Faculty of Eng. & Natural Sci.

ENS511-202002

Engineering Optimization

Instructor(s)

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Course Content

This course will cover optimization methods for solving engineering problems. The methods will include linear and nonlinear programming, integer programming, dynamic programming, network models and an introduction to metaheuristic algorithms. Special emphasis will be given to practical aspects.

Objectives

This course will expose students to operations research modeling and basic tools for optimization. It is designed for engineering students who do not have an industrial engineering background but would like to learn about modeling and optimization concepts. This course will be particularly useful for those who are likely to use these methods in their research and projects.

Recommend or Required Reading

Textbook

Introduction to Operations Research, 9/e
Frederick S Hillier, Gerald J Lieberman

Readings

Winston and Venkataramanan, Introduction to Mathematical Programming, Thomson, 2003, ISBN 0-534-35964-7.
Rardin, Optimization in Operations Research, Pearson

Wolsey, Integer Programming, Wiley
Taha, Operations Research: An Introduction, Prentice Hall
Vanderbei, Linear Programming: Foundations and Extensions, Kluwer

Assessment Methods and Criteria

	Percentage(%)	Number of assessment methods
Exam	60	6
Assignment	10	6
Participation	15	
Group Project	15	

Course Outline

Subjects covered will include:
Week 1) Operations research and modeling of optimization problems.
Week 2) Linear programming, Graphical solution.
Week 3) Simplex method for LP
Weeks 4 and 5) Duality and sensitivity in LP.
Weeks 6 and 7) Nonlinear programming.
Week 8 and 9) Networks, Shortest Path and Max Flow problems.
Week 10) Integer programming, discrete optimization models.
Week 11 and 12) Dynamic programming.
Week 12 and 13) Heuristics and Optimization Methods for Machine Learning.

Learning Outcomes

At the end of the course, the student is expected to have the ability to construct mathematical models of real life problems and to use appropriate methods/software to solve the constructed models.

Course Policies

There will be 6 (possibly 7 if time allows) homework assignments throughout the semester -- approximately one every two weeks. There will be a quiz in the week following the due date of each quiz. The quiz topic will be the same as the topic of the homework assigned in the previous week. The least quiz grade in the semester will be dropped. Quizzes will be administered online during lecture hours on Sucourse. Your webcam and microphone should be on during the exam. In the case of non-compliance with this and other declared exam procedures, your exam will be void. Make sure to check that your webcam and microphone function properly before the exam. The dates of the quizzes cannot be changed due to a tight schedule. "I may give an oral exam under

certain circumstances to double-check your grade from a quiz."

The students need to develop their coding capabilities. Hence, there will be a single group project assignment where the students will either use Python (preferred since it will be more useful for you in the future) or Matlab to model and solve optimization problems. The project will be assigned in the second half of the semester. No instruction will be given on how to code in Python or Matlab.

The students are expected to attend all classes, and they are expected to participate in the lectures by actively answering/asking questions. During each lecture, there will be one or more poll questions where the students need to respond. Your participation grade will be partially based on your responses to the polls. You must attend the synchronous Zoom lectures, recitations, etc., and real-time online exams with your SU email account. The final participation grade will be based on the instructor's view of the students' active participation and not merely the number of lectures the students have attended.