Department of Mathematics
SA 405 - Advanced Mathematical Programming
Course Syllabus - Fall 2022

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Course Textbook

Deterministic Operations Research by David Rader (ISBN 978-0470484517)

Course Description

This course covers a range of advanced topics in mathematical programming. Topics include integer programming modeling, branch-and-bound methods, integer programming theory and nonlinear optimization theory and algorithms. Students will also learn to use a set-based modeling language for an advanced integer programming solver. Topics will vary with instructor.

Prerequisites

SA 305

Course Objectives

By the end of this course, students will be able to:

- creatively and critically problem solve;
- successfully collaborate in groups;
- intuitively identify, creatively model, and solve (using software) a variety of real-world problems that can be formulated as integer linear programs;
- solve integer programming problems with Python Pyomo;
- understand the theoretical and computational difficulty of integer linear optimization, along with associated theoretical and algorithmic considerations and algorithms.

Tentative course schedule

A tentative schedule of the class is as follows:

Week	Topic
1	Linear Programming Review
2	Minimum Cost Network Flow Models
3	Shortest Path and Max Flow Models
4	Fixed Charge Models
5	Set Covering and Binary Logic Constraints
6	Review and Exam 1
7	Combinatorial Models and Traveling Salesperson Problem
8	Vehicle Routing Models
9	Scheduling Models
10	Facility Location Models
11	Review and Exam 2
12	IP Formulations
13	IP Formulations and Branch and Bound
14	Branch and Bound
15	Lagrangian Relaxation
16	Project and Review