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Kursnamn: Datateknik AV, Tillämpad optimering
Provnamn: Skriftlig tentamen
Ort: Sundsvall
Termin: 
Åmne: 
Exam in Applied Optimization DT059A, 6hp,

Date: 2019-01-14


1. For the optimization problem

\[ \min \, z = x_1^2 + 2x_2^2 + 4 \]

\[ s.t \]

\[ x_1 + 2x_2 = 6 \]

a) Show mathematically that this optimization problem is convex (2p)
b) Make the optimization problem unconstrained (2p)
c) Solve the problem analytically (3p)
d) Solve the problem using the Newton method (3p)

2. For the primal LP problem below

\[ \max \, z = 2x_1 + 5x_2 \]

\[ s.t \]

\[ 2x_1 + x_2 \leq 5 \]

\[ x_1 + 2x_2 \leq 4 \]

\[ x_1, x_2 \geq 0 \]

a. Formulate the problem in a simplex table introducing slack variables (2p)
b. Calculate the optimal solution with the simplex method (4p)
c. Formulate the dual problem (2p)
d. Formulate the problem as an unconstrained optimization problem using a log barrier function approximation [no solution is needed only the formulation] 2p

3. Explain the concepts below

a. Affine and Convex sets (2p)
b. Convex, Concave and Quasi-convex functions (3p)
c. The general KKT conditions (2p)
d. Show that an affine set is always convex (3p)

4. For the optimization problem

\[ \min \, z = x_1 - 2x_2 \]

\[ s.t \]

\[ 1 + x_1 - x_2^2 \geq 0 \]

\[ x_2 \geq 0 \]

a. Formulate the problem as an unconstrained optimization problem using a log barrier function approximation (3p)
b. Calculate the optimal solution analytically (4p)
c. Motivate if this problem is convex or not (3p)