MAT 353 Optimization Theory and Practice

Summer 2023

Course Credits: 4
Contact Hours: 55 hours
Instructor: TBA
Email:TBA

COURSE OBJECTIVES

This course provides a comprehensive study of optimization methods, focusing on linear programming, integer programming, dynamic programming, and nonlinear programming. Students will learn various algorithms for solving optimization problems, explore duality theory and post-optimum sensitivity analysis, and analyze the Kuhn-Tucker conditions for optimality. Additionally, quadratic programming, network optimization, and modeling techniques will be covered. Through theoretical discussions and practical applications, students will develop the skills necessary to formulate and solve optimization problems in diverse contexts.

Upon Completion of this Course, students will be able to:

1. Understand the fundamental concepts and principles of optimization and apply linear programming techniques to solve optimization problems
2. Analyze duality theory and perform post-optimum sensitivity analysis
3. Formulate and solve integer programming problems
4. Apply deterministic and stochastic dynamic programming to solve optimization problems
5. Apply the Kuhn-Tucker conditions for optimality in nonlinear programming
6. Demonstrate proficiency in quadratic programming
7. Apply network optimization techniques to solve real-world problems
8. Develop mathematical models for optimization problems in various domains

PREREQUISITES

MAT 222 Multivariable Calculus

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
Quizzes	10 Points
Midterm 1	20 Points
Midterm 2	20 Points
Final Exam	40 Points
Final Group Course Project	10 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

An Introduction to Optimization, 4th edition, Edwin K. P. Chong and Stanislaw H. Zak, Wiley, 2013.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS

Module 1	**Topics:** Topic 1: Modeling with Linear Programming Topic 2: Network Optimization Models Topic 3: Geometry of Linear Topic 4: The Simplex Method **Assessments:** Quiz#1
Module 2	**Topics:** Topic 5: The Simplex Method (Cont.) Topic 6: Simplex Method Development Topic 7: Duality Theory Topic 8: Motivation for Duality **Assessments:** Quiz#2
Module 3	**Topics:** Topic 9: Duality and the Simplex Method, Sensitivity Analysis Topic 10: Dantzig-Wolfe Decomposition Topic 11: Interior Point Methods Topic 12: Linear Programming Optimality Conditions **Assessments:** Midterm#1
Module 4	**Topics:** Topic 13: Primal-Dual Interior Point Strategy Topic 14: Quadratic Programming Topic 15: QP Model Structure Topic 16: QP Application: Financial Optimization **Assessments:** Midterm#2
Module 5	**Topics:** Topic 17: Linear Optimization under Uncertainty Topic 18: Stochastic Programming Topic 19: Robust Optimization Topic 20: Modeling and applications **Assessments:** Final Exam Final Group Course Project

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.
2) Assignments submitted in the wrong format will be counted as not submitted.
3) Failure to submit or fulfill any required course component results in failure of the class.
4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors

and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.