

LINEAR PROGRAMMING PROBLEM

(Mathematical formulation)

1. Total passenger demand

D = 40 passengers

Available vehicle types

VEHICLE	CAPACITY	COST
Van (1)	8	200
Minibus (2)	20	350
Bus (3)	50	600
	(passengers)	(€)

2. Decision variables

x_1 = number of passengers transported by vans

x_2 = number of passengers transported by minibuses

x_3 = number of passengers transported by buses

3. Objective function

The goal is to minimize the total transportation cost:

$$\min Z = 200x_1 + 350x_2 + 600x_3$$

4. Demand constraint

At least 40 passengers must be transported:

$$x_1 + x_2 + x_3 \geq 40$$

Capacity constraints

Each vehicle has a maximum capacity:

$$x_1 \leq 8$$

$$x_2 \leq 20$$

$$x_3 \leq 50$$

Non-negativity constraints

$$x_1, x_2, x_3 \geq 0$$

5. Final mathematical model

$$\text{Min } Z = 200x_1 + 350x_2 + 600x_3$$

Subject to:

$$\begin{cases} x_1 + x_2 + x_3 \geq 40 \\ x_1 \leq 8 \\ x_2 \leq 20 \\ x_3 \leq 50 \\ x_1, x_2, x_3 \geq 0 \end{cases}$$

Optimal solution

$$x_1 = 8$$

$$x_2 = 20$$

$$x_3 = 12$$

Minimum cost calculation

$$Z = 200(8) + 350(20) + 600(12)$$

$$Z = 1600 + 7000 + 7200$$

$$Z = 15800$$

Minimum total cost: 15 800 €

the total transportation cost is minimized,
the cheapest vehicles are fully used first.