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GOPAL GOVIND POY RAITURCAR COLLEGE OF COMMERCE AND ECONOMICS, PONDA-GOA
B.C.A (SEMESTER-V) EXAMINATION, JANUARY 2021
NON-COMPUTER SCIENCE (Elective – I)
OPERATIONS RESEARCH

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 permitted.
3) Graph paper will be provided on request.
4) Figures to the right indicate full marks.

Q1) Answer the following: **(5x2=10)**

a) State Bellman's Principle of Optimality in Dynamic Programming.
b) State different replacement policies.
c) Explain Dominance rule in Game Theory.
d) Define queuing system.
e) Define demand and order cycle in inventory control theory.

Q2. A) Use the simplex method to solve the following LP problem**.** **(5)**

$$Max\ Z = 3x_1 + 5x_2 + 4x_3$$

Subject to the constraints:

$$2x_1 + 3x_2 \leq 8$$
$$2x_1 + 5x_3 \leq 10$$
$$3x_1 + 2x_2 + 4x_3 \leq 15$$
$$x_1, x_2, x_3 \geq 0$$

Q2. B) Use the graphical method to solve the following LP problem. **(5)**

$$Min\ Z = 20x_1 + 10x_2$$

Subject to the constraints:

$$x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \geq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_1, x_2 \geq 0$$

OR

Q2.X) A company makes three products X, Y, Z which flow through 3 departments, drill, lathe and assembly. The hours of department time required by each of the department and the profit contribution of each of the products are given in the following table**.** **(5)**

Products	Time required per unit			Profit Contribution/Unit
	Drill	Lathe	Assembly	
X	3	3	8	₹ 9
Y	6	5	10	₹ 15
Z	7	4	12	₹ 20
Hours Available	210	240	260	

Determine the optimal production schedule.

Q2.Y) Use Big-M method to solve the following LP problem. **(5)**

$$Min\ z = 5x_1 + 3x_2$$

Subject to constraints,

$$2x_1 + 4x_2 \leq 12$$

$$2x_1 + 2x_2 = 10$$

$$5x_1 + 2x_2 \geq 10$$

$$x_1, x_2 \geq 0$$

Q3 . A) Solve the following two-person zero-sum game. **(5)**

		Player B		
Player A	8	-3	7
	6	-4	5
	-2	2	-3

Find the optimum strategies for each of the following players and the value of the game.

Q3. B) Use Vogel's Approximation method to find the initial basic feasible solution to the following transportation problem. Also obtain optimal solution. **(5)**

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	

OR

Q3. X) XYZ company buys in lots of 500 boxes which is a 3-month supply. The cost per box is ₹ 125 and the ordering cost is ₹ 150. The inventory cost is estimated at 20% of unit value. **(5)**

i. What is the total annual cost of the existing inventory policy?
ii. How much money could be saved by employing the economic order quantity?

Q3.Y) Find the optimal assignment for the following cost matrix. **(5)**

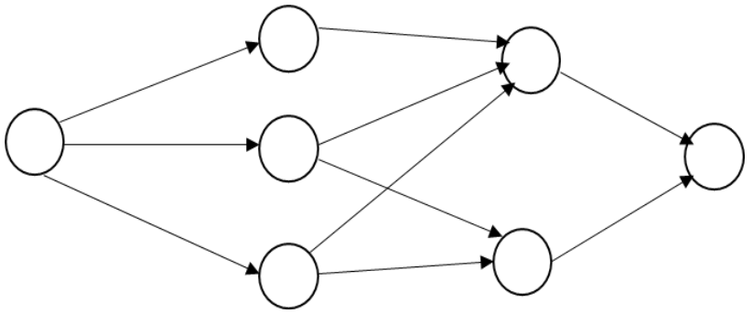
	Areas			
Salesmen	A_1	A_2	A_3	A_4
S_1	11	17	8	16
S_2	9	7	12	10
S_3	13	16	15	12
S_4	14	10	12	11

Q4. A) Six jobs go first over machine I and then over Machine II. The order of the completion of the jobs has no significance. The following table gives the machine times in hours for six jobs and the two machines**.** **(5)**

	1	2	3	4	5	6
Machine I	5	9	4	7	8	6
Machine II	7	4	8	3	9	5

Find the sequence of the jobs that minimizes the total elapsed time to complete the jobs. Find the minimum time.

Q4.B) Use Bellman's principle to find the shortest path in the following diagram**. (5)**



OR

Q4.X) A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below. Decide the optimum sequence of processing of books in order to minimize the total time required to bring out all the books**. (5)**

Books	1	2	3	4	5	6	7
Printing time (in hrs)	20	90	80	20	120	15	65
Binding time (in hrs)	25	60	75	30	90	35	50

Q4.Y) Find the initial basic feasible solution to the following transportation problem using Vogel's Approximation method. **(5)**

	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	

Q5. A) Customers arrive at a booking office window, being manned by a single individual at a rate of 25 per hour. Time required to serve a customer has exponential distribution with a mean of 120 seconds. Find the mean waiting time of a customer in the queue. **(5)**

Q5. B) A firm is considering the replacement of a machine, whose cost price is ₹ 12,200, and its scrap value is ₹ 200. From experience the running cost (maintenance & operating) cost are found to be as follows: **(5)**

Year	1	2	3	4	5	6	7	8
Running Cost (In ₹)	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

OR

Q5.X) A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city only once and then return to his starting point. The travelling cost (in '000 ₹) of each city from a particular city is given below. What should be the sequence of visit of the salesman so that the cost is minimum? **(5)**

To city

From City	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

Q5.Y) Determine the optimal strategies for both the manufacturers and the value of the game. The payoff matrix is given below**:** **(5)**

XYZ

ABC		B_1	B_2	B_3	B_4
	A_1	2	-2	4	1
	A_2	6	1	12	3
	A_3	-3	2	0	6
	A_4	2	-3	7	1

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