



Problem 1 (25 %)

Go through Example 12.3 in detail in Nocedal & Wright. Replace the objective function with $x_1 + 2x_2$.

- a Find the optimal point.
- b Check the KKT conditions at the optimal point.
- c Illustrate the gradients of the active constraints and the objective function at the solution.
- d Explain why the Lagrange multipliers are positive.
- e Is this problem a convex problem? Substantiate your answer.

Problem 2 (30 %)

Go through Example 12.1 in detail in Nocedal & Wright. Replace the objective function with $2x_1 + x_2$.

- a Find all extreme points.
- b Check the KKT conditions at these points. Are the KKT conditions satisfied at these points? Explain why.
- c Illustrate the gradients of the active constraint and the objective function at the optimal point(s).
- d What is the value of the Lagrange multiplier? Is this consistent with the KKT conditions?
- e Check the 2nd order conditions for the extreme points. How does this relate to the theory in Chapter 12.5?
- f Is this problem a convex problem? Substantiate your answer.

Problem 3 (20 %)

Solve Problem 12.19 a), b), c) and d) in Nocedal & Wright.

Problem 4 (25 %)

Solve Problem 12.21 in Nocedal & Wright. Illustrate the gradients of the active constraint and the objective function at the optimal points.