King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
STAT-361 Operations Research I [1]
MidTerm Exam I
Three Problems, March 10^{th}, 2016 [2]

Problem 1 (40 **pts)**

Given the following linear program (P):

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

(a) Solve the linear program (P) using the Simplex algorithm. (20 points)

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

(b) Write the dual program (D) corresponding to (P).
(5 points)

(c) Solve the dual linear program (D) using the Dual Simplex algorithm.
(15 points)

Problem 3 **(30 Points)**

The following Simplex tableau corresponds to the representation of a basic feasible solution of a linear program during its optimization.

c^t	?	?	?	0	0	0		
$Basis$	x_1	x_2	x_3	e_1	e_2	e_3	b_j	$\frac{b_j}{c_{pj}}$
x_1	1	2	0	-1	0	0	2	
e_2	0	1	0	2	1	-1	1	
x_3	0	2	1	0	0	4	2	
RC	0	-2	0	1	0	4		

(a) Complete the missing values in the Tableau.(10 points)

(b) Peform a single pivot iteration in case the objective has to be maximized. (5 points)

(c) Peform a single pivot iteration in case the objective has to be minimized. (5 points)

(d) Give a possible original expression of the linear program.(10 points)

Problem 3 (30 **pts)**

Consider the following linear program:

$$\begin{array}{ll} \max\limits_{x_1,x_2,x_3} & 5x_1 + 3x_2 + 2x_3 \\ \text{s.t.} & 2x_1 + x_2 + x_3 \leq 4, \\ & x_1 + 2x_2 + x_3 \geq 5, \\ & x_1, x_2, x_3 \geq 0. \end{array}$$

Solve the linear program using the Revised Simplex algorithm. (30 points)
N.B.: You would be graded on 20 if you solve using the Simplex algorithm.

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