

# ISyE 8872

## Topics in Nonlinear Optimization

Fall 2001

### Administrative Info

**Instructor:** Anton J. Kleywegt  
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**Class Room:** IC 207

**Class Times:** Tuesday, Thursday 12:00–1:30

### Description:

The course covers the fundamentals of convex optimization, which includes much of linear and nonlinear programming. The first part of the course is devoted to convex analysis, and the second part of the course covers topics in duality and dual methods for optimization.

**Objectives** of the course are

- to develop an understanding of the fundamentals of convex optimization;
- to develop a familiarity with the tools of convex analysis;
- to develop an understanding of duality results for convex optimization;
- to develop skills with dual methods for optimization.

### Prerequisites:

A basic knowledge of linear algebra and real analysis will be important. Appendix A of the text gives a brief overview of prerequisite knowledge.

**Textbook:**

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

This is the same text that is used in ISyE6663, Optimization III (Nonlinear Programming).

**References:**

Aubin, J.-P., *Optima and Equilibria: An Introduction to Nonlinear Analysis*, Springer-Verlag, Berlin, 1993.

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

Bonnans, J. F. and Shapiro, A., *Perturbation Analysis of Optimization Problems*, Springer-Verlag, Berlin, 2000.

Hiriart-Urruty, J.-B. and Lemaréchal, C., *Convex Analysis and Minimization Algorithms*, Springer-Verlag, Berlin, 1993.

Rockafellar, R.T., *Convex Analysis*, Princeton University Press, Princeton, NJ, 1970.

**Topics Covered:**

- Convex Analysis
- Duality
  - Lagrangian Duality
  - Conjugate Duality
- Dual Methods for Optimization
  - Subgradient Methods
  - Cutting Plane Methods
  - Ascent Methods

**Grading:**

Grades will be based on assignments. Assignments are to be treated as take-home exams, and thus you should do your own work and list all references used.