King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
STAT-361 Operations Research I [1]
MidTerm Exam I
Three Problems, March 12^{th}, 2015 [2]

Problem 1 **(**30 **pts)**

Given the following linear program:

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

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

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

(b) If the objective function coefficient c_1 of x_1 is changing, for which values of c_1 the solution obtained in (a) would remain optimal? Explain. (5 points)

(c) If the objective function coefficient c_2 of x_2 is changing, for which values of c_2 the solution obtained in (a) would remain optimal? Explain. (5 points)

(d) If the right hand side b_1 of constraint 1 is changing, for which values of b_1 the solution structure obtained in (a) remain optimal? Explain. (5 points)

(e) If the right hand side b_2 of constraint 2 is changing, for which values of b_2 the solution structure obtained in (a) remain optimal? Explain. (5 points)

Problem 2 (35 pts)

Consider the following linear program:

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

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

(b) If the objective function coefficient c_1 of x_1 is changing, for which values of c_1 the solution obtained in (a) would remain optimal? Explain. (5 points)

(c) If the objective function coefficient c_2 of x_2 is changing, for which values of c_2 the solution obtained in (a) would remain optimal? Explain. (5 points)

(d) If the objective function coefficient c_3 of x_3 is changing, for which values of c_3 the solution obtained in (a) would remain optimal? Explain. (5 points)

Problem 3 (35 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	3	
RC	0	3	0	-1	0	4		

(a) Complete the missing values in the Tableau.(5 points)

(b) Peform a single pivot iteration in case the objective has to be maximized. (10 points)

(c) Peform a single pivot iteration in case the objective has to be minimized. (10 points)

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

END