Exam Date & Time: 04-Dec-2023 (02:30 PM - 05:30 PM)



MME 3156

MANIPAL ACADEMY OF HIGHER EDUCATION

Data missing if any, may be suitably assumed **OPERATIONS RESEARCH** [MME 3156]

Marks: 50

Duration: 180 mins.

Descriptive

Answer all the questions.

1A) Solve the following linear programming problem using the Simplex method. Maximize, $Z=12X_{1}+16X_{2}$ Subject to: $10X_{1}+20X_{2} \le 120$ $8X_{1}+8X_{2} \le 80$ $X_{1}, X_{2} \ge 0$ (5)

- 1B) A company manufactures two products A and B. it takes 10 minutes to process one unit of A and 2 minutes for each unit of B and the machine operates for a maximum of 35 hours in a week. Product A requires 1 Kg and B requires 0.5 Kg of raw material per unit, the supply of which is 600 Kg per week. Market constraint on product B is known to be (3) a minimum of 800 units every week. Product A costs 5 Rs per unit and sold at 10 Rs. Product B costs 6 Rs and sold at 8 Rs per unit. Formulate the problem.
- 1C) Mention any four differences between the Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM).
- 2A) A company has a team of four salesmen and there are four districts where the company wants to start its business. After considering the capacity and the nature of districts, the company estimates the profit per day in rupees for each salesman in each district is given below. Find the optimum assignment.

	Districts							
		I	П	ш	IV			
Salesmen	Α	16	10	14	11			
	В	14	11	15	15			
	С	15	15	13	12			
	D	13	12	14	15			

(4)

(2)

2B) Determine the optimum solution using the stepping stone method showing the (4) appropriate steps.

SOURCE	DESTINATION								
	D1	D2	DS	D4					
S1	2	5 3	1 11	8					
S2	1	0	8	1 1					
S3	3 5	8	6 15	1 9					

MME 3156

- 2C) Mention the different phases of operations research problems for an industrial application.
- 3A) Solve the following using the dominance property

		Player-B			
			B1	B2	B3
Play	er-A	A1	-1	2	-2
		A2	6	4	-6

3B) Apply the penalty cost method to obtain the feasible solution, also calculate the total cost.

Factory	W1	W2	W3	W4	Supply
F1	10	2	20	11	15
F2	12	7	9	20	25
F3	4	14	16	18	10
Demand	5	15	15	15	

- 3C) A box contains 2 red balls, 2 white balls and 2 green balls. Two players A and B are playing a game with each player having to select 2 balls at a time. Player A will lose 2Rs for each red ball, gain 1Rs for each white ball and gain 2Rs for each green ball. Prepare the payoff matrix for player -A, and find the value of the game and optimum strategies.
- Analyze the network for the project details are given in the below table. The duration of the tasks is given in days.
 Draw the network
 Determine the critical path
 Calculate early start and late finish.

Calculate the total float for every event.

Task	Α	В	С	D	Е	F	G	Н	Ι	J	K
	1–2	1–3	1–4	2–5	3–5	3–6	3–7	4–6	5-7	6–8	7-8
Duration	2	7	8	3	6	10	4	6	2	5	6

- 4B)Solve the following Linear Programming Problem using the graphical method.
Maximize $Z=100X_1+60X_2$
Subject to: $5X_1+10X_2 \le 50$; $8X_1+2X_2 \ge 16$; $3X_1-2X_2 \ge 6$; $X_1, X_2 \ge 0$.(4)4C)Graphically illustrate the project time -project cost trade-off.(2)
- 5A) An airline that operates seven days a week has the timetable shown below. Crews must (4) have a minimum layover of 4 hours between flights and should not be more than 24 hours. Obtain the pairing of flights that minimizes layover time away from the house. Obtain the pairing of flights that minimizes layover time away from the house. For any given pairing, the crew will be based in the city which results in a smaller layover. For each pair mention the town where the crew should be based. Obtain the opportunity

(2)

(4)

(4)

(2)

(4)

MME 3156

matrices based on waiting time at both locations.

	City 1 to City 2	2	City 2 to City 1			
Flight No.	Departure	Arrival	Flight No.	Departure	Arrival	
1	14.15	20.15	101	8.20	8.30	
2	9.30	19.20	102	13.30	13.15	
3	6.45	15.30	103	7.45	17.30	

5B)

Customers arrive to an ATM with an interarrival time (in minutes) of 0, 10, 3, 8, 20, 4 and service time (in minutes) of 8, 7, 12, 5, 6, 3 respectively for the first six customers. Develop the simulation table for six customers and determine:

- Average waiting time
- Average time customer spends in system
- Percentage of idle server

5C) Describe the elements of a queuing system.

(2)

(4)

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