

Optimization of Chair Production for Maximum Profit

Manufacturing Company

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Problem Summary

A small manufacturing company produces two types of office chairs: **Standard** and **Ergonomic**. The goal is to determine the optimal number of units of each chair to produce next month in order to maximize profit, while respecting production capacity and market constraints.

Profit per Unit

- Standard chair: €30
- Ergonomic chair: €50

Production Capacity

- **Carpentry Department:**
 - Time per Standard chair: 2 hours
 - Time per Ergonomic chair: 3 hours
 - Total available hours: 600 hours
- **Upholstery Department:**
 - Time per Standard chair: 1 hour
 - Time per Ergonomic chair: 2 hours
 - Total available hours: 400 hours

Market and Policy Constraints

- At most 150 Ergonomic chairs can be sold.
- At least 100 Standard chairs must be produced.
- Production quantities cannot be negative.

Mathematical Model

Let:

x = number of Standard chairs produced

y = number of Ergonomic chairs produced

Objective Function

Maximize profit:

$$\max Z = 30x + 50y$$

which is equivalent to minimizing the negative profit:

$$\min -Z = -30x - 50y$$

Constraints

$$\begin{cases} 2x + 3y \leq 600 & \text{(Carpentry hours)} \\ x + 2y \leq 400 & \text{(Upholstery hours)} \\ y \leq 150 & \text{(Demand limit for Ergonomic chairs)} \\ x \geq 100 & \text{(Minimum Standard chairs)} \\ x \geq 0, \quad y \geq 0 & \text{(Non-negativity)} \\ x, y \in \mathbb{Z} & \text{(Integer quantities)} \end{cases}$$

Optimal Solution

The optimal production plan is:

$$x = 102 \quad \text{Standard chairs}$$

$$y = 132 \quad \text{Ergonomic chairs}$$

This yields a maximum profit of:

$$Z = 30(102) + 50(132) = 3060 + 6600 = 9660 \text{ euros}$$

Interpretation

The company should produce 102 Standard chairs and 132 Ergonomic chairs next month to maximize profit while respecting all production and market constraints. This plan fully utilizes the available resources efficiently and meets the demand and policy requirements.