King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
MATH-480 Linear and Nonlinear Programming [1]
Final Exam

Exercice 1 (30 points)

Consider the following linear program:

$$
\begin{array}{ll}
\displaystyle\min_{x_1,x_2,x_3} & 3x_1 + x_2 + 2x_3 \\
\text{s.t} & x_1 + x_2 + 2x_3 \leq 3, \\
& x_1 - x_2 + x_3 \geq 2, \\
& 2x_1 + x_2 + x_3 \leq 5, \\
& x_1, x_2, x_3 \geq 0.
\end{array}
$$

(a) Solve the linear program using the Primal Simplex algorithm.

(b) Solve the linear program using the Dual Simplex algorithm.

[1]Dr. Slim Belhaiza (c), 29 January, 2010

Exercice 2 (25 points)

Consider the following nonlinear program:

$$\min_{x,y} f(x,y) = x^2 + xy^2 + 2y^2$$

where x and y are real decision variables.

(a) Give the first order optimality conditions and find **all points** satisfying these conditions.

(b) Give the second order optimality conditions.

(c) Conclude on the optimality of each point found in (a).

Exercice 3(45 points)

Consider the following nonlinear program:

$$\min_{x_1,x_2} f(x_1, x_2) = (x_1 - 1)^4 + 2(x_1 - x_2)^2$$

where x_1 and x_2 are real decision variables.

(a) Starting from the point $(2, 2)$ perform 3 iterations of the Newton Method.

(b) Adding the constraint: $x_1 + x_2 - 2 = 0$, Give the Kuhn-Tucker conditions corresponding to the constrained problem.

(c) Perform 3 iterations of the Penalties Method to optimize the constrained problem.