King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
STAT-361 Operations Research I [1]
Midterm Exam
Three Problems, April 3rd, 2014 [2]

Problem 1 (**25 pts**)

Given the following pair of linear programs:

$$\begin{array}{ll} \max\limits_{x,y} & z = 2x + 3y \\ \text{s.t.} & x + 2y \leq 5, \\ & 2x + y \leq 4, \\ & x, y \geq 0 \end{array} \qquad \begin{array}{ll} \min\limits_{\alpha,\beta} & \gamma = 5\alpha + 4\beta \\ \text{s.t.} & -\alpha - 2\beta \leq -2 \\ & 2\alpha + \beta \geq 3 \\ & \alpha, \beta \geq 0 \end{array}$$

(a) What is the relation between these two linear programs. (5pts)

(b) Write the linear complementary conditions corresponding to these two linear programs. (10pts)

(c) Solve both programs graphically and give their optimal solutions.(10pts)

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[1]Dr. Slim Belhaiza (c)
[2]This is NOT an open book exam. The exam lasts 120 minutes.

Problem 2 (**40 pts**)

Consider the following linear program:

$$\max_{x_1,x_2,x_3} \quad 3x_1 + 2x_2 + x_3$$

$$\text{s.t.} \quad x_1 + x_2 + 2x_3 \le 3,$$
$$x_1 - x_2 + x_3 \ge 2,$$
$$2x_1 + x_2 + x_3 \le 4,$$
$$x_1, x_2, x_3 \ge 0.$$

(a) Solve the linear program using the Primal Simplex algorithm.(20pts)

(b) Solve the linear program using the Dual Simplex algorithm.(20pts)

Problem 3 (35 Points)

Given the following linear program:

$$\max_{x_1,x_2,x_3} \quad 3x_1 + 5x_2 + 2x_3$$

$$\text{s.t.} \quad 2x_1 + 4x_2 + x_3 \leq 7,$$
$$3x_1 + 2x_2 + x_3 \leq 4,$$
$$x_1, x_2, x_3 \geq 0.$$

(a) Write the standard form corresponding to the linear program.(5pts)

(b) Solve the linear program using the Revised Simplex method.(30pts)