Project 1

Problem 1

We want to solve the following quadratic programming problem in R or Python:

$$\begin{aligned} \underset{x_1,x_2,x_3}{\text{Maximize}} \quad & 20x_1 + 16x_2 - 2x_1^2 - x_2^2 - x_3^2, \\ \text{subject to} \quad & x_1 + x_2 \leq 5 \\ & x_1 + x_2 - x_3 = 0, \\ & x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0. \end{aligned} \tag{1}$$

1. Restate the objective function and the constraints in matrix form
2. Write a code in R, python, C++, or SAS to solve this quadratic problem

Problem 2

Consider the problem

$$\begin{aligned} \underset{x_1,x_2}{\text{Minimize}} \quad & x_1^2 + 2x_2^2 + 2x_1 + 8x_2, \\ \text{subject to} \quad & -x_1 - 2x_2 + 10 \leq 0 \\ & x_1 \geq 0, \quad x_2 \geq 0. \end{aligned} \tag{2}$$

1. Form the Lagrangian.
2. Find the dual problem.
3. Give the KKT conditions
4. Does strong duality hold for this problem? One can check Slater's condition.

5. Write a code to solve the dual problem.

6. Solve the primal problem (**??**)