

ISYE 675: Advanced Decision Analysis for Engineering

Syllabus

Term: Spring 2022

Credit hours: 3

Classroom: Online, asynchronous

Time: N/A

Instructor: Dr. Ziteng Wang

- **Email:** zwang3@niu.edu
- **Phone:** (815) 753-9971
- **Office hour:** Tuesdays 3:30pm – 4:30pm, or by email appointment.

Teaching assistant: See Blackboard

Course description: Introduction to advanced statistical and strategic methods for decision making, with emphasis on problems in engineering, industry and operations.

Prerequisites:

- ISYE 335, or consent of department.
- Basic knowledge of probability and statistics.

Textbook:

- *An Introduction to Bayesian Inference and Decision*. 2nd edition. Robert L. Winkler. Probabilistic Publishing. <http://www.decisions-books.com/Bayesian>

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

- Understand basic concepts of Bayesian inference
- Perform Bayesian inference for discrete and continuous probability models
- Understand the principles of decision theory, utility theory and value of information
- Understand basic concepts of game theory

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

- Decision making under uncertainty
- Bayesian theorem and inference
- Non-cooperative and cooperative game theory models

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.

Grading:

- Homework: 20%
- Project: 20%
- 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.
- Homework will be assigned and should be submitted on Blackboard.
- 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 encourage you to study a certain topic deeper than it is taught in class. You are expected to identify a topic of interest as the course goes, read more (books, papers, etc.) and/or try an application, and then report what you learn.
- A project report is due **Thursday 05/12 11:59pm**. No late work will be accepted.
- See Blackboard for additional information including potential topics and report requirements.

Exams:

- Midterm Exam: **Saturday 03/26 9:00am – Sunday 03/27 11:59pm**
- Final exam: **Saturday 05/07 9:00am – Sunday 05/08 11:59pm**
- Exam policies:
 - Both exams are take-home exams. You should take the exam and submit your work within the specified timeframe.
 - You must complete the exams individually. Receiving help from others or giving help to others is prohibited. You may use other resources such as textbook, notes, lectures, calculator and computer. No late work will be accepted.
 - You must contact the instructor ahead of time if you are 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	Topic	Lecture (Blackboard)	Assignment
1	01/17 – 01/23	Course overview; Subjective interpretation of probability; Bayes' theorem	0, 1, 2	HW1
2	01/24 – 01/30			
3	01/31 – 02/06	Bayesian inference for discrete probability models	3	HW2; HW1 due
4	02/07 – 02/13	Bayesian inference for continuous probability models	4	HW3; HW2 due
5	02/14 – 02/20	Bayesian inference for continuous probability models (cont.)	5	HW4; HW3 due
6	02/21 – 02/27	Decision theory	6	HW5; HW4 due
7	02/28 – 03/06	Value of information	7	HW6; HW5 due
8	03/07 – 03/13	Inference and decision	8	HW6 due
9	03/14 – 03/20	Spring Recess		
10	03/21 – 03/27	Midterm exam		Midterm exam: Saturday 03/26 9:00am – Sunday 03/27 11:59pm
11	03/28 – 04/03	Game theory – basics; Introduction to non-cooperative game; Non-cooperative game; Mixed strategy	9, 10	HW7
12	04/04 – 04/10			
13	04/11 – 04/17	Extensive game; Cooperative game	11, 12	HW8; HW7 due
14	04/18 – 04/24			
15	04/25 – 05/01	Other game models and applications		HW8 due

16	05/02 – 05/08	Course review and wrap-up		Final exam: Saturday 05/07 9:00am – Sunday 05/08 11:59pm
17	05/09 – 05/15	Exam week		Project report due Thursday 05/12 11:59pm

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.

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: 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.