TTK4135 Optimization and Control
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Exercise 1
The KKT Conditions

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 all 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), 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.