Iowa State University Syllabus Template

Term Offered
Fall 2026

Full Course Title
Linear Programming

Course Designator
IE 5340

Course Meeting Schedule
Tuesdays and Thursdays, 9:30-10:45, 1106 TIEB

Instructor Contact Information
Dr. Esther Jose (estherjo@iastate.edu | 515-294-5797)
Office: 2306 TIEB
Office hours: 11-12 Tuesday; 1-2 Wednesday (or scheduled as needed)

How to Contact
I'll check my emails a few times a day during the week. I will do my best to get back to you within 24 hours during the workweek. Of course, this depends on the email: if you have high-level doubts about concepts / homework / exams, please allow me at least three business days to get back to you in detail or set up a meeting to talk further. Please note that the more time you have before a deadline or exam, the more likely you are to get a prompt response from me.

Student Office Hours and Location
11-12 Tuesday; 1-2 Wednesday (or scheduled as needed). Can meet at 2306 TIEB or Microsoft Teams (let me know ahead of time).

Course Canvas Page
https://canvas.iastate.edu/courses/129975
You can access the Canvas Page at the above link: all course announcements, assignments, and grades will be posted on the Canvas page. I will also use the calendar to mark deadlines for your convenience.

Course Description
Optimization is the art and science of making the best possible decision within given constraints. Whether it's planning airline routes, or scheduling NFL games (NFL teams often hire Operations Researchers!), optimization turns real-world challenges into precise mathematical models and solves them.

In this course, we'll learn to formulate optimization problems as mathematical models, including linear programming (LP), where both the objective function and constraints are linear (What weight can a plane carry?), and integer programming (IP), where some or all decisions must be

integers (How many people can a plane carry?). We'll also explore multi-objective optimization (How to minimize travel time while maximizing profit?).

You'll be introduced to classic algorithms such as the Simplex method (For solving LPs) and cutting plane algorithms (For tightening and solving IPs). We'll cover foundational ideas in duality theory (how every optimization problem has a "mirror image" problem) and sensitivity analysis (understanding how changes in inputs affect the optimal solution). Finally, we will use Gurobi, a commercial and free-for-students solver to solve these models.

Course Learning Objectives

Upon successful completion of this course, you will be able to:

1. Formulate real-world decision problems as linear, integer, mixed-integer, and multi-objective optimization models.
2. Apply the Simplex method to solve linear programming problems.
3. Apply Branch and Bound and cutting-plane algorithms to tighten and solve integer programming problems.
4. Explain and apply foundational concepts in duality theory and sensitivity analysis.
5. Use Gurobi to solve optimization models and evaluate optimal solutions.

Required and Recommended Course Materials

Linear Programming and Network Flows by Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, 4th edition, Wiley, 2010. ISBN-13: 978-0470462720.
Any other required materials (such as articles and codes) will be posted on Canvas.

Grading

Refer to the Grade Policies section of the ISU Catalog for more information on the university grade policy.

Course Requirements

I want to make it clear that the goal of the following graded components is to encourage your learning, not to "test" you. To that end, feel free to discuss with me or give feedback (anonymously is fine, too!) at any time if any of the following components is not aiding your learning, or if you have any suggestions.

Item	Weight (%)
Homework (10): With few exceptions, one homework assignment is due each week. Your lowest homework grade will be dropped.	20
Retrieval Practice (~20): These activities encourage active learning and will be graded for attendance and participation rather than accuracy.	20
Exam I / Report I: Students will complete either Exam I or Research Report I, depending on their selected track.	20
Exam II / Report II: Students will complete either Exam II or Research Report II, depending on their selected track.	20
Oral defense (+ final report): All students will complete an oral defense. Students in the research track will also submit a final research report.	20
Total	100

Retrieval Practice: The goal of these is to encourage active learning (read more here: https://www.cmu.edu/teaching/resources/instructionalstrategies/activelearningstrategies/retrievalpractice/index.html). These might include activities such as "Write down everything you remember from class in 5 minutes", "Write down three things you remember about duality from last month", etc.

Homeworks: Your homework submissions should reflect your best work. I may refuse to grade all or part of a paper they deem sloppy or unreadable. You are allowed and encouraged to work together on homework problems. You are also allowed to use generative AI tools, but I strongly discourage this. If you use principles not taught in class (this often happens when you use genAI) to solve your HW problems, you will be penalized for it. Each student must submit one's own work on Gradescope via Canvas, understand everything submitted, and acknowledge help received and provided.

