Fall 2024

IE 650-103: Adv Topics Oper Res

Sufian Ikhmeis

New Jersey Institute of Technology

[Department of Mechanical and Industrial Engineering]

[EM 650 851] [Advanced Topics in Operations Research]

[Fall 2024]

Instructor: Ikhmeis, Ph.D.IE

[T 06:00 – 08:50 PM]; [FMH 313]

[si8@njit.edu]

Office hours: [Tuesday] [4:30 –5:30 PM], or by appointment

Prerequisite Knowledge

An introductory course in operations research or equivalent. Current topics in deterministic models of operations research: linear programming, large scale decomposition, integer programming, dynamic programming, and nonlinear programming. Emphasis on optimization techniques for solving mathematical programming problems.

Course Description

This course will introduce the basic models in operations research. The students will learn to formulate, analyze, and solve mathematical models motivated by real-world problems. Current topics in deterministic models of operations research: linear programming, integer programming, dynamic programming, and nonlinear programming. Emphasis on optimization techniques for solving mathematical programming problems.

Course Objectives

The course intends to prepare students to understand and apply operation research optimization algorithms and technique principles to solve and interpret results. At the end of the semester, the students should be able to:

- Apply general principles underlying the various types of optimization techniques (e.g., Linear Programming, Integer programming, dynamic Programming, and nonlinear programming....).
- Learn how to formulate, analyze, and solve mathematical models.
- to interpret results and to decide which method to use under different inputs.
- Perform and apply different algorithms to manual solve various mathematical models.

The instructor for this course reserves the right to adjust this schedule to serve the educational needs of the students enrolled in this course.

Course Learning Outcomes:

By the end of the course students will be able to

- Proficiency with tools from linear programming, Integer programming, Dynamic and nonlinear programming including fundamental theory and applications of those tools.
- Facility with using mathematical and computational modeling of real decision-making.
- Deal and set up models using analytic skills to evaluate the problems.

General Policies:

- No incomplete grade will be given.
- No late submittal of assignments/exams will be accepted. Solution will be posted immediately on the due date of the assignment.
- Students must submit all assignments/exams via Canvas only.
- Assignments attached to emails sent directly to the professor will not be accepted.

Canvas

We are going to use Canvas throughout the semester to distribute all course material. Submissions are also going to be collected through Canvas. You can access your Canvas account with your UCID and password.

- Each week's contents are organized through modules. A lecture es and some solved problems will be available to students before class
- A module will include lecture notes, discussions, homework, and any other resources available for the lecture on hand.

Provided material on Canvas: PowerPoint Slides, Videos, Reading Material, Homework problems.

Course Structure

- course mode: In-class meetings

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Referenced Textbook

- Applied Mathematical Programming by Stephen P. Bradley, Arnoldo C. Hax, and Thomas L. Addison-Wesley, 1997. ISBN: 9780201004649.
- Operations Research Applications and Algorithms by Wayne L. Winston, 4th edition. ISBN: ISBN 0-534-38058-1
- Linear and Nonlinear Programming, by David G. Luenberger • Yinyu Ye 5th edition. International Series in Operations Research & Management Science ISBN 978-3-030-85449-2 ISBN 978-3-030-85450-8 (eBook)

Homework:

This will be based on the course text and lecture. This is an individual effort and must be done without collaboration.

Homework will be submitted to the course NJIT canvas website before or on the due day and time with late submissions counted as a zero.

Exams:

- There will be one midterm and one final exam.
- A missed exam will be counted as a zero.

This will be based on the course lectures and discussions. This is an individual effort and must be done without collaboration.

Exams will be during a specified time interval and no make-up exams will be given unless a note is received by the instructor from the Dean of Students office.

Course Assessment Criteria

- Homework [30%]
- Midterm Exam [week of 10/22/2024], [35%]
- Final Exam [week of 12/17/2024], [35%]

Your final grade in the class will be determined based on the summation of the number of points that you acquire. The following point spread corresponds to the following grade.

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Total	< 50	50	65	75	85	90
Grade	F	C	C+	B	B+	A

Students with disabilities

Students with disabilities need accommodations of any nature so as to have a fair opportunity to perform in the class need to contact the counseling center. Staff at the counseling center will determine what constitutes a reasonable accommodation and inform the instructor of what it is.

Academic Integrity

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at
http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf Links to an external site.**.**

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu."

Requesting Accommodations:

The Office of Accessibility Resources and Services works in partnership with administrators, faculty, and staff to provide reasonable accommodations and support services for students with disabilities who have provided their office with medical documentation to receive services.

If you are in need of accommodations due to a disability, please contact the Office of Accessibility Resources and Services to discuss your specific needs.

Resources for NJIT Online Students (not for this class)

NJIT is committed to student excellence. To ensure your success in this course and your program, the university offers a range of academic support centers and services. To learn

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more, please review these Resources for NJIT Online Students, which include information related to technical support.

[Week], Date (2024)	**Topic / Reading Material**	Homework	Notes
[1] 09/03	Introduction and Overview / Linear Programming Formulation and Graphical Solutions		
[2] 09/10	LP Simplex Method		
[3] 09/17	LP Dual Simplex Method		
[4] 09/24	LP Duality and Sensitivity Analysis		
[5] 10/01	LP Interior – point Method		
[6] 10/08	Integer Programming / Branch – and – Bound Algorithm		
[7] 10/15	Homework Solutions and Midterm Review	HW 1 Due	
[8] 10/22	**Midterm Exam**		
[9] 10/29	Integer Programming, Cut Algorithms		
[10] 11/05	Classical Optimization Theory I		
[11] 11/12	Classical Optimization Theory II		
[12] 11/19	NLPP/ Unconstrained Algorithms		
[13] 12/03	NLPP / Constrained Algorithms		
[14] 12/10	Homework Solutions and Final Review	HW 2 Due	
[15] 12/17	**Final Exam**		

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