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S.No. 6857

P 16 MAE 4 B

(For candidates admitted from 2016–2021 Batch)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Mathematics – Elective

ADVANCED OPERATIONS RESEARCH

Time : Three hours

Maximum : 75 marks

PART A — (10 × 2 = 20)

Answer ALL the questions.

1. Define mixed integer program.
2. Define set covering problem.
3. Define characteristics of Dynamic programming.
4. Write the recursive equations of the backward formulation.
5. Define payoff matrix.
6. Define saddle point of the game.
7. Define continuous review.
8. Define lead time.

9. Write short notes on the steepest ascent method.

10. Define quadratic programming.

PART B — (5 × 5 = 25)

Answer ALL questions, choosing either (a) or (b).

11. (a) Explain Branch and Bound Algorithm.

Or

(b) Solve the problem

Maximize : $Z = 7x_1 + 10x_2$

Subject to : $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_1, x_2 \geq 0$ and integer.

using cutting – plane algorithm.

12. (a) Solve the problem

Maximize : $Z = 8x_1 + 7x_2$

Subject to : $2x_1 + x_2 \leq 8$

$5x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

by using forward computational method.

Or

- (b) Solve the problem

$$\text{Maximize : } Z = 50x_1 + 100x_2$$

$$\text{Subject to : } 10x_1 + 5x_2 \leq 2500$$

$$4x_1 + 10x_2 \leq 2000$$

$$x_1 + \frac{3}{2}x_2 \leq 450$$

by using forward computational method.

13. (a) Solve graphically

$$I$$
$$\begin{bmatrix} 2 & 2 & 3 & -1 \\ 4 & 3 & 2 & 6 \end{bmatrix}$$

Or

- (b) Obtain the optimal strategies for both-persons and the value of the game for zero sum two person game whose payoff matrix is as follows

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & -1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

14. (a) Explain multi-Item EOQ with storage limitation.

Or

- (b) Lubecar specializes in fact automobile oil change. The garage buys car oil in bulk at \$3 per gallon discounted to \$ 2.50 per gallon if the order quantity is more than 1000 gallons. The garage services approximately 150 cars. per day and each oil change takes 1.25 gallons. Lubecar stores bulk oil at the cost of \$ 0.02 per gallon per day. Also, the cost of placing an order is \$ 20. There is a 2 day lead time for delivery. Determine the optimal inventory policy.

15. (a) Explain direct search method.

Or

- (b) Solve the following problem using Dichotomous methods.

$$\text{Maximize : } f(x) = \begin{cases} 3x & , 0 \leq x \leq 2 \\ \frac{1}{3}(-x + 20) & , 2 \leq x \leq 3 \end{cases}$$

PART C — ($3 \times 10 = 30$)

Answer any THREE questions.

16. Solve the problem

$$\text{Maximize : } Z = 2x_1 + 8x_2$$

$$\text{Subject to : } 2x_1 - 6x_2 \leq 3$$

$$-x_1 + 4x_2 \leq 5$$

$$2x_1 + 2x_2 \leq 13$$

$$x_1, x_2 \geq 0 \text{ and integer}$$

Use Branch and Bound method.

17. A vessel is to be loaded with stocks of 3 items each unit of item i has a weight w_i and value r_i . The maximum cargo weight the vessel can take is 5 and the details of three items are as follows.

i	w_i	r_i
1	1	30
2	3	80
3	2	65

Using dynamic programming.

18. Solve the game whose payoff matrix is given below.

	B_1	B_2	B_3	B_4
A_1	4	-2	3	-1
A_2	-1	2	0	1
A_3	-2	1	-2	0

19. Find the optimal inventory policy for the following 6-period inventory situation.

Period	D_i (units)	k_i (\$)	h_i (\$)
1	10	20	1
2	15	17	1
3	7	10	1
4	20	18	3
5	13	5	1
6	25	50	1

The unit production cost is \$ 2 for all the periods.

20. Solve the problem

$$\text{Maximize : } Z = x_1 + x_2^4$$

$$\text{Subject to : } 3x_1 + 2x_2^2 \leq 9$$

$$x_1, x_2 \geq 0.$$

Use separable programming algorithm to the non-linear programming problem.