

CDS 270 (Fall 09) - Lecture 3 (Oct 9, 09)

The following is a list of concepts/topics/examples covered in this lecture. A good reference for these subjects is the book “Convex Optimization” by Stephen Boyd and Lieven Vandenberghe (Cambridge University Press), also available at

<http://www.stanford.edu/~boyd/cvxbook/>.

Most of the material in this note is from sections 4.1, 4.2.1-4.2.2, 4.2.4, 4.3, 4.4, 4.6.2, 4.6.3 (first page), 5.1.1-5.1.3, and 5.2.1-5.2.4 of this book.

- Optimization problem, feasible set, optimal value.
- Equivalent optimization problems
 - transformations on the objective function and constraint functions
 - Introducing equality constraints
 - epigraph form (extension of this can be thought as introducing slack variables)

Transforming problems into a “more useful” and equivalent form may be important to realize certain nice properties of the problem. Moreover, solvers (such as SeDuMi) can only solve certain types of optimization problems and transforming a problem into an equivalent form that can be handled by SeDuMi is important in practice. You have a problem in Assignment 3 on this (QCQP \rightarrow SDP). For more details read sections 4.1.3 and 4.2.4).

- Convex optimization problems
 - Linear program (LP)
 - Quadratic program (QP)
 - Quadratically constrained quadratic program (QCQP)
 - Semidefinite program (SDP)
- Duality: Lagrangian; Lagrange dual function; Lower bound on primal optimal value; Lagrange dual problem; Weak duality; Strong duality.