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University Examinations 2012/2013

SECOND YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE

HBC 2122: OPERATIONS RESEARCH I

DATE: AUGUST 2013 **TIME: 2HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE – (30 MARKS)

(a) Discuss any three basic elements of Queing Model. (6 Marks)

(b) Find the dual linear program of the following primal

$$\begin{aligned} &maximize\ z = 5x_1 + 6x_2 \\ &Subject\ to:\ x_1 + 2x_2 = 5 \\ &\qquad x_1 + 5x_2 \geq 3 \\ &\qquad 4x_1 + 7x_2 \leq 8 \\ &x_1\ unresticted, x_2 \geq 0 \end{aligned}$$

(6 Marks)

(c) Solve the following L.P.P by simplex method

$$\begin{aligned} &maximize\ z = 3x_1 + 2x_2 \\ &Subject\ to:\ 4x_1 + 3x_2 \leq 12 \\ &\qquad 4x_1 + x_2 \leq 8 \\ &\qquad 4x_1 - x_2 \leq 8 \\ &\qquad x_1,\ x_2 \geq 0 \end{aligned}$$

(10 Marks)

(d) Consider the following information

Activity	Immediate Predecessors	Duration
A	None	2
B	None	3
C	A	1
D	B	4
E	C,D	3
F	D	1
G	E	2
H	F	3

Draw the project network and find the critical path. (8 Marks)

QUESTION TWO – (20 MARKS)

A firm operates 3 plants each of which produces animal feeds in 3 outputs A, B and C. The hourly output in tones of the plants is as follows:

	A	B	C
Plant I	10	20	30
Plant II	20	10	10
Plant III	30	20	10

On a particular day, this company receives an order to supply 1000 tonnes of feed A, 800 tonnes of feed B and 500 tonnes of feed C. The cost per hour of running the three plants are 40, 50 and 60 dollars respectively. Assuming that the plant will run simultaneously, formulate the underlying linear program and determine how long each plant need to be run in order to provide sufficient output and minimize the cost. (20 Marks)

QUESTION THREE – (20 MARKS)

A company has 3 supply points and three demand areas for a particular commodity. The cost of transporting 1 unit from a supply point to a demand area and the capacities are as given below:

		Demand Areas			Available
		1	2	3	
Supply	1	1	2	1	350
	2	1	2	3	450
	3	2	1	1	240
Required		360	480	300	

By using minimum cost rule to make the initial allocation, obtain the optimal allocation that minimizes transportation cost. (20 Marks)

QUESTION FOUR – (20 MARKS)

In order to ensure optimal health (and thus accurate test results), a lab technician needs to feed rabbits on a daily diet containing a minimum of 24g of fat, 36 g of carbohydrates and 4g of protein. But the rabbits should be fed no more than 5 ounces of food a day. Rather than order rabbit food that is custom-blended, it is cheaper to order food X and food Y and blend them for a optimal mix. Food X contains 8g of fat, 12g of carbohydrates and 2g of protein per ounce and costs $0.02 per ounce. Food Y contains 12g of fat, 12g of carbohydrates and 1g of protein per ounce, at a cost of $0.30 per ounce. Formulate the underlying linear programming problem and by finding the corresponding dual, obtain the minimum cost for the blend. (20 Marks)