ISyE 6663

Nonlinear Optimization

Spring 2011

Administrative Info

Instructor: Anton J. Kleywegt
Office: Groseclose 409
Office hours: Tuesday, Thursday 1:30pm–3:00pm
e-mail: Anton.Kleywegt@isye.gatech.edu
WWW URL: http://www.isye.gatech.edu/faculty/Anton_Kleywegt
Phone: (404) 894-4323
Fax: (404) 894-0390

Class Room: IC 217
Class Times: Tuesday, Thursday 12:05pm–1:25pm

Description:
The course covers the fundamentals of nonlinear continuous optimization, also called nonlinear programming. The first part of the course is devoted to unconstrained optimization, and the second part of the course covers topics in constrained optimization.

Objectives of the course are

- to develop an understanding of the fundamentals of nonlinear optimization;
- to become familiar with some of the more widely used algorithms for nonlinear optimization;
- to learn how to analyze optimization algorithms;
- to become familiar with some of the implementation issues that are important for optimization algorithms.

Prerequisites:
ISyE6661. Knowledge of linear algebra and real analysis at the level of Math4317 Analysis I or ISyE8803 Mathematics of Operations Research will be important. Appendix A of the text gives a brief overview of some prerequisite knowledge. The ability to write computer programs of algorithms.

Textbook:
Nocedal, J. and Wright, S.J., *Numerical Optimization*, Springer, New York, NY, 1999.

References:

Bazaraa, M.S., Sherali, H.D., and Shetty, C.M., *Nonlinear Programming: Theory and Algorithms*, John Wiley & Sons, Inc., New York, NY, 1993.

Bertsekas, D. P., *Constrained Optimization and Lagrange Multiplier Methods*, Athena Scientific, Belmont, MA, 1996.

Bertsekas, D.P., *Nonlinear Programming*, Athena Scientific, Belmont, MA, 1999.

Ben-Tal, A. and Nemirovski, A., *Optimization III: Convex Analysis, Nonlinear Programming Theory, Standard Nonlinear Programming Algorithms*,
<http://www2.isye.gatech.edu/∼nemirovs/>.

Topics Covered:

- Unconstrained Optimization
  - Fundamentals
  - Line Search Methods
  - Trust Region Methods
  - Conjugate Gradient Methods
  - Newton Methods
  - Quasi-Newton Methods
- Constrained Optimization
  - Fundamentals
  - Quadratic Programming
  - Penalty, Barrier, and Augmented Lagrangian Methods

Grading:
Grades will be assigned as follows:

- Homework: 20%
- Midterm exam 1: 20%
- Midterm exam 2: 20%
- Final exam: 40%

Homework:
Homework will be assigned approximately once every two weeks. You should start working on each homework early, that way you will have time to ask questions in class before the homework is due. Late homework will be accepted only in case of unavoidable occurrences, such as illness or death in the family. You are encouraged to discuss homework and learn from each other, but each person must submit his/her own work, unless the homework specifically indicates that you should work in groups. Any queries on homework grades must be submitted in writing to the instructor, together with the homework in question.

Exams:
Exams will cover material discussed in class, as well as reading assignments and homeworks. The exams will be comprehensive. Midterm exam 1 is scheduled for Tuesday March 1, 2011, in class. Midterm exam 2 is scheduled for Tuesday April 5, 2011, in class. The exams will be closed book. Any queries on exam grades must be submitted in writing to the instructor, together with the exam in question. Make-up exams will be scheduled only in case of unavoidable emergencies, the instructor must be notified of the emergency as soon as possible, and the exam must be scheduled with the instructor as soon as possible after the emergency. If you cannot take an exam at the designated time or in the designated way, you should make alternative arrangements with the instructor as soon as possible.

Academic Honor Code:
It is your responsibility to familiarize yourself with the Georgia Tech Honor Code. Specifically, you must do your own work in all homeworks and exams; when homework is specifically assigned as group homework you may and should work with the other members of your group.