Norwegian University of Science and Technology
Department of Mathematical Sciences

TMA4180 Optimization Theory
Spring 2013

Exercise set 7

Tutorial: Thursday 07.03 16:15-17:00 in Kjl 4.

1 Problem 12.17 in N&W p. 353.

2 (Midterm Exam 2010)
Consider the following constrained optimization problem for $(x_1, x_2) \in \mathbb{R}^2$:

$$\min_{x\in\Omega} \{-4x_1 - x_2\}, \tag{1}$$

where Ω is defined in terms of the constraints

$$0 \le x_1 \le 2, \tag{2}$$
$$0 \le x_2, \tag{3}$$
$$x_2 \le 3 - x_1. \tag{4}$$

a) Reformulate the constraints into four constraints of the form

$$c_i(x) \ge 0, \ i = 1, \cdots, 4, \tag{5}$$

and write down all KKT-equations and inequalities.

b) Solve the problem graphically by making a sketch of Ω.

c) Identify the active and inactive constraints and the corresponding Lagrange multipliers at the solution.

3 Problem 12.21 in N&W, p. 354.

4 Consider the problem

$$\min(x_2 + x_3),$$
$$x \in \Omega = \left\{x \ ; \ x_1 + x_2 + x_3 = 1, \ x_1^2 + x_2^2 + x_3^2 \ge 1\right\}.$$

Note that the feasible domain is unbounded.

a) Show that the only KKT-point for the problem is $(-1, 2, 2)^{\mathrm{T}}/3$.

b) Use the second order conditions to investigate whether this KKT-point really is a local minimum.