Course Announcement : OR 635, Interior-point Methods for Mathematical Programming

ORIE 635:	Interior-Point Methods for Mathematical Programming
Instructor:	Mike Todd, 229 Rhodes Hall, 5-9135, miketodd@cs.cornell.edu
Place:	Hollister 368
Time:	MW 11:10-12:25
First meeting:	September 1

This course will provide a rather deep introduction to interior-point methods (ipm's) for linear, quadratic, second-order cone, and semidefinite programming and, more generally, for convex programming. We will discuss the basic ingredients – barrier functions, central paths, and potential functions – that go into the construction of polynomial-time algorithms. We will then describe some particular recipes using these ingredients.

The background and interests of the students will to some extent influence the balance of theory, computation, and applications, and of concrete versus abstract settings. Our emphasis will be on contemporary viewpoints rather than on historical developments. We will rely on class notes and journal articles.

Prerequisites: The following would be very useful, but the only mandatory prerequisite is motivation: ORIE 630 (graduate level linear programming) or equivalent, some background in nonlinear programming, at least as far as the Karush-Kuhn-Tucker optimality conditions, and linear algebra and real analysis.

There will be periodic homeworks and a take-home final.

As mentioned, there is no text. Some reasonably accessible references are the following:

D. Goldfarb and M. Todd, Linear Programming, in: Optimization (G. Nemhauser, A. Rinnooy Kan and M. Todd, eds.), North-Holland, Amsterdam, 1989, 73-170 (out-of-date but elementary).

M. Todd, Recent Developments and New Directions in Linear Programming, in: Mathematical Programming: Recent Developments and Applications (M. Iri and K. Tanabe, eds.) Kluwer Academic Publishers, Holland, 1989, 109-157 (a little less of each).

C.C. Gonzaga, Path following methods for linear programming, SIAM Review, 34, 167–227, 1992.

M. Todd, Potential-reduction methods in mathematical programming, Mathematical Programming, 76, 3–45, 1996.

S. Wright, Primal-Dual Interior-Point Methods, SIAM Publications, SIAM, Philadelphia, 1997.

Y.Ye, Interior Point Algorithms: Theory and Analysis, John Wiley, New York, 1997.

A. Ben-Tal and A. S. Nemirovskii, Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications, SIAM Publications, SIAM, Philadelphia, 2001.

J. Renegar, A Mathematical View of Interior-Point Methods in Convex Optimization, SIAM Publications, SIAM, Philadelphia, 2001.

The following is rather less accessible, but is perhaps the bible in the field:

Yu.E. Nesterov and A.S. Nemirovskii, Interior Point Polynomial Methods in Convex Programming: Theory and Algorithms, SIAM Publications. SIAM, Philadelphia, USA, 1994.