

## MSc Sem.-2 Examination

408

AMS

Time : 2-30 Hours]

May-2025

[Max. Marks : 70

**Instructions:** All questions are compulsory. Use of a non-programmable scientific calculator is allowed.

- Q.1 (a) Solve the following game graphically. (07)

		Player B		
		$B_1$	$B_2$	$B_3$
Player A	$A_1$	-4	3	-1
	$A_2$	6	-4	-2

- (b) A newspaper boy has the following probability of selling a magazine. Cost of the copy is Rs. 0.30 and the sale price is Rs. 50. He cannot return unsold copies. How many copies can he order? (07)

No. of copies sold	Probability
10	0.10
11	0.15
12	0.20
13	0.25
15	0.30
Total	1.00

OR

- (a) A business manager wants to decide whether to replace certain equipment in the first year or in the second year or not replace at all. The payoffs are shown below. Draw a decision tree to decide the strategy. (07)

Profits or Payoffs in Rupees			
Strategy	First year	Second year	Total
A Replace now	4000	6000	10000
B Replace after one year	5000	4000	9000
C Do not replace	5000	3000	8000

- (b) Find value of the following 2 player game. (07)

		Player B	
		$B_1$	$B_2$
Player A	$A_1$	6	9
	$A_2$	8	4

- Q.2 (a) Compute the Hessian of  $f(x, y) = 5x^2 + xy^3 + y^2$  at the point (0,1) (07)

- (b) Maximize  $z = 2x_1 + 3x_2$  subject to  $x_1^2 + x_2^2 \leq 20$ ,  $x_1x_2 \leq 8$  and  $x_1, x_2 \geq 0$ . (07)

OR

(a) Optimize  $Z = x_1^2 + x_2^2 + x_3^2$  (07)  
 Subject to,  $4x_1 + x_2^2 + 2x_3 = 14$   $x_1, x_2, x_3 \geq 0$

(b) Linearize (Only) the following QP-problem by Wolfe's method (07)  
 Minimize  $z = x_1^2 - x_1x_2 + 2x_2^2 - x_1 - x_2$   
 Subject to constraints:  $2x_1 + x_2 \leq 1, x_1, x_2 \geq 0$

Q.3 (a) Solve the following Goal programming problem using Graphical method, (07)  
 Minimize  $F = u + v$   
 Subject to  $120x_1 + 60x_2 + u - v = 720; x_1 \leq 10; x_2 \leq 9;$   
 $x_1, x_2, u, v \geq 0$ , such that  $u$  or  $v$  or both equal to zero.

(b) Use modified simplex method to solve the following GP problem, (compute up to second iteration table only) (07)  
 Minimize  $Z = P_1d_1^- + P_2(2d_2^- + d_3^-) + P_3d_1^+$   
 Subject to the constrains  $x_1 + x_2 + d_1^- - d_1^+ = 400, x_1 + d_2^- = 240, x_2 + d_3^- = 300$   
 and  $x_1, x_2, d_1^-, d_1^+, d_2^-, d_3^- \geq 0$ .

OR

(a) A factory manufacturer two products, A and B. The profit on one unit of A is 150 rupees and one unit of B is 75 Rupees. The maximum demand of A is 15 units per week and of B it is 10 units per week. The manufacturer has set up a goal of achieving a profit of 1500 per week. Formulate the problem Goal programming and solve it using graphical method. (07)

(b) Solve the following Goal programming problem using simplex method (calculate up to second iteration table only): (07)  
 Minimize  $F = u + v$   
 Subject to  $80x_1 + 40x_2 + u - v = 640; x_1 \leq 6; x_2 \leq 8;$   
 $x_1, x_2, u, v \geq 0$ , such that  $u$  or  $v$  or both equal to zero.

Q.4 (a) Write down the state variables and the recursive formula for the given DP. (07)  
 Find max  $z = y_1 \cdot y_2 \cdot y_3$  subject to constraint,  $y_1 + 2y_2 + y_3 = 10$  and  $y_j \geq 0$ ,  
 $j = 1, 2, 3$

- (b) A firm has divided its marketing area into three zones. The amount of sales depends on the number of salesmen in each zone. The firm has been collecting the data regarding sales and salesmen in each area over a number of past years and has summarized in the following table. The firm currently has only 9 salesmen, and the problem is to allocate the salesmen to three different zones so that the total sales are maximum. Use backward propagation to find the solution at the end of Stage 2. (07)

	1	2	3
0	30	35	42
1	45	45	54
2	60	52	60
3	70	64	70
4	79	72	82
5	90	82	95
6	98	93	102
7	105	98	110
8	100	100	110
9	90	100	110

