Introduction to decision analysis	1 and 2	
2	08/31 – 09/06	Making compelling decisions; Scalable decision process – I	4 and 5	Homework 1 due
3	09/07 – 09/13	Scalable decision process – II; Structuring phase of SDP	5 and 6	Homework 2 due
4	09/14 – 09/20	Decision making under uncertainty	3	Homework 3 due
5	09/21 – 09/27	Influence diagram	7	Homework 4 due
6	09/28 – 10/04	Decision tree	7	
7	10/05 – 10/11	Review of probability	8	Homework 5 due; Project proposal due 10/11
8	10/12 – 10/18	Midterm exam		Midterm exam 10/17 – 10/18
9	10/19 – 10/25	Monte Carlo simulation	9	
10	10/26 – 11/01	Using subjective information; Discrete probability approximation	10	Homework 6 due
11	11/02 – 11/08	Deterministic sensitivity analysis; Probabilistic evaluation	11	Homework 7 due
12	11/09 – 11/15	Value of information	11	Homework 8 due
13	11/16 – 11/22	Risk attitude and utility	11	
14	11/23 – 11/29	Agreement phase of SDP Portfolio analysis and management	12 and 15	
15	11/30 – 12/06	Course review	13 and 14	
16	12/07 – 12/13	Exam week		Final exam 12/06 – 12/07; Project final report due 12/10

Academic integrity: Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university.

Each student is responsible to know and observe the university academic regulations that can be found in the Undergraduate Catalog and Graduate Catalog.

- Undergraduate: [link](#)
- Graduate: [link](#)

Accommodations for students with disabilities: If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu.

Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

Syllabus change policy: This syllabus is a guide and every attempt is made to provide an accurate overview of the course and its requirements. However, certain circumstances may make it necessary for the instructor to modify the syllabus during the semester for the benefit of the students and the changes may depend, in part, on course progress and students' needs. Changes to the syllabus will be made with advance notice to students and approval by the department.