ECE M146 Discussion 5
Introduction to Machine Learning
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1. Introduction to optimization problem

   (a) Convex sets.

   (b) Convex functions.

   (c) Optimization problem in standard form.

      - Convex optimization.

   (d) Globally and locally optimal.

   (e) Duality.

      - Lagrange dual problem.
      - Geometric interpretation.
      - KKT conditions.

   Notes: One can read the book Convex Optimization by Boyd and Vandenberghe (freely available on-line) for more extensive coverage of the above topics.

2. Find the dual problem of the following Quadratic program

$$\begin{array}{ll} \text{minimize}_x & x^T P x \\ \text{subject to} & Ax \leq b \end{array}$$

Assume $P \in \mathcal{S}^n_{++}$.

3. Quadratic program example Consider the objective function

$$J(x_1, x_2) = 5x_1^2 + 4x_1x_2 + 2x_2^2 + 2x_1 - 4x_2.$$

Find the optimal x that minimize $J(x)$ under the following constrains:

(a) No constrain.

(b) $x_1 + x_2 + 2 = 0$.

(c) $x_1 + x_2 + 2 \leq 0$.

(d) $x_1 + x_2 + 2 \geq 0$.