

7E7013

B.Tech. VII Semester (Main&Back) Examination, Nov. - 2019
Mechanical Engineering
7ME3A Operations Research

Time : 3 Hours

Maximum Marks : 80

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Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during the examination. (Mentioned in form No. 205)

1. Graph Paper. 2.Normal Distribution Table.

Unit - I

1. A manufacturer produces four products, A,B,C,and D, by using two types of machines (lathes and milling machines). The times required on the two machines to manufacture 1 unit of each of the four products, the profit per unit of the product, and the total time available on the two types of machines per day are given below :

Machine	Time required per unit (min) for product				Total time available per day (min)
	A	B	C	D	
Lathe machine	7	10	4	9	1200
Milling machine	3	40	1	1	800
Profit per unit (Rs)	45	100	30	50	

Find the number of units to be manufactured of each product per day for maximizing the profit using simplex method.

(16)

OR

1. A product is produced by four factories A, B, C and D. The unit production costs in them are Rs. 2, Rs 3, Rs 1, Rs 5 respectively. Their production capacities are Factory A - 50 units, Factory B - 70 units, Factory C - 30 units, Factory D - 50 units. These factories supply product to four stores, demands of which are 25, 35, 105, 20 units respectively. Unit transportation cost in rupees from each factory to each store is given below :

		Stores			
		S ₁	S ₂	S ₃	S ₄
Factories	A	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each factory to each store so that total production and transportation costs are minimized. (16)

Unit - II

2. Solve the following problem using Integer linear programming :

Maximize $Z = 5X_1 + 7X_2$

Subject to :

$-2X_1 + 3X_2 \leq 6$
 $6X_1 + 2X_2 \leq 30$

where $X_1, X_2 \geq 0$ and integers. (16)

OR

2. a) Machine A costs Rs. 9,000. Annual operating costs are Rs 200 for the first year, and then increases by Rs 2000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? Assume that the machine has no resale value when replaced and that future costs are not discounted. (8)

b) Machine B costs Rs 10,000. Annual operating costs are Rs 400 for the first year, and then increases by Rs 800 every year. You have now a machine of type A which is one year old. Should you replace it with machine B and if so, when? (8)

Unit - III

3. A bank has only one typist. Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with a mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8 - hour work day. If the type writer is valued at Rs. 1.50 per hour, determine
- a) Equipment utilization (4)
 - b) The percent time that an arriving letter has to wait. (4)
 - c) Average system time (4)
 - d) Average cost due to waiting on the part of the typewriter. (4)

OR

3. For the following payoff matrix, transform the zero - sum game into an equivalent linear programming problem and solve it by using the simplex method. (16)

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	-1	3
	A_2	3	5	-3
	A_3	6	2	-2

Unit - IV

4. A food product company is contemplating the introduction of a revolutionary product with new packaging or replacing the existing product at much higher price (S_1). It may even make a moderate change in the composition of the existing product, with a new packaging at a small increase in price (S_2) or may make a small change in composition of the existing product, backing it with the word 'New' and a negligible increase in price (S_3). The three possible states of nature or events are:
- i) High increase in sales (N_1)
 - ii) No change in sales (N_2)
 - iii) Decrease in Sales (N_3).

The marketing department of the company worked out the payoff in terms of yearly net profits for each strategy of three events as :

Pay off Table			
Strategies/alternatives	States of Nature		
	N1	N2	N3
S1	7,00,000	3,00,000	1,50,000
S2	5,00,000	4,50,000	0
S3	3,00,000	3,00,000	3,00,000

Which strategy should be the concerned executive choose on the basis of :

- Maximin criteria (4)
- Maximax criteria (4)
- Minimax regret criteria (4)
- Laplace criteria? (4)

OR

4. A toy manufacturer uses 48,000 rubber wheels per year for its popular dump truck series. The firm makes its own wheel which it can produce at a rate 800 per day. The toy trucks are assembled uniformly over the entire year. Carrying cost is Rs 1/- per wheel a year. Setup costs for a production run of wheel is Rs 45/-. The firm operates 240 days per year. Determine each of the following. C₃

- The optimum run size. (4)
- The minimum total annual cost for carrying and setup. (4)
- The cycle time for the optimum run size. (4)
- The run time. (4)

Unit - V

- The housekeeping department of a motel uses approximately 400 washcloths per day. The actual number tends to vary with the number of guests on any given night. Usage can be approximated by a normal distribution that has a mean of 400 and a standard deviation of nine washcloths per day. A linen supply company delivers towels and washcloths with a lead time of three days. If the motel policy is to maintain a stockout risk of 2 percent, what is the minimum number of wash cloths that must be on hand at recorder time, and how much of that amount can be considered safety stock? (16)

OR

- How simulation can be used in decision making? Explain with suitable example. (8)
- Explain the various methods for generation of random numbers with examples? (8)