

ISYE 371: Operations Research: Probabilistic Models

Syllabus

Term: Spring 2026

Credit hours: 3

Classroom: Engineering building 358

Days and Times: Monday/Wednesday 9:30 am – 10:45 am

Instructor:

- Name: Dr. Ziteng Wang
- Office: EB 240
- Email: zwang3@niu.edu
- Phone: (815) 753-9971
- Office hours: Wednesday 12:30 pm – 1:30 pm or by appointment

Teaching assistant:

- Name: Syed Abrar Zaheer
- Email: Z2037151@students.niu.edu
- Office hours: Monday 11:00 am – 12:00 pm or by appointment
- Room: EB 232

Course description: (from NIU Undergraduate Catalog) Introduction to elementary probabilistic models of operations research. Reliability of simple systems, applications of Markov chains, probabilistic decision models, applications of the Poisson process, elementary models for queueing systems.

Spring 2026 course description: This course provides a comprehensive introduction to probabilistic models in Operations Research, focusing on decision-making under uncertainty and risk. Core topics include Bayesian inference, decision analysis, Markov Chains, Markov Decision Processes (MDP), and Queuing Theory. To enhance modeling efficiency, the course integrates generative AI tools to assist with code generation and computational mechanics. This approach reduces the burden of manual syntax, allowing students to prioritize rigorous problem formulation, model verification, and the interpretation of stochastic system behaviors. The goal is to prepare engineers who can architect, solve, and audit complex industrial models in a modern computational environment.

Prerequisites:

- ISYE 335 or STAT 300 (Basic probability and statistics)
- Basic spreadsheet skills
- Basic computer coding skills

Textbook:

- [*Operations Research: An Introduction*, 11th Edition](#), Hamdy A. Taha, Pearson Education, 2023.
- [optional] [*Introduction to Operations Research*, 2024 release](#), Frederick S. Hillier and Gerald J. Lieberman, McGraw Hill, 2024.

Course objective: To provide students with a working knowledge of probabilistic operations research models, methods, and applications, and a basic skill of using artificial intelligence tools to enhance their learning and problem-solving.

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

- Determine an appropriate OR model for formulation and understanding of a practical engineering problem or system.
 - This is associated with ABET outcome 1.2 “Formulates the given system appropriately for the purpose of understanding qualitative and/or quantitative behavior.”
- Formulate a valid model with clearly defined problem statement, key elements of the model, and appropriate representation of the available data.
 - This is associated with ABET outcome 6.1 “Defines a problem statement, dependent/independent variables and/or appropriate hypothesis.”
- Solve the model by using techniques learned to identify areas of improvement and to achieve optimal solution.
 - This is associated with ABET outcome 1.1 “Identifies problem/project requirements for a system where improvements can be made” and ABET outcome 1.3 “Applies appropriate engineering, science and/or mathematical principles to solve complex industrial and systems engineering problems.”
- Interpret results of the model in the context of the original engineering problem.
 - This is associated with ABET outcome 6.4 “Interprets results and draws conclusions with respect to the assumptions and constraints.”

Assignments and Grading:

- Homework: 25%
 - Homework must be completed individually.
 - No late homework will be accepted.
- Midterm exam: 25%
 - Time: Wednesday, March 4, in class
 - Location: Logistics Lab (EB 251)
- Final exam: 25%
 - Time: Wednesday, May 6, 8:00 am – 9:50 am (university exam schedule)
 - Location: Logistics Lab (EB 251)
- Project: 25%
 - Students must complete the project individually or in team of two.
 - A list of case studies will be provided. Students may choose a case study from the list or use one found elsewhere which must be approved by the instructor.
 - Project sign-up email due: Wednesday, April 1, 11:59 pm
 - Project presentation: Wednesday, April 29, in class
 - Project report: Friday, May 8, 11:59 pm
- Bonus: 0 – 4 points
 - The bonus assignment is optional.
 - The bonus assignment is a 15-minute in-class presentation. Topics of the presentation may be a successful story of Operations Research, a case study, an introduction to an emerging field/trend in Operations Research, a review of an industry where Operations Research is extensively applied, and other self-study of Operations Research related topics.

- The bonus assignment can be done individually or by a group of two students.
- Students should sign up with the instructor and get approval for the topic to be presented.
- There will be no more than one presentation in each class. Once all available spots are signed up, no more presentations will be accepted.
- Honor section
 - Students in the honor section will be assigned extra questions in homework assignments. The purpose of these questions is to motivate self-learning topics that are not covered in class.
- Each student will receive a letter grade based on their cumulative percentage score according to the following scales:
 - A 94 – 100
 - A- 88 – 93.99
 - B+ 82 – 87.99
 - B 76 – 81.99
 - B- 70 – 75.99
 - C+ 64 – 69.99
 - C 58 – 63.99
 - C- 52 – 57.99
 - D 46 – 51.99
 - F 0 – 45.99
- Exam policies:
 - Students must complete the exams individually. Receiving help from others or giving help to others is strictly prohibited. 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 the instructor's approval.

