

Time: 2:30 hrs

Total marks: 75

- Note:
1. All questions are compulsory.
 2. Only simple calculators are allowed.

Q.1[a] Fill in the blanks. [Attempt any 8] [8]

- i. _____ is the maximum amount that should be spent on market research to obtained perfect information about occurrence of state of nature.
- ii. In _____ method allocations are done from top left side corner of transportation table.
- iii. _____ represent the revenue or profit associated with a particular course of action.
- iv. Replacement ratio $[\theta]$ is given by formula _____
- v. IFS by _____ method give lowest transportation cost.
- vi. _____ is the difference between two lowest costs for a row or a column.
- vii. In case of simplex if there is tie between minimum positive θ , then there is _____ in solution.
- viii. _____ method is used for solving assignment problems.
- xi. _____ occurs when number of allocations in the solution is not equal to $m+n-1$.
- x. _____ problem is unbalance if total supply is not equal to total demand.

Q.1[b] Define the following terms.[Attempt any 7] [7]

- | | |
|------------------------------------|---------------------------------|
| 1. Constraints | 6. Decision theory |
| 2. Risk | 7. EMV |
| 3. Optimal solution | 8. Unbalance assignment problem |
| 4. Key row in simplex table. | 9. Penalty |
| 5. Infeasible solution in simplex. | 10. Artificial variable |

Q.2[a] Following pay off matrix represents four actions A_1, A_2, A_3, A_4 and four events E_1, E_2, E_3 and E_4 . [7]

Events	Strategies			
	S1	S2	S3	S4
N1(0.2)	100	-50	-200	-350
N2(0.3)	100	200	50	-100
N3(0.4)	100	200	300	150
N4(0.1)	100	200	300	400

- i. Find Optimal decision using EMV technique
- ii. Find EPPI
- iii. Find maximum amount that can be spent on market research for gathering perfect information.

- [b] A company has choice of launching any one of the three variant of Noodles— Yummy , Oats flavour ,ragi. Demand in market are High, Moderate and low [8]

Demand	Product Variant		
	Yummy	Oats	Ragi
High	30	40	55
Moderate	10	15	20
Low	10	5	3

Find appropriate decision for each of the following criteria
Maximin, maximax, Laplace, Hurwitz(alpha = 0.8)

OR

- Q.2[p] A company wants to launch any one out of two models of a product called "Exotic" and "Natural". The possible market demand levels are 50,000, 40,000, 20,000 and 5,000 units. Possible pay off (in Rs.) for both models under each demand are given below: [7]

Demand(in units)	Exotic	Natural
50,000	60,000	45,000
40,000	50,000	40,000
20,000	20,000	25,000
5,000	10,000	15,000

Identify which model company should launch using Maximin , Hurwitz alpha criteria (alpha= 0.7) and Minimax regret criteria.

- Q.2[q] A company is evaluating three alternative single period investment opportunities whose returns are based on state of economy fair, good and excellent and associated probabilities are 0.20,0.40 and 0.40 The returns in rupees for each investment opportunity and each state of economy are as follows: [8]

Alternatives	State of Economy		
	Fair	Good	Excellent
A ₁	80	50	-25
A ₂	70	45	-10
A ₃	50	40	0

Construct decision tree and find best alternative for investment.

- Q3[a] Solve following LPP by graphical method [7]

Maximize $z = 40x + 80y$

Subject to

$$2x + 3y \leq 48$$

$$x \leq 15$$

$$y \leq 10$$

$$\text{where } x, y \geq 0$$

- [b] Solve the following LPP by simplex method [8]

Minimize $z = 25x + 30y$

Subject to

$$4x + 3y \geq 60$$

$$2x + 3y \geq 36$$

$$\text{where } x, y \geq 0$$

OR

- Q.3[p] Solve following LPP by graphical method [7]

Minimize $z = 2x + 4y$

Subject to

$$6x + y \geq 18$$

[q] Solve following LPP by simplex method [8]

