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| **SESSION** | **FEB-MAR 2025** |
| **PROGRAM** | **MASTER OF BUSINESS ADMINISTRATION (MBA)** |
| **SEMESTER** | **3** |
| **course CODE & NAME** | **doms304 Applications of Operations research** |
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|  |  |

**Assignment Set – 1**

**Q1. A furniture dealer deals only two items viz., tables and chairs. He has to invest Rs.10,000/- and a space to store atmost 60 pieces. A table cost him Rs.500/– and a chair Rs.200/–. He can sell all the items that he buys. He is getting a profit of Rs.50 per table and Rs.15 per chair. Formulate this problem as an LPP, so as to maximize the profit.**

**Ans 1.**

### **LPP Formulation for the Furniture Dealer Problem**

#### **Step 1: Define the Decision Variables**

Let: = number of tables to be bought = number of chairs to be bought

#### **Step 2: Objective Function (Profit Maximization)**

The dealer earns:

* Rs. 50 profit per table
* Rs. 15 profit per chair

So, the total profit (Z) is:

or maximizing the profit for the furniture dealer.

Its Half solved only

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**Q2. Discuss the assumptions of linear programming.**

**Ans 2.**

**Assumptions of Linear Programming**

**Linear Programming**

Linear Programming (LP) is a mathematical technique used for optimal allocation of limited resources to achieve a specific objective, such as maximizing profit or minimizing cost. It is widely applied in business, manufacturing, logistics, and other operational areas where decision-making involves constraints. However, the accuracy and effectiveness of a linear programming model depend on several underlying assumptions. These assumptions simplify real-world problems into a solvable linear structure and help define the boundaries within

**Q3. Solve the following LPP using simplex method.**

**Maximize Z = 70x1 + 50x2**

**Subject to: 4x1 + 3x2 ≤ 240**

**2x1 + x2 ≤ 100**

**and x1, x2 ≥ 0**

**Ans 3.**

Problem is

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Max Z | = |  | 70 | x1 | + | 50 | x2 | |
| subject to |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | 4 | x1 | + | 3 | x2 | ≤ | 240 | |  | 2 | x1 | + |  | x2 | ≤ | 100 | |
| and x1,x2≥0; |

**The problem is converted to canonical form by adding slack, surplus and artificial variables as appropiate**

1. As the constraint-1 is of type '≤' we should add slack variable S1

2. As the constraint-2 is of type '≤' we should add slack variable S2

After introducing slack variables

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Max Z | = |  | 70 | x1 | + | 50 | x2 | + | 0 | S1 | + | 0 | S2 | |
| subject to |

**Assignment Set – 2**

**4. A computer centre has four expert programmers and need to develop four application programmes. The head of the computer centre, estimates the computer time(in minutes) required by the respective experts to develop the application programmes as follows:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Programmes** | | | | |
| **Programmers** | **A** | **B** | **C** | **D** |
| **I** | **120** | **100** | **80** | **90** |
| **II** | **80** | **90** | **110** | **70** |
| **III** | **110** | **140** | **120** | **100** |
| **IV** | **90** | **90** | **80** | **90** |

**Ans 4.**

**Problem:**

We are given a cost matrix (in minutes) representing the time each programmer takes to develop each program:

| **Programmers** | **A** | **B** | **C** | **D** |
| --- | --- | --- | --- | --- |
| **I** | 120 | 100 | 80 | 90 |
| **II** | 80 | 90 | 110 | 70 |
| **III** | 110 | 140 | 120 | 100 |
| **IV** | 90 | 90 | 80 | 90 |

### **Step 1: Row Reduction**

Subtract the minimum value in each row from every element in that row.

* Row I → Min = 80 → [40, 20, 0, 10]

**Q5. Explain the economic interpretation of duality.**

**Ans 5.**

**Economic Interpretation of Duality in Linear Programming**

**Linear Programming**

Duality is an essential concept in linear programming that connects every linear programming problem (called the primal) with another associated problem (called the dual). While the primal problem focuses on optimizing an objective function—such as maximizing profit or minimizing cost—the dual provides a complementary perspective that interprets the value of resources or constraints in the primal. Every constraint in the primal corresponds to a variable in the dual, and every variable in the primal corresponds to a constraint in the dual. This dual

**Q6. Find out the optimal solution for the following transportation.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **D1** | **D2** | **D3** | **D4** | **Supply** |
| **S1** | **11** | **13** | **17** | **14** | **250** |
| **S2** | **16** | **18** | **14** | **10** | **300** |
| **S3** | **21** | **24** | **13** | **10** | **400** |
| **Demand** | **200** | **225** | **275** | **250** |  |

**Ans 6.**

To solve this transportation problem and find the optimal solution, we will use the following steps:

* Verify balance (supply = demand)
* Initial feasible solution using the Least Cost Method
* Optimality test using the MODI method (u-v method)

### **Step 1: Transportation Table Setup**

| Source → Destination ↓ | D1 | D2 | D3 | D4 | Supply |
| --- | --- | --- | --- | --- | --- |
| **S1** | 11 | 13 | 17 | 14 | 250 |