AMSC 607/ CMSC 764 TTh 11-12:15, CSI 3120

Advanced Numerical Optimization, Fall, 2008

http://www.cs.umd.edu/∼oleary/a607

Prof. Dianne P. O'Leary: Room 3271 A.V. Williams Building, (301) 405-2678, `oleary@cs.umd.edu` http://www.cs.umd.edu/∼oleary/

Office Hours: Tuesday 1:00-2:15, Thursday 8:00-9:15, Friday 9-10, and by appointment, in AVW 3271.
Please restrict telephone inquiries to office hour times, except in "emergencies." E-mail is welcome anytime!

Prerequisites: A course in linear algebra and a course in numerical analysis. (A previous course in optimization is NOT expected.)

Texts (available on-line):

- *Linear and Nonlinear Programming* by Stephen G. Nash and Ariela Sofer, McGraw-Hill.
- *Lecture Notes on Interior Point Polynomial Time Methods in Convex Programming* by Arkadi Nemirovski, Spring 2004.

Grading: Grading will be on a *curve*, except that you will be guaranteed an A if your average is 90% or better, a B if your average is 80% or better, etc. Keep all of your work in case there is any question about recording of grades.

Homework	approx. 200 points
Project	100 points
Final Exam	None

Homework: 1-2 weeks will be allowed for each assignment. Some homework will include programming assignments using the software package MATLAB. To pass this course, you must make an honest effort at each homework. Partial credit will be given for partially-working programs. There will be a 15% penalty for assignments turned in up to 2 days late, 30% penalty for assignments turned in 2-4 days late, etc.

The project will involve an investigation of one aspect of constrained optimization. More information will be given in mid-October. It is due at 10am on Monday, December 15.

Regrades: If you think a mistake has been made in grading your work, submit it for regrading within two weeks of the date on which the work was returned to the class. After that, the grade will be considered final.

News: Assignments, course notes, answers to homeworks, and announcements will be posted on the course's homepage. You are responsible for checking this site before each class.

Academic Integrity: Class accounts are to be used only for class assignments. All files within the accounts are subject to inspection, and the campus code of computer conduct must be followed. All work that you submit in this course must be your own; group efforts will be be considered academic dishonesty. See http://www.studenthonorcouncil.umd.edu/code.html for definitions and sanctions. You may discuss homework and the project in a general way, but you may not consult any one else's written work, program drafts, computer files, etc. Any marked similarity in form or notation between submissions with different authors will be regarded as evidence of academic dishonesty – so protect your work. You are free to use reference material to help you with assignments, but you must cite any reference you use. Such citation will not lower your grade, although extensive quotation might.

COURSE OUTLINE

Objective: Understand and use state-of-the-art algorithms for optimization. (Note that this is a moving target.)

Prerequisites: A course in linear algebra and a course in numerical analysis. A previous course in optimization is not assumed.

1. **Introduction** (Nash & Sofer Chapters 1-3) (approx. 2 weeks)

   sources of optimization problems
   feasibility, optimality, convexity
   representation of linear constraints

2. **Unconstrained Optimization** (Nash & Sofer Chapters 10-12) (approx. 4 weeks)

   A survey of the characterization of solutions to minimization problems, algorithms for problems of various smoothness, and global optimization.

   optimality conditions, descent methods
   Newton's method and steepest descent
   automating differentiation
   variations on Newton's method

3. **Constrained Optimization** (Nash& Sofer Chapters 14-17, Nemirovski notes) (approx. 8 weeks)

   A survey of feasible set methods, projection methods, and interior point methods for linear and nonlinear constraints.

   optimality conditions
   duality
   feasible point methods
   penalty and barrier methods
   interior point methods