Research track or Exam track: In the first two weeks of class, you are allowed to choose between a research track and an exam track. Anyone can choose an exam track; if you choose a research track (solo or as a pair), you will need pre-approval after a conversation with me. Deadlines and dates for both tracks are as presented in the course schedule below.

Research track expectations: You will not be permitted to simply use generative AI to conduct a research project. Any suspicions that you are doing so will be taken seriously. You will be allowed to join the research track if you are interested in pursuing research long-term, are a PhD student, and/or have creative ideas that you are interested in tackling together over the Fall semester.

*Oral Defense (**for all students**): If you are in the exam track,* you will be asked to explain your understanding of 1–2 problems chosen from the homework due after Exam II **and/or** from Exam I and Exam II. If your original answer to a chosen problem was correct, you will explain your reasoning, guided by prompting questions from the evaluators. If your original answer was incorrect, you will be expected to identify your mistakes and describe the correct method for solving the problem. *If you are in the research track*, you will be asked to present a 7-minute talk about your work: you will then be asked questions about your method and results.

In both cases, there will be two evaluators: myself and another professor from the IMSE department. You will be assigned a 15-minute time slot for your oral exam. Your performance will be evaluated using a letter grade rather than a point-based score.

Grading Scheme (Scale)

Once the percentage grade is determined, letter grades and corresponding grade-point values will be assigned according to the following scale:

Grade	% Range	Points	Grade	% Range	Points
A	≥ 90	4.00	B-	65–69	2.67
A-	80–89	3.67	C	55–64	2.00

B+	75–79	3.33	D	50–54	1.00
B	70–74	3.00	F	< 50	0.00

Grading or Course Concerns
I encourage you to meet with me if you are facing challenges meeting the course requirements.

Late or Missed Submissions

Late homework will not be accepted unless discussed ahead of time. Because your lowest homework grade will be dropped when calculating your final homework grade, no makeup homework will be given. Similarly, no makeups will be given for retrieval practice, as they reflect your in-class participation. Exams can be rescheduled due to unexpected reasons such as illness.

Course Calendar and Schedule of Assignments

The course calendar below provides an overview of weekly topics, homework deadlines, examinations, research-report deadlines, and oral defenses. Use this schedule to plan your work and prepare for class. Because the pace of the course may change based on our progress and learning needs, the schedule is subject to change. Any changes will be announced in class and posted on Canvas.

Homework assignments are generally due at the beginning of lecture on the assigned day. Please submit your homework by 9:30 AM on the date due, on Gradescope via Canvas. Graded work with detailed feedback will generally be returned via Gradescope within one week after submission.

Exam I and Exam II will be administered during the regularly scheduled class period on the dates listed below. Students in the research track will submit their corresponding research reports on those dates instead, by 5 PM. Additional information about the location, format, permitted materials, and submission process will be provided in class and on Canvas before each exam or report deadline.

Oral defenses will take place during individually assigned 15-minute time slots between December 10 and December 17. Each student will receive information about the date, time, and location of their oral defense in advance. Students in the research track must also submit their final research report during this period, by December 15th at 5 PM.

Students are responsible for reviewing the course schedule and monitoring Canvas for announcements, assignment instructions, and schedule updates. If you anticipate a conflict with a major deadline because of a religious observance, university-sponsored activity, career fair, or another documented circumstance, please contact me as early as possible.

Week	Dates	Topics	HW due
1	Aug 25, 27	Introduction to Optimization; LP basics	

Week	Dates	Topics	HW due
2	Sep 1, 3	LP properties; Simplex introduction	Yes
3	Sep 8, 10	Simplex method (tableau form & examples)	Yes
4	Sep 15, 17	Integer and binary variables	Yes
5	Sep 22, 24	Duality theory and applications; **Exam 1 Review**	Yes
6	Sep 29	**Exam 1 / Research Report 1 due**	
	Oct 1	Sensitivity analysis	
7	Oct 6, 8	Sensitivity continued; Attacking an LP	Yes
8	Oct 13, 15	Fall Break; Multi-objective optimization	Yes
9	Oct 20, 22	Multi-objective examples; Solving MIPs	Yes
10	Oct 27, 29	Solving MIPs continued; Linear fractional programming	Yes
11	Nov 3	LFP Examples; **Exam 2 Review**	
	Nov 5	**Exam 2 / Research Report 2 due**	
12	Nov 10, 12	Dual simplex	Yes
13	Nov 17, 19	Column generation	Yes
14	Nov 24, 26	Thanksgiving Break – No Class	
15	Dec 1, 3	Optional advanced topic (Benders, Neural Nets in Optimization)	Yes
16	Dec 8	Advanced topic continued + Final exam review	
17	Dec 10-17	**Oral Defense, as scheduled + Final Research Report due**	

