New Jersey Institute of Technology

[Department of Mechanical and Industrial Engineering]

[EM 602 851] [Management Science]

[Fall 2023]

Instructor: Ikhmeis, Ph.D.IE

[M 06:00 – 08:50 PM]; [FMH 213]

[si8@njit.edu]

[Office: GITC 303 / Phone: (347)-453.4124]

Office hours: [Monday] [4:00 –5:00 PM], or by appointment

Prerequisite Knowledge

Prerequisite: undergraduate calculus and probability and statistics.

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. Topics include linear programming and the simplex algorithm, integer programming and branch and bound and the cutting plane algorithms, transportation and network models, Travelling Salesperson Problem (TSP), Dynamic programming.

Course Objectives

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

- Understanding the general principles underlying the various types of optimization techniques (e.g., Linear Programming, Network Optimization, Integer programming and Dynamic Programming, etc.…), how to interpret results and how to decide which method to use in any case.
- Learn how to formulate, analyze, and solve mathematical models
- Understand and perform manual solution using the simplex method for solving linear programming (LP)
- Understand duality problem of LP and perform sensitivity analysis

- Formulate and solve special linear programming problems, the transportation problem, assignment problem, and network models
- Formulate and understand integer programming models and perform manual solution using the branch -and-bound algorithm and cutting plane algorithm
- Understand and solve the TSP
- Understand the recursive nature of dynamic programming via the decomposing a problem into more manageable subproblem to obtain optimal solution
- Use software programming and MS Solver to solve various Operation Research problems introduced during the semester.

Course Learning Outcomes:

By the end of the course students will be able to

- Proficiency with tools from linear programming, Integer programming, Network, and simulation including fundamental and varies industrial 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:

Students are responsible for reading the associated chapters and assigned materials and reviewing key concepts, terms, definitions, discussion questions, and topics in the chapters.

- 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.
- Quizzes, homework, and tests will be graded weekly.
- 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 module will include lecture notes, discussions, and 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: **Online**

Required Textbook

Operation Research, An Introduction 11th Edition, by Hamdy A Taha, ISBN-13: 9780137625864

https://www.pearson.com/store/en-us/pearsonplus/p/9780137625727.html

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 the day and time it is due with late submissions counted as a zero.

Exams:

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

This Will be based on the course text and lecture. 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 10/19/2023], [35%]
- Final Exam [week of 12/21/2023], [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.

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

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

[Week], Date (2023)	Topic / Reading Material	Reading	Notes
[1] 09/07	Introduction to Management Science/ Linear Programming/ Graphical, and Algebraic solution	Ch. 1 & Ch.2	Homework assignment will be announced at the end of the lecture
[2] 09/14	Solving Linear Programming: The Simplex Method - I	Ch.3	
[3] 09/21	Solving Linear Programming: The Simplex Method - II	Ch.3	
[4] 09/28	LP: Sensitivity Analysis and Duality	Ch.4	
[5] 10/05	Transportation and Assignment problems	Ch.5	
[6] 10/12	Homework Solutions and Midterm Review		
[7] 10/19	**Midterm Exam**		
[8] 10/26	Network Optimization Models	Ch.6	
[9] 11/02	Integer Programming,	Ch.9	
[10] 11/09	Inventory Modeling - I	Ch.13	
[11] 11/16	Inventory Modeling - II	Ch.16	
[12] 11/30	Simulation - I	Ch.19	
[13] 12/07	Simulation - II	Ch.19	
[14] 12/14	Homework Solutions and Final Review		
[15] 12/21	**Final Exam**		

 Note: I used Thursday meeting time as the lecture date. All lecture records will be available to you before Thursday.