MATH 467, Fall 2018
(39685R,39686R-Discussion)

Theory and Computational Methods for Optimization

Instructors

Lecture: Dr. Chunming Wang
Office: KAP 244C
Phone: (213) 740-6097
e-Mail: cwang@usc.edu
Office Hours: MW 4:30PM-6PM

Teaching TA: Gang, Bowen
Office:
Phone:
e-Mail: bgang@usc.edu
Office Hours: TBA

Course Description

Optimization is one of the most important categories of mathematical problems that applied mathematicians, scientists and engineering frequently encounter in their work. The development of a large body of mathematical theories was motivated by the optimization problems. While the mathematical theories help to establish the existence of a solution to an optimization problem and, in some cases provide characterization of the solution, the computational techniques are developed to actually find the optimal solution for an application. In this course, we present an introduction to the basic theories of optimization starting from the characterization of optimal solutions for unconstrained and constrained optimization problems using tools of multiple variable calculus and linear algebra. We also provide an introduction to the most frequently used numerical techniques for local and global optimization problems. The following is a tentative list of topics that will be covered in the class:

- Unconstrained optimization and quasi-Newton method
- Least square problems
- Introduction to linear programming and simplex method
- Constrained optimization and convex optimization

Several computation projects which require students to use Matlab to implement specific numerical optimization techniques and to solve interesting application problems will be assigned during the semester. These projects allow students to gain hands-on experience in solving practical optimization problems.

Textbook and Reference

E. K.P. Chong and S.H. Zak, *An Introduction to Optimization*, 4th Ed., Wiley Inter-Science, 2013
S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004

Grading Policy

Homework: 15%, Project: 10%, Quiz: 20%, Midterm Exam: 25%, Final Exam: 30%.
Final Exam: Wednesday, December 12, 11 a.m.-1 p.m.

Monday, August 20 Introduction and Review	*Wednesday, August 22* Introduction and Review	*Friday, August 24* Set constrained and unconstrained optimization
Monday, August 27 Set constrained and unconstrained optimization	*Wednesday,* August *29* One-dimensional search	*Friday, August 31* One-dimensional search
Monday, September 3 Labor Day	*Wednesday, September 5* Gradient method	*Friday, September 7* Gradient method
Monday, September 10 Newton's method	*Wednesday, September 12* Newton's methods	*Friday, September 14* Newton's methods
Monday, September 17 Conjugate gradient method	*Wednesday, September 19* Conjugate gradient method	*Friday, September 21* Conjugate gradient method
Monday, September 24 Conjugate gradient method	*Wednesday, September 26* Quasi-Newton Method	*Friday, September 28* Quasi-Newton Method
Monday, October 1 Linear programming	*Wednesday, October 3* Linear programming	*Friday, October 5* Linear programming
Monday, October 8 Linear programming	*Wednesday, October 10* Linear programming	*Friday, October 12* Midterm Exam
Monday, October 15 Linear programming	*Wednesday, October 17* Simplex Method	*Friday, October 19* Simplex Method
Monday, October 22 Simplex Method	*Wednesday, October 24* Simplex Method	*Friday, October 26* Simplex Method
Monday, October 29 Duality	*Wednesday, October 31* Duality	*Friday, November 2* Duality
Monday, November 5 Constrained optimization	*Wednesday, November 7* Constrained optimization	*Friday, November 9* Constrained optimization
Monday, November 12 Constrained optimization	*Wednesday, November 14* Constrained optimization	*Friday, November 16* Constrained optimization
Monday, November 19 Constrained optimization	*Wednesday, November 21* Thanksgiving	*Friday, November 23* Thanksgiving
Monday, November 26 Convex optimization	*Wednesday, November 28* Convex optimization	*Friday, November 30* Convex optimization

This is a tentative schedule. The contents of lectures may change significantly.