King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
STAT-361 Operations Research I [1]
Final Exam
Four Problems, May 14^{th}, 2014 [2]

Problem 1 **(25 Points)**

The company $Z - Car$ produces a unique model of spare parts for heavy duty transportation vehicles. The manager of the company is asking you to find the optimal solution to its transportation problem. The company has 4 plants supplying 5 customer zones. The following table 1 displays the unit transportation costs, the supplies and the demands.

Demand Nodes $\rightarrow$	1	2	3	4	5	
Supply Nodes $\downarrow$	Costs					Offer
1	5	4	6	4	7	1000
2	4	3	5	8	5	1200
3	4	7	6	5	2	800
4	3	5	2	6	4	1100
Demand	1200	400	1000	1300	1100	

Table 1: Data for problem 1

[1] Dr. Slim Belhaiza (c)
[2] This is NOT an open book exam. The exam lasts 150 minutes.

Problem 2 **(**25 **pts)**

Consider the following linear program:

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

(a) Solve the linear program using the Primal Simplex algorithm.(12.5 pts)

(b) Solve the linear program using the Dual Simplex algorithm.(12.5 pts)

Problem 3 **(**25 **pts)**

Consider the following project scheduling problem detailed in table 3.

Tasks	Condition	Duration (days)
a	–	6
b	–	5
c	after b	3
d	after a	4
e	after c	8
f	after 3 days of the end of d	7
g	after f	4
h	1 day before the end of e	5
i	after g	4
k	after h and i	3

Table 2: Data for problem 3

(i).Draw the graph representing the interdependence between the tasks of the project. (10 pts)
(ii).Find the shortest possible duration of the project. (10 pts)
(iii).Find the critical tasks and the critical tasks. (5 pts)

Problem 4 **(**25 **pts)**

A young traveler has to select the items he would take him for a short camping trip. He has selected 10 items and noticed that his bag does not offer a sufficient space to fit all items. The traveler cannot take just small parts of any chosen items. The traveler is asking you to formulate a linear program that would help him decide which items to take while maximizing his total utility and satisfying the total weight and volume conditions.

Item	Weight	Volume	Utility
a	4	4	3
b	2	5	6
c	3	4	7
d	5	3	4
e	3	4	5
f	4	2	6
g	7	1	4
Available	25	18	–

Table 3: Data for problem 4