(7 pages)

S.No. 3154   **P 16 MAE 4 B**

(For candidates admitted from 2016–2017 onwards)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2022.

Mathematics – Elective

ADVANCED OPERATIONS RESEARCH

Time : Three hours   Maximum : 75 marks

PART A — (10 × 2 = 20)

Answer ALL the questions.

1. Define Integer Linear programming.

2. What are the two methods developed for generating the special constraints in Integer linear programming.

3. What is meant by Dynamic programming?

4. What is referred as the curse of dimensionality?

5. What is known as the analytic hierarchy approach?

6. Define a two-person zero-sum game.

7. What is effective lead time in inventory model?

8. State the assumptions made in No-setup model.

9. When a function is said to be separable?

10. Define a general constrained nonlinear programming.

PART B — (5 × 5 = 25)

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

11. (a) Five projects are being evaluated over a 3-year planning horizon. The following table gives the expected returns for each project and the associated yearly expenditures.

Project	Expenditures (million Rs)/yr.			Returns (million Rs)
	1	2	3	
1	5	1	8	20
2	4	7	10	40
3	3	9	2	20
4	7	4	1	15
5	8	6	10	30
Available funds (million Rs)	25	25	25	

Determine the projects to be executed over the 3-year horizon.

Or

(b) Solve the following Integer linear programming problem.

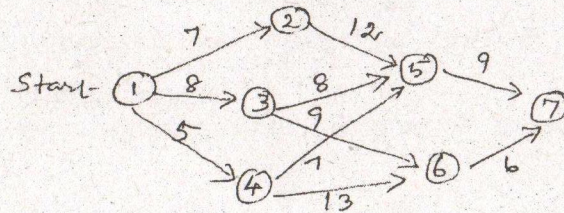Maximize $z = 5x_1 + 4x_2$

Subject to $x_1 + x_2 \leq 5$
$$10x_1 + 6x_2 \leq 45$$

$x_1, x_2 \geq 0$ and integer.

12. (a) Select the shortest highway route between two cities from the following network. This network provides the possible routes between the starting city at node 1 and destination city at node 7. The route pass through intermediate cities designated by node 2 to 6.

Or

(b) Explain cargo-Loading model.

13. (a) Explain consistency of the comparison matrix.

Or

(b) Find the value of following 2×4 games whose payoff for plays A is

	B_1	B_2	B_3	B_4
A_1	2	2	3	−1
A_2	4	3	2	6

14. (a) The owner of a newsstand wants to determine the number of USA now newspapers that must be stocked at the start of each day. It costs 30 cents to buy a copy and owner sells it for 75 cents. The sale of the newspaper typically occurs between 7.00 at 8.00 A.M. Newspaper left at the end of the day are recycled for an income of 5 cents a copy. How many copies should the owner stock every morning, assuming that the demand for the day can be described as

(i) A normal distribution with mean 300 copies and standard deviation 20 copies.

(ii) A discrete pdf $f(D)$, define as

D	200	220	300	320	340
$f(D)$	0.1	0.2	0.4	0.2	0.1

Or

(b) Explain setup model (s-S policy)

15. (a) Solve the following by assuming that $\Delta = 0.001$

$$\text{maximize } f(x) = \begin{cases} 3x, & 0 \le x \le 2 \\ \dfrac{-x}{3} + \dfrac{20}{3}, & 2 \le x \le 3 \end{cases}$$

by dichotomons search method.

Or

(b) Solve the following problem by geometric programming;

Minimize $z = 5x_1 x_2^{-1} + 2x_1^{-1} x_2 + 5x_1 + x_2^{-1}$

PART C — (3 × 10 = 30)

Answer any THREE questions.

16. The daily production schedule at the Rainbow company includes batches of White (W), Yellow (Y), Red (R) and Black (B) paints. The following table summarises the clean-up time in minutes when the row-designated color is followed by the column-designated color. Determine the optimal sequencing for the daily production of the four colors that will minimize the associated total clean up time.

Cleanup min given next paint is

Current paint	White	Yellow	Black	Red
White	α	10	17	15
Yellow	20	α	19	18
Black	50	44	α	25
Red	45	40	20	α

17. A construction contractor estimates that the size of the work force needed over the next 5 weeks to be 5, 7, 8, 4 and 6 workers, respectively. Excess labor kept on the force will cost Rs. 300 per worker per week and new hiring in any week will incur a fixed cost of Rs. 400 plus Rs. 200 per worker per week. Determine the optimum solution to the above problem.

18. Solve the following game by linear programming.

	B1	B2	B3	Row min
A1	3	−1	−3	−3
A2	−2	4	−1	−2
A3	−5	−6	2	−6
Column max	3	4	2	

19. Electro uses resin in its manufacturing process at the rate of 1,000 gallons per month. It cost Electro Rs. 100 to place an order for a new shipment. The holding cost per gallon per month is Rs. 2 ; and the shortage cost per gallon is Rs. 10. Historical data show that the demand during lead time is uniform over the range (0, 100) gallons. Determine the optimal ordering policy for Electro.

20. Solve the following problem by the linear combinations method:

Maximize $f(x) = 4x_1 + 6x_2 - 2x_1^2 - 2x_1 x_2 - x_2^2$

Subject to $x_1 + 2x_2 \leq 2$

$x_1, x_2 \geq 0$

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