Maximize $z = 4x + 3y$

Subject to

$x + y \leq 50$

$x + 2y \leq 80$

$3x + 2y \leq 140$

where $x, y \geq 0$

Q.4[a] A company has 3 plants A, B, C with capacities of 152, 164 and 154 units. They supply to 3 warehouses P, Q and R with demand of 144, 204, and 82 units. Find IFS by VAM and optimum solution by MODI method. [8]

Plants	Warehouses		
	P	Q	R
A	16	24	24
B	48	72	48
C	24	48	72

[b] A company has 3 plants P1, P2, P3 with capacities 300, 250 and 150 units. It supplies to three warehouses W1, W2, W3 with demand of 250, 250 and 200 units. Profit per unit from each plant to each warehouse is given in Rs. Find optimal solution and optimal profit. [7]

Plants	Warehouses		
	W1	W2	W3
P1	20	32	28
P2	24	35	26
P3	27	29	31

OR

Q.4[p] There are 3 plants A, B, C. They supply to 4 warehouses w1, w2, w3, and w4. Cost per unit and demand-supply data is as given below. Find optimal transportation schedule. [8]

Plants	Warehouses				Capacity
	W1	W2	W3	W4	
A	10	12	9	6	70
B	7	3	7	7	60
C	6	6	9	11	90
Demand	60	40	60	20	

[q] Consider the given IFS and answer the following questions [7]

WH Plant	W1	W2	W3	W4	Supply
P1	6	3	5	4	22
P2	5	9	2	7	15
P3	5	7	8	6	8
Demand	7	12	17	9	

- Is the solution degenerate?
- Is the solution optimal?
- Find optimal transportation schedule.

Q.5[a] A five star Hotel, which has four banquet halls used for function. The halls are of same size but with varying facilities. 4 parties approached to reserved a hall for a function on the same day. These parties were told that first choice among these halls would cost Rs. 10,000 for the day. They were told to indicate the 2nd, 3rd and 4th preferences and the price they would be willing to pay. Two parties A and D told that they were not interest in halls 3 and 4. The following table shows preference wise income details. What would be the optimal assignment to maximize total revenue.

[8]

Parties	1	2	3	4
A	10	9	--	--
B	8	10	8	5
C	7	10	6	8
D	10	8	--	--

[b] A company has 4 districts I, II, III and IV to sell its product and 4 salesmen A, B, C and D for it. District wise sales record of each salesmen is as given in the table. Determine the area allocation so as to make the sales maximum. What will be total maximum sale?

[7]

Salesman	Districts			
	I	II	III	IV
A	420	350	280	210
B	300	250	200	150
C	300	250	200	150
D	240	200	160	120

OR

Q.5[p] In a factory there are 5 employees and 5 jobs are to be done on a one to one basis. Time required (in minutes) is given for each employee-Job combination. Find optimal assignment of Employees and jobs to minimize total time.

[5]

Job \ Emp.	P	Q	R	S	T
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

[q] Vitamins A and B are found in foods F_1 and F_2 . One unit of food F_1 contains 3 units of Vitamins A and 4 units of Vitamins B. One unit of food F_2 contains 6 units of Vitamins A and 3 units of Vitamins B. One unit of food F_1 and F_2 cost 4 and Rs. 5 respectively. The minimum daily requirement for a person of Vitamins A and B is 80 and 100 units respectively. Assuming that anything in excess of the daily minimum requirements of the Vitamins is not harmful, formulate the given L.P.P.

[5]

[r]

A company has 3 factories A, B and C with capacities of 11,13 and 19 units. It has 4 warehouses W1, W2, W3 and W4 with demands of 6,10,12 and 15 units. Unit cost Transportation is given from each factory to each warehouse.

[5]

Plants	Warehouses			
	W1	W2	W3	W4
A	22	20	15	26
B	18	15	12	18
C	10	12	10	15