Class Attendance and Absences
Retrieval-practice activities will be conducted once or twice each week and will be graded for attendance and participation rather than accuracy. These activities may include individual recall exercises and class discussion.

University Syllabus Statements and Standard University Information

Free Expression
Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

No employee, student, applicant, or campus visitor is compelled to disclose their pronouns. Anyone may voluntarily disclose their own pronouns.

Academic Dishonesty
The class will follow Iowa State University's policy on academic misconduct (5.1 in the Student Code of Conduct). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams and for following directions given by faculty, instructors, and ISU Test Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the Office of Student Conduct in the Dean of Students Office. Information about academic integrity and the value of completing academic work honestly can be found in the Iowa State University Academic Integrity Tutorial.

Accessibility Statement
Iowa State University is committed to supporting students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at www.sas.dso.iastate.edu, by email at accessibility@iastate.edu, or by phone at 515-294-7220.

Non-Discrimination Statement
Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, creed, national origin, pregnancy, sexual orientation, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to the Office of Equal Opportunity, 2680 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, email eooffice@iastate.edu.

Mental Health and Wellbeing Resources
We're committed to your success and wellbeing at Iowa State. As a Cyclone, you can access 24/7 resources, services, and people dedicated to helping you achieve your goals and be your best in and out of the classroom. Whether you need academic support or just someone to talk to, we're here for you at Cyclone Support. If you are struggling emotionally and need support, there's confidential help available 24/7/365. You can call or text 988 or use the chat at 988lifeline.org.

Statement on Prep Week
This class follows the Iowa State University Prep Week policy, as noted in the ISU Policy Library and the Senior Vice President and Provost's website.

Religious Accommodations
Iowa State University welcomes a broad spectrum of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort

to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.

Generative Artificial Intelligence (GenAI) Usage

The permitted use of generative artificial intelligence (GenAI) tools varies by assignment type. If you are uncertain whether or how GenAI may be used for a particular assignment, contact me for clarification before using it.

For homework, you may use GenAI tools, although I strongly discourage relying on them. Your submission must reflect your own understanding and best work. You are responsible for understanding and being able to explain everything you submit. Solutions that rely on principles or methods not taught in this course may be penalized. You must acknowledge any assistance received or provided, including the use of GenAI tools.

For research-track projects, GenAI may support your thinking and communication. For example, by helping you explore possible methods or express your own ideas more clearly. It may not replace the critical thinking and intellectual work that the research project is intended to demonstrate. The research questions, reasoning, methodological choices, analysis, and conclusions must reflect your own informed judgment. You must critically evaluate, verify, and be prepared to explain and defend any material developed with GenAI assistance. Using GenAI to produce work that you have not independently considered, evaluated, or understood constitutes misuse and will be taken seriously.

No GenAI tools or other technological devices or resources may be used during retrieval-practice activities or exams unless I explicitly authorize their use or they are part of an approved accommodation.

Regardless of the assignment, each student must submit their own work unless collaboration or group work has been expressly permitted. When GenAI is used, you remain responsible for the accuracy, relevance, attribution, and integrity of all submitted material.

Student Code of Conduct

Students are responsible for being familiar with the Iowa State University Student Code of Conduct.

Academic Support Services

Iowa State University provides many academic support services to help students maximize their academic potential.

- Cyclone Support
- Student Health and Wellness
- Academic Success Center

- Student Accessibility Services
- Office of Student Assistance
- Graduate College's Center for Communication Excellence

Technology Support
If you need help with technology, please contact the IT Solution Center by emailing solution@iastate.edu, calling 515-294-4000, or submitting a request. Additional information is available on the ITS Resources for Students site.

Inclement Weather or Emergencies
In the event of inclement weather or any emergency that leads to an official campus delayed opening or closure, the ISU Alert site will be the first to announce it. You should check your university email and Canvas course announcements for further information regarding assignments and expectations once the severity of the disruption is known.