Mittuniversitetet
MID SWEDEN UNIVERSITY

Försättsblad Prov Original

Kurskod	Provkod	Tentamensdatum
DT059A	T101	2019-01-14

Kursnamn	Datateknik AV, Tillämpad optimering
Provnamn	Skriftlig tentamen
Ort	Sundsvall
Termin	
Ämne	

Exam in Applied Optimization DT059A, 6hp,

Date: 2019-01-14

Only pen, paper and pocket calculator is allowed, Max: 40p, A 36p B 32 p C 28p D 24p E 20p, Fx 16p. Author: Leif Olsson 072-5818886.

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

$$\max z = 2x_1 + 5x_2$$
$$s.t$$
$$2x_1 + x_2 \le 5$$
$$x_1 + 2x_2 \le 4$$
$$x_1, x_2 \ge 0$$

   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

$$\min z = x_1 - 2x_2$$
$$s.t$$
$$1 + x_1 - x_2^2 \ge 0$$
$$x_2 \ge 0$$

   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)