SYLLABUS

SIE 440/540: Survey of Optimization Methods

Department of Systems & Industrial Engineering
University of Arizona

Spring 2022

Course Description

(3 units) Survey of methods including network flows, integer programming, nonlinear programming and dynamic programming. Models development and solution algorithms are covered.

Course Objective

Students are able to develop a working knowledge of different types of optimization methods in these directions: learning solution approaches for linear/integer/dynamic/nonlinear programming and some network optimization problems; developing an appropriate optimization model from a verbal description of a problem; choosing an appropriate solution technique; extract relevant information from the model and solutions.

Prerequisites

SIE 340 - Deterministic Operations Research, or equivalent. Knowledge of linear programming.

Time and Location: TuTh 12:30PM-1:45PM, ENGR 301

Instructor: Dr. Neng Fan
Office: ENGR 312
Office Hours: TuTh 3:30PM-4:30PM or by appointment
Email: nfan@arizona.edu

Teaching Assistant

Masoud Eshghali
Office: ENGR 306
Office Hours: MoWe 4:00PM-5:00PM or by appointment
Email: masoudeshghali@email.arizona.edu

Course Website

We'll be using D2L. All class materials, including homework assignments, lecture notes, supplemental readings, videos, etc., will be distributed from D2L. You must check the announcements in D2L at least twice a week.

References

(Textbook) F. Hillier and G. Lieberman, Introduction to Operations Research, 11th Edition, McGraw-Hill Education, 2021.

W.L. Winston, Operations Research: Applications and Algorithms, 4th Edition, Duxbury Press, 2004.
OR
W. L. Winston and M. Venkataramanan, Introduction to Mathematical Programming, 4th Edition, Thomson Learning, 2002.

Course Outline

1. Review of linear programming: modeling, simplex method, big M and two-phase methods, sensitivity, duality, dual simplex method, transportation simplex method, interior-point method
2. Network optimization: terminology, shortest path problem, minimum spanning tree problem, maximum flow problem, minimum cost flow problem, network simplex method
3. Integer programming: modeling with integer variables and binary variables, branch-and-bound algorithm, cutting plane algorithm
4. Nonlinear programming: review of differential calculus, types of nonlinear programming, convexity of functions, one-variable and unconstrained optimization, convex programming
5. Dynamic programming: examples, solution procedure

Course Policies

SIE 440:
Homework: 5 sets (30%); Exams: Midterm exam (30%), Final exam (40%)

SIE 540:
Homework: 5 sets (20%); Exams: Midterm exam (25%), Final exam (35%); Project (20%)

I expect you to understand and write your own solutions, but you are allowed to discuss with your classmates. Also, if you have any references, you must cite them. Late problem sets will not be accepted unless you contact the instructor in advance. Any questions with grades for homework and exam, you should write explanation to teaching assistant/instructor within one week of grades posted.

Accessibility and Accommodations: At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu) to establish reasonable accommodations.

You are encouraged to make recommendations to improve the class and my teaching skills. Information contained in the course syllabus, other than the grade policy, may be subject to change with advance notice, as deemed appropriate by the instructor.