RD – 06

B.C.A. (Semester – V) Examination, October 2015
NON COMPUTER SCIENCE
Operations Research (Elective – I)

Duration : 2 Hours | Max. Marks : 50

Instructions : 1) ***All*** *questions are* ***compulsory****, however* ***internal choice*** *is* ***provided*** *from Q.* ***2*** *to Q.* ***5****.*
2) ***Use*** *of calculator is* ***permitted****.*
3) *Graph paper will be* ***provided*** *if needed.*
4) *Figures to the* ***right*** *indicate* ***full*** *marks.*

1. a) Obtain dual of the following linear programming problem : **2**

Max $Z = 2x + 5y + 6z$

Subject to $5x + 6y - z \leq 3$

$-2x + y + 4z \leq 4$

$x - 5y + 3z \leq 1$

$x, y, z \geq 0$

b) Define standard form of a linear programming problem. **2**

c) Give mathematical formulation of transportation problem. **2**

d) Define queuing system. **2**

e) Briefly explain dominance property in game theory. **2**

2. A) Use simplex method to solve the following linear programming problem. **5**

Maximize $Z = 7x_1 + 5x_2$

Subject to $x_1 + 2x_2 \leq 6$

$4x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$

B) Using graphical method solve the following linear programming problem. **5**

Maximize $Z = 4x + 3y$

Subject to $2x + 3y \leq 6$

$3x + 4y \leq 12$

$x, y \geq 0$

OR

P.T.O.

X) Use Big-M method to solve 5

Maximize $Z = 3x_1 - x_2$

Subject to the constraints

$2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 3$

$x_2 \leq 4$ and $x_1, x_2 \geq 0$

Y) A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suitings, shirtings and woolens yielding the profit of Rs. 2, Rs. 4 and Rs. 3 per metres respectively. One metre of suiting requires 3 min. in weaving, 1 min. in processing and 3 min. in packing, one metre of shirting requires 4 min. in weaving, 1 min. in processing and 3 min. in packing while one metre woolen requires 3 min. in each department. In a week total run time for each department is 60, 40 and 80 hours of weaving, processing and packing department respectively. Formulate the linear programming problem to maximize the profit. 5

3. A) In a game of matching coins with two players A and B, suppose A win 1 unit of value when there are two heads, win nothing when there are two tails and losses $\frac{1}{2}$ unit of value when there is one head and one tail. Determine the pay-off matrix, the best strategies for each player and value of the game to player A. 5

B) A shopkeeper has a uniform demand of an item at the rate of 30 items per month. He buys from supplier at a cost of Rs. 200 per item and purchases at a rate of 100 per month. Cost of ordering is Rs. 1,000 each time and cost of holding is Rs. 20 per unit per month.

i) Represent the model graphically.

ii) Find economic order quantity. 5

OR

X) Define saddle point of a two-person zero sum game. In a 2 × 2 game if the largest and second largest element lies along a diagonal, then prove that the game has no saddle point. 5

Y) A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a metre and there is a demand for 8,000 metres a week. Each replenishment costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 percent of value held a year. Assuming no shortages are allowed, what should be order quantity per year, represent the model graphically. 5

4. A) State Bellman's principle of optimality and use it to solve the problem :

Minimize $Z = y_1^2 + y_2^2 + {}^2_3$

Subject to $y_1 + y_2 + y_3 \geq 15$

and $y_1, y_2, y_3 \geq 0$ 5

B) Find the optimal transportation cost using Vogel approximation method for the following transportation table : 5

				Supply
5	2	4	3	30
6	2	9	4	40
2	3	8	1	55
15	20	40	50	
Demand				

OR

X) Use dynamic programming problem to find three positive real numbers such that sum of their squares is minimum subject to the restriction that their product is 27. **5**

Y) Using Vogel's approximation method find the IBFS of the given transportation problem and find optimum solution to minimize the cost. **5**

Destination → / Origin ↓	D1	D2	D3	D4	Supply
O1	1	2	1	4	**30**
O2	4	2	5	9	**20**
O3	3	3	2	1	**50**
Demand	20	40	30	10	**100**

5. A) The cost of machine is Rs. 6,100 and its scrap value is only Rs. 100. The maintenance cost are found from experience to be

Year	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	100	250	400	600	900	1250	1600	2000

When should machine be replaced ? **5**

B) There are five jobs each of which must go through the two machines A and B in the order AB. Processing time are given below :

	Processing time (hours)				
Job →	1	2	3	4	5
Time for A	5	1	9	3	10
Time for B	2	6	7	8	4

Determine a sequence for five jobs that will minimize the elapsed time. **5**

OR

X) A machine owner finds from his past records that the costs per year of maintaining a machine whose purchase price is Rs. 6,000 are given as below :

Year	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	1,000	1,200	1,400	1,800	2,300	2,800	3,400	4,000
Resale price	3,000	1,500	750	375	200	200	200	200

Determine at which year is a replacement due ? **5**

Y) Six jobs go first over machine I and then over machine II. The order of completion of jobs has no significance. The following table gives the machine times in hours for six jobs and two machines :

job →	1	2	3	4	5	6
Time for A	5	9	4	7	8	6
Time for B	7	4	8	3	9	5

Find the sequence of jobs that minimizes the total elapsed time. **5**

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