MATP6600/ISYE6780 • Introduction to Optimization • Fall 2017

Time: 10:00-11:50am MR Location: LOW3112

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Course page: https://xu-yangyang.github.io/MATP6600.html

Course Objective

This course is to introduce you optimization theory, methods, and applications. An emphasis will be placed on understanding theory and algorithms of nonlinear programming. After taking the course, you are expected to apply knowledge of nonlinear optimization to formulate and solve engineering problems.

Prerequisites

You should be familiar with calculus and linear algebra and have basic knowledge on probability and real analysis.

Textbooks

- *Nonlinear Programming: theory and algorithms, 3rd edition* by Mokhtar S. Bazaraa, Hanif D. Sherali, and C. M. Shetty, 2006. (**required**)
- *Nonlinear Programming* by Dimitri Bertsekas (**recommended**)
- *Convex Analysis* by Rockafellar (**recommended**)
- *Convex Optimization* by Stephen Boyd and Lieven Vandenberghe (**recommended**)
- *Numerical Optimization* by Jorge Nocedal and Stephen Wright (**recommended**)

Topics to cover

1. Convex sets: definitions, Weierstrass' Theorem, Separation Theorem
2. Convex functions: definitions, subgradients, optimality conditions
3. Linear, convex qudratic, and conic optimization

4. Optimality conditions for constrained optimization: Fritz John and Karush-Kuhn-Tucker (KKT) conditions, constraint qualifications
5. Lagrangian duality and saddle point optimality conditions
6. Optimization algorithms: gradient descent, Newton's method, interior-point method, and recent first-order and operator splitting methods
7. Integer programming: examples, convex relaxations
8. Stochastic programming: modeling, examples, stochastic approximation methods

Homework and exams

- **Homework:** 6 in total, approximately once every two weeks. The homework will be posted on the course page https://xu-yangyang.github.io/MATP6600.html
- **Exam:** one mid-term exam and one final exam
- **Grades:** homework 40%, mid-term exam 30%, and final exam 30%. **No late homework will be accepted; no make-up exams**

Academic Integrity

Intellectual integrity and credibility are the foundation of all academic work. A violation of Academic Integrity policy is, by definition, considered a flagrant offense to the educational process. It is taken seriously by students, faculty, and Rensselaer and will be addressed in an effective manner.

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