47-834 LINEAR PROGRAMMING

Fall 2016 - Mini 1
Syllabus

Instructor:
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Office Hours: Wednesdays 3:30pm-5pm, or by appointment (email)

Date & Time: Monday and Wednesday 1:30pm - 3:20pm

Location: Posner Hall 147

Course Webpage: On Blackboard: http://www.cmu.edu/blackboard/

Course Description

Linear programming, optimizing a linear function over a polyhedron, lies at the basis of modern optimization theory.

This course focuses primarily on linear optimization (LO) theory and algorithms, leaving beyond the scope of practical LO applications, which are by far too numerous and diverse. A brief outline of the course content is as follows:

1. *LO Modeling*, including instructive examples of LO models and "calculus" of LO models – collection of tools allowing to recognize the possibility to pose an optimization problem as an LO program;
2. *LO Theory* – geometry of LO programs, existence and characterization of optimal solutions, theory of systems of linear inequalities and duality;
3. *LO Algorithms* – classical linear optimization algorithms (simplex), and decomposition approaches for large-scale optimization;
4. *Introduction to Advanced LO Algorithms*[*] – complexity issues and an introduction to conic programming and some interior point methods.

Prerequisites

This course requires certain degree of mathematical maturity. In particular, a good command of linear algebra, as well as knowledge of multivariable calculus (limits, open and closed sets, continuity) will be necessary. If you are interested in the course but feel uneasy about your background, please arrange a meeting with me.

Textbooks

- A. Nemirovski, *Lecture Notes Optimization I: Introduction to Linear Optimization*, 2015. Lecture notes available at http://www2.isye.gatech.edu/~nemirovs/OPTI_LectureNotes2015.pdf
- D. Bertsimas and J.N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, 1997.

[*] This topic will be covered as much as possible depending on time permitting.

Other References

- R.J. Vanderbei, *Linear Programming: Foundations and Extensions*, Springer, 2010.
- A. Schrijver, *Theory of Linear and Integer Programming*, Wiley, 1998.
- V. Chvátal, *Linear Programming*, W.H. Freeman & Co., 1983.
- G.B. Dantzig, *Linear Programming and Extensions*, Princeton University Press, 1998.

Grading Policy

Grading will be based on the following:

- an in-class final exam (50%),
- 5-6 equally weighted problem sets (45%), and
- participation in one of the homework grading sessions (5%).

There will be approximately one homework every week. You will have at least a week's worth of time to work on the homework, and the homeworks will be due at the beginning of the class (usually Wednesdays) unless otherwise stated. You are encouraged to attack each problem by yourself first. *If you like you can discuss with only students taking this class (i.e., you are not allowed to discuss with anyone who has taken it in previous years, or reference to past homework solutions, etc.)*. Moreover, everybody is required to write their own solution and make sure that they understand every part of their answer.