Homework Assignment 7

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Problem 1. State all of the KKT conditions for (N-max). More precisely state all of the following results for (N-max): KKT-FONC, KKT-FOSC, KKT-SONC, KKT-SOSC.

Solution. □

Problem 2. Find local minimizers for

$$\begin{array}{rll} (N\text{-}\min) & \text{minimize} & x_1^2 + 6x_1x_2 - 4x_1 - 2x_2 \\ & \text{subject to} & x_1^2 + 2x_2 \leq 1 \\ & & 2x_1 - 2x_2 \leq 1. \end{array}$$

Solution. □

Problem 3. Consider the problem of optimizing

$$\begin{array}{lll} (N) \quad \text{minimize (maximize)} & (x_1-2)^2+(x_2-1)^2 & \\ & x_2-x_1^2 & \geq 0 \\ \text{subject to} & 2-x_1-x_2 & \geq 0 \\ & x_1 & \geq 0. \end{array}$$

Let $x^* = [0, 0]$.

a. Does x^* satisfy the KKT-FONC for minimization or maximization? What are the KKT multipliers?

b. Does x^* satisfy the KKT-SOSC? Justify your answer.

Solution. □

Problem 4. Consider the problem with equality constraint

$$\begin{aligned} \text{minimize} \quad & f(\boldsymbol{x}) \\ \text{subject to} \quad & \boldsymbol{h}(\boldsymbol{x}) = \mathbf{0}. \end{aligned}$$

We can convert the above into the equivalent optimization problem

$$\begin{aligned} \text{minimize} \quad & f(\boldsymbol{x}) \\ \text{subject to} \quad & \tfrac{1}{2} \left\| \boldsymbol{h}(\boldsymbol{x}) \right\|^2 \leq 0. \end{aligned}$$

Write down the KKT condition for the equivalent problem and explain why the KKT theorem cannot be applied in this case.

Solution. □