Sub:- Management Stream Operations Research.

9/06/15

(1) (33) Chem./VI/CBGS/OR.

QP Code : 5159

(REVISED COURSE)

(3 Hours) [Total Marks: 80

N.B. :

1) Question – 1 is compulsory. Answer any three questions from remaining.

2) Assume data if necessary and specify the assumptions clearly.

3) Draw neat sketches wherever required.

4) Answer to the sub-questions of an individual question should be grouped and written together i.e. one below the other.

1. (a) Write the dual of the following LP: [05]

$$Max \quad z = x_1 + 2x_2 + 3x_3$$

$$s.t.\ 3x_1 + 2x_2 + x_3 = -4$$

$$4x_1 + 5x_2 + 6x_3 \leq 8$$

$$x_1, x_2 \geq 0, \quad x_3 \text{ unrestricted}$$

(b) Show all possible spanning trees in the following network of cities: [05]

city	*connected to*
A	*B and D*
B	*C and D*
C	*D*

(c) The following is the pay-off matrix for player A. [05]

1	q	6
p	5	10
6	2	3

Determine the values of p and q that will make the entry $(2,2)$ a saddle point.

(d) A bakery receives customers totally randomly at an average of 40 per day. If the bakery is open 8 hours a day, what is the probability that no customers will arrive in any one hour? [05]

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2. (a) Solve the following LP using Revised Simplex: [10]

$$Max \quad z = 2x_1 + x_2 - x_3$$

$$s.t.\ x_1 + 4x_2 + 2x_3 \leq 12$$

$$2x_1 - x_2 + 2x_3 \leq 20$$

$$x_1, x_2, x_3 \geq 0$$

(b) Find the shortest distance from node 1 to node 5 in the following network, using Dijkstra's algorithm: [10]

From Node	*To Node*	*Distance*
1	2	1
1	3	4
2	3	2
2	4	6
2	5	5
3	5	1
4	5	3
4	6	2
5	6	1

3. (a) Solve the following IP using Branch and Bound Technique: [10]

$$Max \quad z = 3x_1 + 4x_2$$

$$s.t.\ 2x_1 + 3x_2 \leq 9$$

$$3x_1 + 2x_2 \leq 10$$

$$x_1, x_2 \geq 0 \ \ and\ integer$$

(b) A company has accepted a contract to supply 80 chairs at the end of the first month, and 120 at the end of the second month. The cost of manufacturing chairs in any month is $50x + 0.2x^2$ rupees, where x is the number of chairs manufactured in that month. If the company manufactures more chairs than needed in the first month, there is an inventory cost of *Rs*.8 per chair carried into the second month. Find the number of chairs to be manufactured in each month to minimize the total cost. The company has facilities to manufacture up to 200 chairs in a month. Assume that there is no initial inventory. [10]

4. Solve the following transportation problem using the Least Cost method to obtain the initial BFS: [20]

Source	*Dest. #1*	*Dest. #2*	*Dest. #3*	*Cap.*
1	22	16	18	500
2	16	20	25	600
3	22	24	18	100
Demand	500	300	600	

The entries represent cost of transportation in rupees from each supply node to each destination node.

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9106/15

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CHEM./VI/CBGS/O

QP Code : 5159

5. (a) A company produces three products A, B, *and* C. The sales volume for A is at least 50% of the total sales. However the company cannot sell more than 75 units of A per day. The three products use one raw material, of which the maximum daily availability is 240 kg. The usage rates of the raw material are 2 kg per unit of A, 4 kg per unit of B, and 3 kg per unit of C. The unit prices for A, B, *and* C are $Rs.200$, $Rs.500$, *and* $Rs.350$ respectively. Determine the optimal product mix for the company. Determine the dual price of the raw material resource and its allowable range. [10]

(b) An automobile garage purchases engine oil in bulk at \$3 per gallon. A discount price of \$2.50 per gallon is available if it purchases more than 1000 gallons. The garage services approximately 150 cars per day, and each car requires 1.25 gallons of engine oil. The garage stores engine oil at a cost of \$0.02 per gallon per day. The cost of placing an order for bulk oil is \$20. Determine the optimal inventory policy. [10]

6. (a) A $4-ton$ vessel can be loaded with one or more of three items. The following table gives the unit weight w_i in tons, and the unit revenue, in lakhs of rupees r_i, for item i. How should the vessel be loaded to maximize the total return? [10]

item i	w_i	r_i
1	2	31
2	3	47
3	1	14

(b) The following table lists the activities of a project along with the duration of each activity: [10]

Activity	*Predecessor*	*Duration in days*
A	–	10
B	–	8
C	A	6
D	C	4
E	B, D	2
F	B, E	6
G	E, F	12
H	D, G	10

Determine the cririca path and the duration of the project.

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