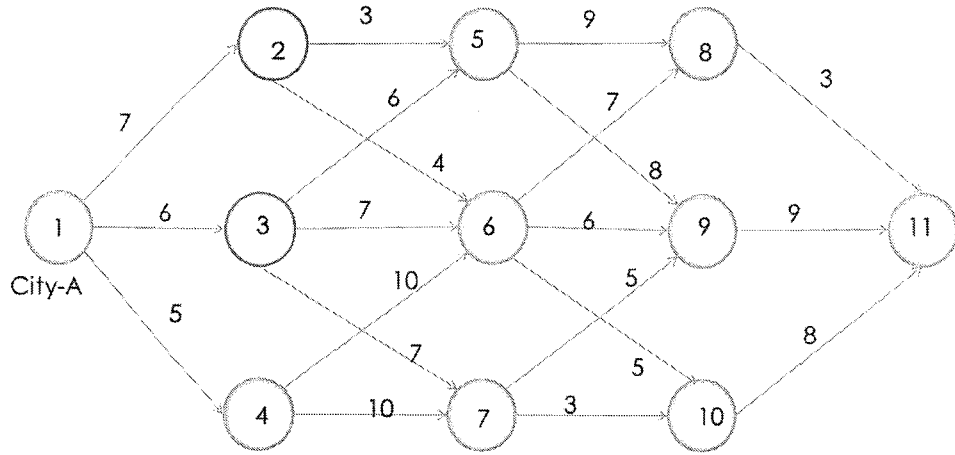
OR

- (a) A company has decided to plan an event in three phases. A total of Rs. 5 million has been budgeted for this event. The expected values for this phase's money spent are given below. How should the money be allocated at the end of the second phase to maximize the profit of this event? (07)

Money Spent (in millions)	Profit in each phase (in Rs.)		
	Phase 1	Phase 2	Phase 3
0	0	0.30	0.50
1	10	0.50	0.70
2	15	0.70	0.85
3	22	0.80	0.90
4	27	0.85	0.93
5	30	0.90	0.95

- (b) A salesman is located in a city named 'A'. He decided to travel to the city named 'B'. He is aware of the distances of alternative routes from city A to city B. He has the diagram of the routes from 'A' to 'B' with cities in between. The city of origin A is city 1. The destination city B is 11. Find the shortest path from city A to B. (According to the diagram, the distances have been given in Kms. (07)

(P.T.O)



Q.5 Attempt any SEVEN out of TWELVE:

(14)

(1) Which strategies player A and player B will play to optimize their gain

		Player B		
		$B_1$	$B_2$	$B_3$
Player A	$A_1$	3	2	-2
	$A_2$	1	-3	-4
	$A_3$	0	1	-3

- (a)  $A_1, B_1$
- (b)  $A_3, B_1$
- (c)  $A_1, B_3$
- (d)  $A_2, B_3$

(2) Payoff matrix for a problem is given below. Select the optimal strategy using criterion of pessimism (Maximin method).

		State of Nature		
		$N_1$	$N_2$	$N_3$
Strategies	$A_1$	15	12	18
	$A_2$	9	14	10
	$A_3$	13	4	26
	$A_4$	5	10	16

- (a)  $A_1$
- (b)  $A_2$
- (c)  $A_3$
- (d)  $A_4$

(3)

		Player B		
Player A	$A_1$	2	-3	0
	$A_2$	-1	5	2
	$A_3$	5	0	1

Identify the row dominance in the above pay-off matrix

- (a) First row dominates over third row
- (b) First row dominates over second row
- (c) second row dominates over first row
- (d) Third row dominates over first row

- (4) The Hessian matrix of the Lagrange function  $H(L(x,y,z, \lambda^*))$  is given by

$$H(L(x,y,z, \lambda^*)) = \begin{bmatrix} -1 & 2 & 0 \\ 2 & -5 & 0 \\ 0 & 0 & -4 \end{bmatrix}$$

then a stationary point is \_\_\_\_\_

- (a) maximum  
 (b) minimum  
 (c) none of the above  
 (d) both (a) and (b)
- (5) In quadratic programming problem  $\mu_j x_j = 0$  and  $\lambda_i s_i = 0$  are called  
 (a) Complementary slackness condition  
 (b) Complementary surplus condition  
 (c) Randomized slackness condition  
 (d) Randomized surplus condition
- (6) Discuss the definiteness for the given  $Q = \begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix}$ .
- (7) Select the correct statement from below  
 (a) The deviational variable  $d_i^+$  (called surplus variable) is removed from the objective function of GP when overachievement is acceptable.  
 (b) If overachievement is acceptable,  $d_i^-$  (called slack variable) is removed from the objective function of the GP.  
 (c) If underachievement is acceptable,  $d_i^-$  (called slack variable) is added to the objective function of the GP.  
 (d) The deviational variable  $d_i^+$  (called surplus variable) is added to the objective function of GP when overachievement is acceptable.
- (8) In goal programming, the main objective is to:  
 (a) Maximize profit subject to constraints  
 (b) Minimize cost and maximize profit simultaneously  
 (c) Achieving multiple goals by minimizing deviations from the set targets  
 (d) Solving nonlinear optimization problems
- (9) Which of the following statements is **true** about the deviational variables used in goal programming?  
 (a) Positive deviational variables represent overachievement of a goal.  
 (b) Negative deviational variables represent underachievement of a goal.  
 (c) Deviational variables are used only in transportation problems.  
 (d) Both A and B

(P.T.O)

(10) Here  $\min z = y_1^2 + y_2^2 + y_3^2$  How many stages problem?

- (a) 3 - Stage
- (b) 2 - stage
- (c) single stage
- (d) none

(11) How many allocations can be made for the following stage?

Decision $x_1$ States $s$	0	1	2	3	4	5	6	Optimal Return $f^*(s)$	Optimal Decision $x^*$
6	108	123	129	126	116	102	72	129	2

- (a) 1
- (b) 4
- (c) 3
- (d) 2

(12) In a T20 match, what should be the stage?

- (a) runs in overs. 0-5, 5-10, 10-15, 15-20.
- (b) number of players.
- (c) Both (a) & (b).
- (d) None of the above.

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