



LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.B.A. DEGREE EXAMINATION – BUSINESS ADMINISTRATION

FOURTH SEMESTER – APRIL 2025

UBU 4501 – OPERATIONS RESEARCH



Date: 24-04-2025

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION A - K1 (CO1)

Answer ALL the Questions

(10 x 1 = 10)

1. Definitions

- a) Operations Research
- b) Linear Programming Problem (LPP)
- c) Vogel's Approximation Method (VAM)
- d) Assignment Problem
- e) Saddle point

2. True or False

- a) Operation Research aims to provide optimal solutions to complex decision-making problems.
- b) In Linear Programming Problems (LPP), all constraints must be linear equations.
- c) The MODI (Modified Distribution) Method is used to find the initial basic feasible solution.
- d) PERT is suitable for projects with uncertain activity durations
- e) The Maximin-Minimax principle is used in game theory to determine the optimal strategy.

SECTION A - K2 (CO1)

Answer ALL the Questions

(10 x 1 = 10)

3. Fill in the blanks

- a) The _____ solution in LPP satisfies all the given constraints.
- b) The _____ Variable is introduced in a $\leq$ constraint to convert it into an equality.
- c) A _____ transportation problem occurs when total supply equals total demand.
- d) The CPM technique is primarily used in _____ projects to determine the critical path.
- e) The _____ principle is used in two-person zero-sum games to determine optimal strategies.

4. MCQ

- a) _____ is NOT a characteristic of Operations Research.
a) Interdisciplinary approach b) Use of mathematical models c) Emphasis on intuition-based decision-making d) Use of optimization techniques
- b) The graphical method of solving LPP is applicable only when there are:
a) 1 or 2 variables b) 2 or 3 variables c) More than 3 variables d) Any number of variables
- c) _____ is used to find the initial basic feasible solution in transportation problems.
a) Simplex Method b) MODI Method c) North-West Corner Method d) Cutting Plane Method
- d) _____ is the key difference between PERT and CPM.
a) PERT is event-oriented, while CPM is activity-oriented b) PERT is used for deterministic time estimates, while CPM is used for probabilistic time estimates c) PERT ignores uncertainties, while CPM considers them d) None of the above
- e) _____ methods is used to solve two-person zero-sum games with mixed strategies.
a) Simplex Method b) Dominance Method c) Graphical Method d) Both b and c

SECTION B - K3 (CO2)**Answer any TWO of the following in 100 words each.****(2 x 10 = 20)**

5. Discuss the various techniques of Operations Research and their applications.
6. A company produces two types of products: Product x and Product y. The profit per unit for Product x is ₹5 and for Product y is ₹3. The company has the following constraints:
 Material constraint: $4x + 6y \leq 24$
 Labor constraint: $2x + y \leq 6$
 Non-negativity constraint: $x, y \geq 0$
 Solve this LPP using the graphical method to determine the number of products x and y to maximize profit.
7. A company has three warehouses (W1, W2, W3) and three retail stores (S1, S2, S3). The transportation cost per unit is given in the table below. Find the Initial Basic Feasible Solution using the North-West Corner Method.
- | | S1 | S2 | S3 | Supply |
|--------|----|----|----|------------|
| W1 | 2 | 3 | 1 | 50 |
| W2 | 5 | 4 | 8 | 40 |
| W3 | 5 | 6 | 8 | 10 |
| Demand | 20 | 30 | 50 | Total: 100 |
8. A company has four workers (A, B, C, D) and four tasks (T1, T2, T3, T4) to be completed. Each worker can be assigned to only one task, and the costs of assignment are given in the matrix below. Find the optimal assignment using the Hungarian Method.
- | | T1 | T2 | T3 | T4 |
|---|----|----|----|----|
| A | 9 | 2 | 7 | 8 |
| B | 6 | 4 | 3 | 7 |
| C | 5 | 8 | 1 | 8 |
| D | 7 | 6 | 9 | 4 |

SECTION C – K4 (CO3)**Answer any TWO of the following in 100 words each.****(2 x 10 = 20)**

9. Explain the features of Operations Research and its significance in decision-making.
10. Maximize $Z = 3X_1 + 5X_2$
 Subject to constraints:
 $X_1 + 2X_2 \leq 8$
 $2X_1 + 3X_2 \leq 12$
 $X_1, X_2 \geq 0$
 Solve this problem using the Simplex Method.
11. A company needs to transport goods from three warehouses (W1, W2, W3) to three retail stores (S1, S2, S3). The transportation costs per unit are given in the table below. Find the Initial Basic Feasible Solution using the Least Cost Method.
- Transportation Cost Table:
- | | S1 | S2 | S3 | Supply |
|--------------|----|----|----|--------|
| W1 | 3 | 1 | 7 | 50 |
| W2 | 2 | 6 | 5 | 60 |
| W3 | 4 | 2 | 3 | 40 |
| Total Demand | 30 | 40 | 50 | |
12. A company is in competition with another company. The payoff matrix (profit for Company A) is given below. Find the optimal strategy using the Saddle Point (Pure Strategy) Method.
- | Company A (Strategies) | Company B Strategy 1 | Company B Strategy 2 |
|------------------------|----------------------|----------------------|
| A1 | 4 | -3 |
| A2 | 2 | 6 |

SECTION D – K5 (CO4)**Answer any ONE of the following in 250 words****(1 x 20 = 20)**

13. A factory manufactures two types of products: Product X and Product Y. The production constraints and profits are given below:
 Each unit of Product X requires 2 hours of machine time and 3 hours of labor.
 Each unit of Product Y requires 4 hours of machine time and 2 hours of labor.
 The factory has a maximum of 40 machine hours and 36 labor hours available per week.
 The profit per unit of Product X is ₹30, and the profit per unit of Product Y is ₹50.
 Formulate the Linear Programming Problem (LPP) and solve it using the Simplex Method to maximize profit.

14. A company has three factories (F1, F2, F3) and four warehouses (W1, W2, W3, W4). The supply capacities of the factories and the demand requirements of the warehouses are given in the table below. The cost of transporting one unit from each factory to each warehouse is also provided.
 Cost Table (in ₹ per unit)

Factories → Warehouses	W1	W2	W3	W4	Supply
F1	2	3	4	6	50
F2	3	2	5	8	40
F3	4	3	6	7	20
Demand	20	30	50	10	Total = 110

Solve the problem using Vogel's Approximation Method.
 Find the Initial Basic Feasible Solution.

SECTION E – K6 (CO5)**Answer any ONE of the following in 250 words****(1 x 20 = 20)**

15. A project consists of six activities (A, B, C, D, E, F) with given durations and dependencies as shown below. Find the Critical Path and the Project Duration using CPM (Critical Path Method).

Activity Predecessor Duration (Days)

A	-	3
B	A	5
C	A	6
D	B	4
E	C	8
F	D, E	7

16. Consider the following payoff matrix for a two-person zero-sum game. The row player (A) wants to maximize their payoff, while the column player (B) wants to minimize it.

Player A / Player B	B1	B2	B3
A1	2	-1	3
A2	4	2	1
A3	-2	3	2

Find the optimal strategy and value of the game using the following methods:
 Maximin-Minimax Principle & Saddle Point
 Dominance Method
 Mixed Strategy (if required).

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