ISE 530 Optimization for Analytics
Spring 2023, Thursday 12:30 – 3:20 PM; GER 206

Instructor	Dr. Maryam Pishgar
Coordinates	Email: pishgar@usc.edu, Phone number: 9496560063
Office Hour	Thursday 3:30-4:30PM or by appointment
Teaching Assistant	Rumeysa Dagsoy ; Email: dagsoy@usc.edu
Office Hour	Friday 10:00-11:00AM
Required textbooks	Jasbir S. Arora Introduction to Optimum design Third Edition. Wayne L Winston and Munirpallam Venkataramanan. Introduction to Mathematical Programming. Operations Research: Volume One. Fourth Edition. ISBN-13: 978-0-534-35964; Brooks/Cole (2002)
Workload	• Roughly five homework sets for the semester • No late homework be accepted Start your homework assignments early
Expectations	Similar homework papers will be examined carefully for sign of plagiarism Penalty will be imposed if there is evidence of academic integrity violation
Examinations	Two examinations
Grade Distribution	Homework 30%; each exam 35%

Goals. Taught at a fast-paced masters level, this course covers classes of optimization problems (linear, quadratic, nonlinear, and integer), their mathematical models, a touch of theory, and basic methods for their numerical solution. The topics provide a set of fundamental tools for the understanding and solution of a variety of data-analytic problems including those arising from operations, statistics, machine learning, financial engineering, and decision making.

Recommended background. This course makes heavy use of linear algebra and matrix operations and assumes that you are comfortable with college-level mathematical reasonings typical of an engineering curriculum. If you are not comfortable with these background materials, either quickly review them or postpone taking the course until you are ready.

Homework policy. Homework may be done in groups of at most three people. In this case:
1. Each individual team member must write their own report (i.e., cannot submit the same exact file multiple times).
2. Each report must specify the names of all members of the group that worked jointly on the assignment.
3. When grading, a single report will be chosen at random and graded (with all group members getting the same grade).

Tentative Schedule: All of the lectures are based on the texts.

• LINEAR PROGRAMMING
— modeling
— simplex method and modeling language
— duality theory and post-optimality analysis
• NONLINEAR OPTIMIZATION
— logistic regression
— optimality conditions
— basic descent methods
— Newton methods
— Constrained optimization
• QUADRATIC PROGRAMMING
— applied models (least-squares regression, portfolio selection, support vector machines)
— the LASSO estimator and extensions
— a touch of theory
— feasible direction method
CONIC PROGRAMMING
— optimization under uncertainty
— semi-definite optimization
— interior point methods
• INTEGER PROGRAMMING
— selected problem classes (knapsack, set covering/partition/packing, fixed costs, logical relations)
— basic branch and bound and cutting planes methods
— Lagrangian relaxation