King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
STAT-361 Operations Research I [1]
MidTerm Exam I
Three Problems, March 6^{th}, 2018 [2]

Problem 1 **(**40 **pts)**

Given the following linear program (P):

$$\begin{array}{ll} \max\limits_{x_1,x_2} & 2x_1 + 3x_2 \\ \text{s.t.} & x_1 + 4x_2 \leq 5, \\ & 5x_1 + 2x_2 \leq 7, \\ & 2x_1 + x_2 \geq 2, \\ & x_1, x_2 \geq 0. \end{array}$$

(a) Solve the linear program (P) graphically. (10 points)

[1] Dr. Slim Belhaiza (c)
[2] This is NOT an open book exam. The exam lasts 90 minutes.

(b) What is the impact on the optimal solution of an increase of the right hand side of the second condition by one unit? (10 points)

(c) For your interpretation in (b) to remain valid, how much is the maximum increase in the right hand side of the second condition ? (5 points)

(d) Solve the linear program (P) using the Simplex algorithm. (15 points)

Problem 2 **(**30 **pts)**

Consider the following linear program:

$$\begin{array}{ll} \max\limits_{x_1,x_2,x_3} & 2x_1 + 3x_2 + 2x_3 \\ \text{s.t.} & 3x_1 + 3x_2 + x_3 \leq 7, \\ & 2x_1 + x_2 + 3x_3 \leq 6, \\ & x_1 + 2x_2 + 3x_3 \leq 6, \\ & x_1, x_2, x_3 \geq 0. \end{array}$$

Solve the linear program using the Tables' representation of the Simplex algorithm. (30 points)

N.B.: You would be graded on 20 if you use any other representation.

Problem 3 **(30 Points)**

Consider the following linear program:

$$\begin{array}{ll} \max\limits_{x,y,z} & x + 3y + 2z \\ \text{s.t.} & 2x + 2y + z \leq 5, \\ & x + 3y + z \leq 5, \\ & x, y, z \geq 0. \end{array}$$

Solve the linear program using the Matrices' representation of the Simplex algorithm. (30 points)

N.B.: You would be graded on 20 if you use any other representation.