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BCA Semester V
EXAMINATION OCTOBER 2019
Non Computer Science Elective-I : Operation Research

[Duration : Two Hours] **[Max. Marks: 50]**

Instruction :
i) All questions are compulsory
ii) From Q.2 to Q.5 Attempt A & B or X & Y
iii) Figure to right indicate full marks
iv) Draw Diagrams / Graph wherever needed on the graph paper provided

Q.1 Answer the following: **5X2=10**
i) What is dominance property in game theory.
ii) Explain Bellman's Principle of Optimality in Dynamic Programming
iii) Define Transportation problem.
iv) Define Inventory problem.
v) Write the dual of the L.P.P :
Maximize $z = 5x_1 + 3x_2$ subject to the constraints
$$3x_1 + 5x_2 \leq 15, 5x_1 + 2x_2 \leq 10, x_1 \geq 0 \text{ and } x_2 \geq 0$$

Q.2 A) Using Simplex method solve the following L.P.P **05**
Find the maximum value of $z = 107x_1 + x_2 + 2x_3$
Subject to the constraints :
$$14x_1 + x_2 - 6x_3 + 3x_4 = 7\,, 16x_1 + x_2 - 6x_3 \leq 5, 3x_1 - x_2 - x_3 \leq 0$$
$$x_1, x_2, x_3, x_4 \geq 0$$

B) A company produces two types of hats. Each hat of the first type requires twice as much labour time as the second time. If all hats are of the second type only the company can produce a total of 500 hats a day. Market limits daily sales of the first and second type to 150 and 250 hats. Assuming that the profits per hat are Rs.8.00 for type A and Rs.5.00 type B. Formulate the problem as a linear programming model in order to determine the number of hats to be produced of each type so as to maximize the profit . **05**

OR

X) Use big M – Method (or penalty) to Maximize $z = 6x_1 + 4x_2$
subject to the constraints $2x_1 + 3x_2 \leq 30$ **05**
$$3x_1 + 2x_2 \leq 24$$
$$x_1 + x_2 \geq 3$$
$$x_1, x_2 \geq 0$$

Y) Solve the given Linear Programming Problem using graphical method **05**
Maximize $z = 2x_1 + 3x_2$
Subject to $x_1 + x_2 \leq 30$

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$$x_1 - x_2 \geq 0$$
$$x_2 \geq 3$$
$$0 \leq x_1 \leq 20 \; and \; 0 \leq x_2 \leq 12$$

Q.3 A) Solve the game whose payoff matrix is given by **05**

$$\begin{array}{cc} & \begin{matrix} & B \\ I & II & III \end{matrix} \\ \begin{matrix} A \\ \\ \end{matrix} & \begin{matrix} I \\ II \\ III \end{matrix} \begin{bmatrix} -2 & 15 & -2 \\ -5 & -6 & -4 \\ -5 & 20 & -8 \end{bmatrix} \end{array}$$

B) You have to supply your customers 100 units of a certain product every Monday (and only then). You obtain the product from a local supplier at Rs.60 per unit. The costs of ordering and transportation from the supplier are Rs.150 per order. The cost of carrying inventory is estimated at 15 % per year of the cost of the product carried **05**

i) Find the lot size which will minimize the cost of the system

ii) Determine the optimal cost

OR

X) Consider a "modified" form of "matching biased coins" game problem. Matching player is paid Rs.8.00 if two coins turn both heads and rupees Rs. 1.00 if the coins turn both tails. The non- matching player is paid Rs. 3.00 when the two coins do not match. Given the choice of being the matching or non- matching player which one would you choose and what would be your strategy? **05**

Y) A manufacturing company purchases 9,000 parts of a machine for its annual requirements. Ordering one – month usage at a time. Each part costs Rs. 20 The ordering cost per order is Rs.15 and the carrying charges are 15% of the average inventory per year. How frequently should production run be made? **05**

Q.4 A) A firm is considering replacement of n machines whose cost price is given as Rs.12,200 and the scrap value as Rs. 200. The running (maintenance and operating) cost in rupees are found from experience to be as follows. **05**

Year	1	2	3	4	5	6	7	8
Running cost	200	500	800	1,200	1,800	2,550	3,200	4,000

When should the machine be replaced?

B) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter- arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following: **05**

i) The mean queue size (line length) , and
ii) The probability that the queue size exceeds 10

OR

X) A machine owner finds from his past records that the costs per year of maintaining a machine whose purchase price is Rs.6000 are as given below. **05**

Year	1	2	3	4	5	6	7	8
Maintenance cost (Rs.)	1000	1200	1400	1800	2300	2800	3400	4000
Resale Price	3000	1500	750	375	200	200	200	200

05

Y) Using Bellman's Principle of Optimality Minimize $z = y_1^2 + y_2^2 + y_3^2$ subject to $y_1 + y_2 + y_3 \geq 15$ *and* $y_1, y_2, y_3 \geq 0$

Q.5 A) Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC . **05**

Processing time (in hours) on	Job					
	1	2	3	4	5	6
Machine A	8	3	7	2	5	1
Machine B	3	4	5	2	1	6
Machine C	8	7	6	9	10	9

B) Use Vogel's Approximation Method to obtain an initial basic feasible solution of the transportation problem: **05**

	D_1	D_2	D_3	D_4	*supply*
S_1	20	25	28	31	200
S_2	32	28	32	41	180
S_3	18	35	24	32	110
Demand:	150	40	180	170	

OR

X) A readymade garments manufacturer has to process 7 items through two stages of production , viz. cutting and sewing. The time taken for each of these at the different stages are given below in appropriate units :- **05**

	Item	1	2	3	4	5	6	7
Process time	Cutting	5	7	3	4	6	7	12
	Sewing	2	6	7	5	9	5	8

Find an order in which these items are to be processed through these stages so as to

minimize the total processing time .

Y) Find the starting solution in the following transportation problem by Vogel's Approximation Method also obtain the optimal solution: **05**

	D_1	D_2	D_3	D_4	Supply
S_1	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	