Tentative course schedule:

Week	Date(s)	Topics	
		Monday	Wednesday
1	01/12, 01/14	Course overview. Introduction to Operations Research modeling.	Review of probability. Probabilistic inventory models.
2	01/19, 01/21	No class. MLK Day.	Probabilistic inventory models
3	01/26, 01/28	Bayesian models	Bayesian models
4	02/02, 02/04	Bayesian models	Decision under uncertainty
5	02/09, 02/11	Decision under uncertainty	Markov chains
6	02/16, 02/18	Markov chains	Markov chains
7	02/23, 02/25	Markov chains	Midterm review
8	03/02, 03/04	Markov chains	Midterm exam: in class.

9	03/09, 03/11	No class. Spring recess.	No class. Spring recess.
10	03/16, 03/18	Markov Decision Processes	Markov Decision Processes.
11	03/23, 03/25	Markov Decision Processes	Markov Decision Processes
12	03/30, 04/01	Queuing systems	Queuing systems. Project sign-up due.
13	04/06, 04/08	Queuing systems	Queuing systems
14	04/13, 04/15	Queuing systems	Queuing systems
15	04/20, 04/22	Advanced topics	No class. Dr. Wang's conference travel.
16	04/27, 04/29	Final review	Project presentations
17	05/04-05/08	Final exam: Wednesday, May 6, 8:00 am – 9:50 am	Project report due.

Policy on artificial intelligence and generative tools:

- 1. Encouraged and integrated use.** In this course, students are permitted and encouraged to use Artificial Intelligence (AI) tools, including generative AI (e.g., ChatGPT, Gemini, Claude), AI coding assistants, and other automated systems. Learning to leverage AI effectively is an emerging and essential skill; therefore, you are expected to experiment with these tools to identify their benefits and limitations.
- 2. Student responsibility for content.** While AI is a powerful tool for augmenting human decision-making and brainstorming, it is not a replacement for your own critical thinking. You are fully responsible for any work you submit, including AI-generated content. You must verify all information to ensure it does not contain “hallucinations,” factual errors, biased information, or unethical content. You are required to thoroughly read and certify the accuracy and suitability of every submission.
- 3. Disclosure of usage.** To maintain academic transparency, you must disclose if you used AI in your work. Every assignment that utilizes AI must include a clear explanation of how the tool was used in your process (e.g., for brainstorming, drafting, debugging code, or refining style) and which specific platforms were employed. Failure to acknowledge the use of these tools may be considered a violation of academic honesty policies.
- 4. Scientific defense of work.** You must be prepared to explain and scientifically defend all aspects of your work product, including content originally generated by an AI. Because AI often lacks critical thinking and can produce inaccurate outputs, you must be able to argue a rationale for why the AI-generated portions of your assignment are appropriate, accurate, and scientifically sound.
- 5. Documentation and chat history requirements** For any work involving chat-based AI tools (such as ChatGPT, Gemini, Claude, or Grok), you must provide a sharable link to the complete chat and prompt history. This documentation must:
 - Be referred to directly within your assignment.
 - Include the entire exchange and the specific input parameters/prompts used to guide the tool.

- **Remain accessible for the duration of the entire semester** for instructor review.

Academic integrity statement: 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.

Americans with disabilities and non-discrimination statement: 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 in the Campus Life Building, Suite 180, and can be reached at 815-753-1303 or drc@niu.edu.

Also, please contact me privately as soon as possible so we can discuss your accommodations. Please note that you will not be required to disclose your disability, only your accommodations. The sooner you let me know your needs, the sooner I can assist you in achieving your learning goals in this course.

Syllabus change policy statement: 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 me to modify the syllabus during the semester for your benefit and the changes may depend, in part, on course progress and our needs. I will announce any change to the syllabus as early as possible so that you can adjust your schedule. The department/ school will also be notified of any change.

Mental health and well-being statement: I understand that college students may experience a range of academic, social, and personal stressors, which can be overwhelming. You are not alone. Well-being at NIU offers resources, programs, and services. If you or someone you know need assistance with comprehensive or crisis mental health support, Counseling and Consultation Services (CCS) at 815-753-1206 is ready to help 24 hours a day, 7 days a week. Additionally, the National Suicide Prevention Lifeline can be reached at 988.