Optimization: Theory and Algorithms – ISE 520

Syllabus

Instructor: Richard Waltz <rwaltz@usc.edu>
Class: Tuesday and Thursday 11:00-12:20 (room to be announced)
Office Hours: Tuesday and Thursday 1:30-3:00 (room to be announced)

Required Text: *Numerical Optimization* 2nd Edition
by Jorge Nocedal and Stephen J. Wright
Prerequisite: Calculus, Linear Algebra and some Computer Programming.
No prior knowledge of optimization is assumed.

Course Objective:
The objective of this course is to provide students with an introductory training in the theory and algorithms for continuous optimization (i.e., mathematical programming). This course will focus on both unconstrained and constrained *nonlinear* optimization and emphasis will be placed on learning practical solution techniques. As part of the course students will be required to implement optimization algorithms in computer programs. The course will also provide students with experience using practical software tools for solving optimization problems.

Assignments:
Written problems and computer assignments will be handed out regularly. Computer assignments are intended to teach optimization methods, not computer programming techniques. It is highly recommended that computer assignments be done in Matlab – however, other programming languages (e.g. C/C++) may also be acceptable with permission from the instructor.

Homework will be assigned roughly every other week. Assignments must be turned in by the beginning of class on the day it is due. Late **homework will not be accepted,** except under special circumstances.

Grading:
In addition to regular assignments, there will be a final exam. The final grade is determined as follows:

1. Homework 60%
2. Midterm Exam 20%
3. Final Exam 20%

Statement for Students with Disabilities
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the

letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Class Schedule (Tentative)
The course covers 15 weeks of classes plus a final exam. Below is the *tentative* schedule of topics that will be covered, along with readings and assignment due dates. It is possible that deviations to this tentative schedule may be made as the class progresses depending on how quickly material is covered.

Date	Topic Covered	Reading	Assignments Due
Week 1 Aug 28, 30	Introduction/ Background	Chapter 1	
Week 2 Sep, 4, 6	Fundamentals of Unconstrained Optimization	Chapter 2	
Week 3 Sep 11, 13	Line Search Methods	Chapter 3 (3.1, 3.2, 3.3, 3.5)	Assignment 1 due, Thurs, Sep 13.
Week 4 Sep 18, 20	Line Search Methods (continued)	Chapter 3 (3.4, 3.5)	
Week 5 Sep 25, 27	Trust-Region Methods	Chapter 4	Assignment 2 due, Thurs, Sep 27.
Week 6 Oct 2, 4	Conjugate Gradient Methods	Chapter 5	
Week 7 Oct 9, 11	Quasi-Newton Methods	Chapter 6	Assignment 3 due, Thurs, Oct 11.
Week 8 Oct 16, 18	Large-Scale Unconstrained Optimization	Chapter 7	

Week 9 Oct 23, 25	Theory and Fundamentals of Constrained Optimization	Chapter 12 Chapter 15 (15.1, 15.2, 15.4)	Midterm Exam, Tues, Oct 23.
Week 10 Oct 30, Nov 1	Quadratic Programming	Chapter 16 (16.1, 16.2, 16.3)	
Week 11 Nov. 8 **(*Class canceled Nov. 6 - Informs*)**	Quadratic Programming (continued)	Chapter 16 (16.4, 16.5, 16.6)	
Week 12 Nov 13, 15	Sequential Quadratic Programming	Chapter 18 (18.1, 18.2, 18.4)	Assignment 4 due Thurs, Nov 15.
Week 13 Nov 20 **(*Thanksgiving, Nov 22 – no class*)**	Interior-Point Methods	Chapter 19 (19.1, 19.2)	
Week 14 Nov 27, 29	Interior-Point Methods (continued)	Chapter 19 (19.3, 19.7)	Assignment 5 due Thurs, Nov 29.
Week 15 Dec 4, 6	Review	No reading	
Exam Week			Final Exam, Tues, Dec 18 8-10am