Prerequisites: Basic Linear Algebra


Instructor: Muhong Zhang (email: muhong.zhang@asu.edu phone: 965–2899)

Lectures: Mon Wed 3:00 – 4:15 PM (CDN 62)

Office hrs: Mon Wed 1:30 – 2:30 PM (Brickyard 314)

Teaching assistant: Behnam Taghavi (email: Behnam.Taghavifard@asu.edu)

Office hrs: Tue. 10:00 - 12:00 AM (Centerpoint Building Suite 114)

Course web page: https://myasucourses.asu.edu/ (Blackboard)

Course number: 71800

Course description

This is an introductory course on deterministic Operations Research (OR). In the course, we will formulate mathematical models and develop solution methods for real-life optimal decision problems. We will study how to obtain the best decisions (according to a well-defined objective) in allocating scarce resources such as capital, materials, equipment, manpower, energy, etc. among competing activities that produce goods and services. Rather than developing a specific solution method for each optimization problem, we will build abstractions of these problems in the form of mathematical models and study a general method to solve these models.

The course will focus on a class of problems that can be modeled as a Linear Programming Model. Formally, a linear programming model is either a minimization or maximization of a linear function of several variables constrained with linear inequalities. Surprisingly, a large number of decision problems fit into this framework. This explains why linear programming is so widely used in a variety of industries, ranging from transportation to health care, from finance to manufacturing.

The methodological development will include the simplex algorithm, theorems of duality, sensitivity analysis, network flows, and network simplex.

Organization

Students will be assigned theoretical, modeling, as well as computational homework problems, some of which will require the use of computers. Homeworks are due at the beginning of the class. In-class Quizzes will be given almost once a week. There will be two midterm exams and a final exam. If you miss the midterm exam, your final exam grade will be prorated to cover the midterm. You can use calculators during the exams.
Grading

- Homework: 20%
- Quiz: 22%
- Midterm exam: 20% each [September 30 and November 06, 3:00 – 4:15PM]
- Final Exam: 20% [December 11, 12:10 - 2:00 PM]

Outline

1. Introduction to Operations Research: Chapter 1 and Chapter 2 (1 week)
2. Formulating linear programs: Chapter 3 (3 weeks)
   - Work scheduling
   - Capital budgeting
   - Financial planning
   - Multiperiod problem
3. The simplex algorithm: Chapter 4 and Chapter 5 (3 weeks)
   - Basic feasible solutions and standard form
   - The simplex algorithm
   - Certificates of optimality, infeasibility and unboundedness
   - Computer implementation
4. Duality and sensitivity analysis: Chapter 6 (3 weeks)
   - The dual problem
   - Duality theorems
   - Complementary slackness
   - Changing the right hand side
5. Network optimization: Chapter 9 (4 weeks)
   - Definitions and notation
   - Min cost network flow problem
   - Special case: shortest path problem
   - Special case: maximum flow problem
   - Network simplex algorithm
   - Integral solution property

This syllabus may be modified as time and interests dictate.