King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 480 - Linear & Nonlinear Programming
Midterm
Term (132)

Thursday, March 13, 2012   **Time Allowed: 2 hours**

Name: _____   ID Number: _____

Section Number: _____01_____   Serial Number: _____

Class Time: ___UT:03:30-04:45PM___   Instructor's Name: Dr. Mohammed Alshahrani

Instructions:

1. Calculators and Mobiles are not allowed.

2. Write neatly and eligibly. You may lose points for messy work.

3. Show all your work. No points for answers without justification.

	Points	Maximum Points
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Page 2		20
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Page 4		20
Page 5		15
Total		100

Q1. Convert the following problem to a linear program in standard form

$$\begin{aligned}
\text{maximize} \quad & 3x_1 + 13x_2 + 4x_3 \\
\text{subject to} \quad & \\
1 \leq \; & x_1 + x_2 \; \leq \; 3, \\
& -2x_1 - 4x_2 + 5x_3 \; = \; -6 \\
& x_1 \geq 0, x_2 \geq 0, |x_3| \leq 2
\end{aligned}$$

Q2. Use the simplex method to solve the following linear program

$$\text{maximize } 6x_1 + 8x_2 + 5x_3 + 9x_4$$
$$\text{subject to } 2x_1 + x_2 + x_3 + 3x_4 \leq 5$$
$$x_1 + 3x_2 + x_3 + 2x_4 \leq 3$$
$$x_1,\ x_2,\ x_3,\ x_4 \geq 0.$$

Q3. Consider the following linear program

$$
\begin{array}{rrrrrrrr}
\text{maximize} & 6x_1 & + & 9x_2 & + & 3x_3 & & \\
\text{subject to} & -x_1 & + & 2x_2 & + & x_3 & \geq & -3 \\
& 3x_1 & + & x_2 & - & x_3 & \geq & -4 \\
& x_1, & x_2, & x_3 & \geq & 0 &
\end{array}
$$

(a) Write the dual of the above linear program.

(b) Solve the dual program geometrically.

(c) Find the optimal solution of both programs (if exist).

Q4. Use the revised simplex method to solve the following linear program

$$\text{maximize } 4x_1 + 3x_2$$
$$\text{subject to } \quad x_1 - \quad x_2 \leq 1$$
$$2x_1 - \quad x_2 \leq 3$$
$$x_2 \leq 5$$
$$x_1, \ x_2 \geq 0.$$

Q5. In a linear program, show that if a linear inequality is changed to equality, the corresponding dual variable becomes free.