**Practical work in “Optimisation Methods in Logistics”**

**Topic “Linear Programming”**

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# Problem Statement

Chemical wholesaler has orders for 500 liters of certain liquid to bring to factory Grunberg and 700 liters of same liquid to bring to customer in city Friestad. The company has 1000 liters of this liquid produced at supplier plant in Ersburg and extra 400 liters at plant Orfurd. It costs 0.50 EUR per liter to ship chemical product from Ersburg to Grundberg and 0.55 EUR per liter to ship from Ersburg to Friestad. Also costs to ship from Orfurd to both receiving customers are equal to 0.80 EUR / liter What should be the shipment arrangement to fulfill both orders at the least shipping cost?

# Problem Formalisation

**Decision Variables**

The decision variables represent the amount of liquid shipped from each plant to each destination:

x1 : Liters shipped from Ersburg to Grunberg

x2 : Liters shipped from Ersburg to Friestad

x3 : Liters shipped from Orfurd to Grunberg

x4 : Liters shipped from Orfurd to Friestad

**Goal Function (Objective Function)**

The objective is to minimize the total shipping cost: 0.5x1 + 0.55x2 + 0.8x3 + 0.8x4

This function calculates the total cost of transporting the liquid based on the per-liter cost from each plant to each destination.

**Constraints**

1. Demand Constraints

These constraints ensure that the demand at each destination is met:

- Grunberg’s demand: x1 + x3 = 500

- Friestad’s demand: x2 + x4 = 700

2. Supply Constraints

These constraints ensure that we do not exceed the available supply at each plant:

- Ersburg’s supply limit: x1 + x2 <= 1000

- Orfurd’s supply limit: x3 + x4 <= 400

3. Non-negativity Constraints

These ensure that shipment quantities cannot be negative:

x1, x2, x3, x4 >= 0

# Solution

Assuming we solve this with a linear programming solver, the optimal solution will be:

x1 = 500 liters from Ersburg to Grunberg

x2 = 500 liters from Ersburg to Friestad

x3 = 0 liters from Orfurd to Grunberg

x4 = 200 liters from Orfurd to Friestad

Substitute the values into the cost function:

Total Cost = 0.5(500) + 0.55(500) + 0.8(0) + 0.8(200) = 250 + 275 + 0 + 160 = 685