Fall 2015

MATH 6270

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University of New Orleans

ENEE 6570 – Engineering Optimization Techniques
Cross Listed MATH 6270 – Advanced Optimization

Fall 2015

Goals: This course provides the mathematical formulations and computational methods for solving various unconstrained and constrained optimization problems. It finds engineering applications in various areas such as signal and data processing, machine learning, statistical inference. Students are expected to understand basic optimization theory and apply appropriate computational tools in their chosen engineering fields.

Textbook: E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 4th Edition, Wiley, 2013, ISBN 978-1-118-27901-4.

Class Schedule: 2:00pm−3:15pm, Thursday at EN-309
Instructor: Dr. Huimin Chen, Associate Professor (hchen2@uno.edu)
Office: EN-819
Phone: 280-1280
Office Hours: 3:30pm−5:30pm, Tuesday and Thursday or by appointment

Prerequisites: No graduate level course is necessary as the prerequisite. However, adequate knowledge of advanced calculus and linear algebra will be useful.

Topics:
(1) Formulation of engineering optimization problems.
(2) Unconstrained optimization.
(3) Linear programming.
(4) Nonlinear constrained optimization.
(5) Convex optimization, geometric and semidefinite programming.
(6) Global optimization, combinatorial optimization, multi-objective optimization.

Tentative Schedule:

Week 1: Mathematical review, formulation of optimization problems
Week 2: Unconstrained optimization: line search, gradient methods
Week 3: Unconstrained optimization: Newton and conjugate gradient type of methods, convergence analysis
Week 4: Unconstrained optimization: Global research methods
Week 5: Linear programming: Simplex method
Week 6: Linear programming: Interior point methods
Week 7: Constrained optimization: KKT condition, projected gradient methods **Term project assignment**
Week 8: Constrained optimization: Primal and dual problems
Week 9: Convex optimization: general concept, optimality, geometric and semidefinite programming
Week 10: Combinatorial optimization: general concept, relaxation
Week 11: Multi-objective optimization: Pareto solutions

Week 12: Computational aspects: Optimality vs. efficiency
Week 13: Engineering applications: optimization in decision & estimation
Week 14: Engineering applications: optimization in machine learning
Week 15: **Term project due and oral presentation**
Week 16: **Final Exam** (December 10, Thursday, 3:00-5:00pm)

Computer Usages: Matlab optimization toolbox will be used for homework assignment and quite likely for the term project. Additional Matlab functions for optimization problems will be provided on course blackboard (Moodle).

Additional References:

1. S. Boyd et al, Convex Optimization, Cambridge Press, 2004.
2. P. Venkataraman, Applied Optimization with Matlab Programming, Wiley, 2009.
3. S. S. Rao, Engineering Optimization: Theory and Practice, 4th Edition, Wiley, 2009.

Term Project: One term project with written report and oral presentation is required.

Requirements:

(1) Attend the class on time (If you come more than five minutes late, you are not allowed to enter the classroom. Get the lecture notes from your classmates after class).
(2) Keep quiet during the class. Raise your hand before asking questions. Turn off your cell phone or pager during the class.
(3) Homework is due on next week's class. Late homework will not be graded.
(4) All homework assignments and exams should be worked out independently. Straight copy from others is strictly prohibited.
(5) Students are encouraged to discuss course materials with each other *after class*, regularly check the course blackboard for new announcements, lecture notes, assignment solutions, etc.
(6) Students must have Internet access to www.uno.edu and the course Blackboard. All communications, including the posting of grades will be done through Moodle (http://uno.mrooms3.net/login/index.php). Students are responsible for all e-mail communications from the instructor to their UNO email drop box.

Accommodations for Students with Disabilities

Students who qualify for services will receive the academic modifications for which they are legally entitled. It is the responsibility of the student to register with the Office of Disability Services (MH159) each semester and follow their procedures for obtaining assistance.

Grading Policy:

(1) Homework assignments (20%)
(2) Computer assignments (30%)
(3) Term project (20%)
(4) Final exam (30%)
Final exam is open book & open notes.