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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Make-Up Examinations

Programme: B.E. **Semester: VII**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 21MD7OEOPR **Max Marks: 100**
Course: Operations Research

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	List the applications of O R	*CO1*	*PO1*	**06**
	b)	A company produces 2 types of leather belts A and B. The profits on the two types of belts are Rs 40/- and Rs 30/- per belt respectively. Each belt of type A requires twice as much time as required by belt B. If all the belts were sold of type B, the company could produce 1000 belts per day. The supply of leather is sufficient only for making 800 belts per day. For belt A requires a special type of buckle and 400 are available per day. There are 700 buckles available for belt B per day. Formulate a linear programming model and solve the problem by graphical method.	*CO2*	*PO2*	**14**
		OR			
2	a)	a) Use simplex method to solve: Maximize $Z = X_1 + 3X_2$ subject to $X_1+2X_2 \leq 10$, $0 \leq X_1 \leq 5$, $0 \leq X_2 \leq 4$ and $X_i \geq 0$	*CO2*	*PO2*	**10**
	b)	Use simplex method to solve: Maximize $Z = 2X_1 + 5X_2$ subject to $X_1 \leq 40$, $X_2 \leq 30$, $X_1+X_2 \geq 60$ and $X_i \geq 0$	*CO2*	*PO2*	**10**
		UNIT - II			
	a)	Differentiate between transportation problem and assignment problem	*CO1*	*PO1*	**05**

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	3	b)	There are three factories A, B and C supplying goods to four dealers D_1, D_2, D_3 and D_4. The production capacities of these factories are 1000, 700 and 900 units respectively. The requirements from the dealers are 900, 800, 500 and 400 units per month respectively. The per unit return (excluding transportation cost) are Rs 8/- Rs 7/- and Rs 9/- at the three factories. The following Table1 gives the unit transportation costs from the factories to dealers. Find IBFS using VAM and determine the optimum solution to maximize the total returns Table 1 **D_1 D_2 D_3 D_4** **A** 2 2 2 4 **B** 3 5 3 2 **C** 4 3 2 1	*CO4*	*PO3*	**15**
			UNIT - III			
	4	a)	Using the following cost matrix (Table 2), determine (i) optimal job assignment (ii) the cost of assignments. Solve the problem by Hungarian method. Table 2 **Jobs** **Persons** **1 2 3 4 5** **A** 10 3 3 2 8 **B** 9 7 8 2 7 **C** 7 5 6 2 4 **D** 3 5 8 2 4 **E** 9 10 9 6 10	*CO3*	*PO3*	**10**
		b)	A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost of going from one city to another is shown in Table 3. Find the least cost route and the optimal cost. Table 3 Jobs Persons **A B C D E** **A** ∞ 4 7 3 4 **B** 4 ∞ 6 3 4 **C** 7 6 ∞ 7 5 **D** 3 3 7 ∞ 7 **E** 4 4 5 7 ∞	*CO3*	*PO3*	**10**
			UNIT - IV			
	5	a)	Define Total Float, Independent Float and Free Float	*CO1*	*PO1*	**06**

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	b)	A project schedule has the following characteristics as shown in Table 4. (a) construct the project network (b) find the expected duration and variance of the activity (c) identify the critical path and expected project length (d) what is the probability of completing the project at least 4 days earlier than expected (e) what is the probability of completing the project 4 days later than expected (f) if the project due date is 19 days, what is the probability of not meeting the due date (g**)** what due date 90% of chance of being met. Table 4 Activity | 1-2 | 1-3 | 1-4 | 2-5 | 3-5 | 4-5 | 5-6 T_O (days) | 1 | 1 | 2 | 1 | 2 | 2 | 3 T_M (days) | 1 | 4 | 2 | 1 | 5 | 5 | 6 T_P (days) | 7 | 7 | 8 | 1 | 14 | 8 | 15	*CO3*	*PO3*	**14**
		OR			
6	a)	Define most likely time, optimistic time and pessimistic time	*CO1*	*PO1*	**06**
	b)	A project schedule has the following characteristics shown in Table 5. (i) construct a network diagram (ii) compute the earliest event time and latest event time (iii) determine the critical path and total project duration (iv) find EST, EFT, LST, LFT, TF and FF for each activity. Table 5 Activity | 1-2 | 1-3 | 2-4 | 3-4 | 2-5 | 3-6 | 4-7 | 5-7 | 6-7 Time (days) | 4 | 5 | 6 | 3 | 7 | 8 | 9 | 6 | 4	*CO4*	*PO3*	**14**
		UNIT - V			
7	a)	a) Use the relation of dominance to solve the rectangular game whose payoff matrix to player A is given in Table 6 Table 6 **Player A** / **Player B**: 1 | 2 | 3 | 4 | 5 | 6 **1** | 16 | 14 | 11 | 10 | 15 | 16 **2** | 12 | 18 | 13 | 12 | 14 | 17 **3** | 10 | 13 | 12 | 10 | 11 | 15 **4** | 11 | 15 | 10 | 13 | 12 | 14 **5** | 12 | 17 | 17 | 15 | 16 | 18 **6** | 12 | 10 | 11 | 14 | 12 | 13	*CO3*	*PO3*	**10**

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		b)	Consider the payoff matrix of player A as shown in Table 7. Solve it optimally using graphical method Table 7	*CO3*	*PO3*	**10**

		Player B					
		1	**2**	**3**	**4**	**5**	**6**
Player A	**1**	8	5	7	1	6	4
	2	2	3	4	7	1	5
	3	1	4	2	3	5	1
	4	7	5	4	8	9	6
	5	9	6	8	7	6	5
	6	4	3	6	1	5	2

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