

Homework 8: Lagrange duality

Due date: 11:59pm on Wednesday 3/31/21

See the course website for instructions and submission details.

1. Consider the problem

$$\min_{x_1, x_2} \frac{1}{2}(x_1^2 + x_2^2) \quad \text{subject to } 1 - x_1 \leq 0.$$

- (a) Write down the solution of this problem and the optimal primal value p^* .
- (b) Derive the Lagrangian dual function $g(\lambda)$ for $\lambda \in \mathbb{R}$.
- (c) Find the solution of the Lagrangian dual problem $\max_{\lambda \geq 0} g(\lambda)$ and write down the optimal dual objective d^* .
- (d) Is the Slater condition satisfied for this problem? Does strong duality hold, that is, $p^* = d^*$?

2. Consider the problem

$$\min x_1 x_2 \quad \text{subject to } x_1^2 + x_2^2 - 1 \leq 0.$$

Repeat parts (a)-(d) of Question 1 for this problem.