1. **Transportation Problem: Optimal Shipping Plan**

A logistics company supplies goods from **three warehouses (W1, W2, W3)** to **four retail stores (S1, S2, S3, S4)**. The transportation cost per unit from each warehouse to each store is given in the table below. Each warehouse has a limited supply, and each store has a demand requirement. The goal is to minimize the total transportation cost.

To / From	S1	S2	S3	S4	Supply
W1	4	3	6	5	250
W2	2	5	3	4	300
W3	7	6	4	3	400
Demand	200	200	250	300	

Decision Variables:
Let x_{ij} be the number of units transported from warehouse iii to store j.

Objective Function:
Minimize total transportation cost:

Minimize $Z=4x_{11}+3x_{12}+6x_{13}+5x_{14}+2x_{21}+5x_{22}+3x_{23}+4x_{24}+7x_{31}+6x_{32}+4x_{33}+3x_{34}$

Constraints:

1. **Supply Constraints:**
   - $x_{11}+x_{12}+x_{13}+x_{14}\leq 250$ (Warehouse W1)
   - $x_{21}+x_{22}+x_{23}+x_{24}\leq 300$ (Warehouse W2)
   - $x_{31}+x_{32}+x_{33}+x_{34}\leq 400$ (Warehouse W3)
2. **Demand Constraints:**
   - $x_{11}+x_{21}+x_{31}=200$ (Store S1)
   - $x_{12}+x_{22}+x_{32}=200$ (Store S2)
   - $x_{13}+x_{23}+x_{33}=250$ (Store S3)
   - $x_{14}+x_{24}+x_{34}=300$ (Store S4)
3. **Non-Negativity:** $x_{ij}\geq 0$ for all i, j

2. Manufacturing Problem: Maximizing Profit (Product Mix)
A company produces **two types of products (A and B)** using **two machines (M1 and M2)**. The processing time (in hours per unit) and the profit per unit are given below. The company has a limited number of available hours for each machine. The objective is to maximize profit.

Product	M1 Hours per unit	M2 Hours per unit	Profit per unit ($)
A	3	2	50
B	5	4	80

- **Machine M1** has **600 hours available**.

- **Machine M2** has **500 hours available**.

Decision Variables:
Let x_1 be the number of units of product A produced.
Let x_2 be the number of units of product B produced.

Objective Function:
Maximize profit:

Maximize $Z=50x_1+80x_2$

Constraints:

1) **Machine Time Constraints:**
    a. $3x_1+5x_2 \leq 600$ (M1 capacity)
    b. $2x_1+4x_2 \leq 500$ (M2 capacity)
2) **Non-Negativity:** $x_1, x_2 \geq 0$.

3. Manufacturing Problem: Minimizing Production Cost
A furniture company manufactures **chairs and tables**. The company has **limited resources of wood and labor and wants to minimize the total production cost.**

Product	Wood Required (cubic ft.)	Labor Required (hours)	Cost per unit ($)
Chair	5	2	30
Table	8	3	50

- **Available wood:** 800 cubic feet.
- **Available labor:** 300 hours.

Decision Variables:
Let x_1 be the number of chairs produced.
Let x_2 be the number of tables produced.

Objective Function:
Minimize cost:

Minimize $Z=30x_1+50x_2$

Constraints:

1. **Resource Constraints:**
    - $5x_1+8x_2 \leq 800$ (Wood availability)
    - $2x_1+3x_2 \leq 300$ (Labor availability)
2. **Non-Negativity:** $x_1, x_2 \geq 0$.