

ISYE 671: Linear Programming and Network Flows

Syllabus

Term: Spring 2026

Credit hours: 3

Classroom: Engineering building 311

Days and Times: Monday 2:00 pm – 4:40 pm

Instructor:

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- Office hours: Wednesday 12:30 pm – 1:30 pm or by appointment

Teaching assistant:

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- Office hours: Monday 11:00 am – 12:00 pm or by appointment
- Room: EB 232

Course description: (from NIU Graduate Catalog) Formulation and solution techniques for linear programming and network flow problems. Simplex method, theory, and computation. Duality theory, sensitivity analysis. Maximum flow minimum cut theorem. Shortest routes, minimum cost flows.

Spring 2026 course description: This course integrates rigorous mathematical theory with modern computing to equip engineers with advanced decision-making skills. The curriculum is built upon three central pillars: optimization modeling, computational solution methods, and AI-assisted problem solving. Students will master the formulation and solution of Linear Optimization, Integer Optimization, and Network Flow models using the AMPL language and Python. By utilizing Generative AI as a technical co-pilot, students will learn to accelerate the coding and solving process while strictly maintaining the engineering judgment necessary to validate model architecture and interpret computational results.

Prerequisites:

- ISYE 370, or consent of department.
- Basic computer coding skills

Textbook:

- [*Optimization in Operations Research, 2nd Edition*](#), Ronald L. Rardin, Pearson Education, 2016.

Course objective: To provide students with a solid knowledge of optimization-based operations research models, methods, and applications, and practical skills of using artificial intelligence tools to enhance their learning and problem-solving.

Learning outcomes: Upon completion of the course, students will have the ability to

1. Translate complex, ambiguous engineering problems into rigorous mathematical models.
2. Implement these models using the AMPL language within a Python ecosystem.
3. Utilize AI effectively to draft code, generate syntax, and troubleshoot errors.
4. Critique AI outputs to identify “hallucinations” and enforce physical reality.
5. Interpret solver results in making engineering decisions.

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.

Assignments and Grading:

- Homework: 25%
 - Homework must be completed individually.
 - No late homework will be accepted.
- Midterm exam: 25%
 - Time: **Monday, March 16, in class.**
 - Location: Logistics Lab (EB 251)
- Final exam: 25%
 - Time: **Monday, May 4, 2:00 pm – 3:50 pm** (university exam schedule).
 - Location: Logistics Lab (EB 251)
- Project: 25%
 - Students must complete the project individually.
 - Project requirements will be released as a separate document.
 - Project sign-up email due: **Monday, March 2, 11:59 pm.**
 - Project presentation: **Monday, April 27, 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.
- 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 |
| 1 | 01/12 | Course overview. Introduction to optimization. |
| 2 | 01/19 | No class. MLK Day. |
| 3 | 01/26 | Basic linear optimization models |
| 4 | 02/02 | Solve linear optimization models |
| 5 | 02/09 | Basic integer optimization models |
| 6 | 02/16 | Solve integer optimization models |
| 7 | 02/23 | Basic network models |
| 8 | 03/02 | Solve network models. Project sign-up due. |
| 9 | 03/09 | No class. Spring recess. |
| 10 | 03/16 | Midterm exam: in class. |
| 11 | 03/23 | Advanced LP and IP models |
| 12 | 03/30 | Advanced LP and IP models |
| 13 | 04/06 | Stochastic LP |

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| 14 | 04/13 | Large scale problems |
| 15 | 04/20 | Advanced topics |
| 16 | 04/27 | Project presentation |
| 17 | 05/04-05/08 | Final exam: Monday, May 4, 2:00 pm - 3:50 pm. Project report due: Friday, May 8. |

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.