Mathematical Model for Optimal Production of Spare Parts

Parameters

- K: Number of different spare parts
- S: Number of machines capable of making the spare parts
- $Time_{ks}$: Time taken to make spare part k on machine s for $k = 1, 2, \ldots, K$ and $s = 1, 2, \ldots, S$
- $Profit_k$: Profit obtained from making spare part k for $k = 1, 2, \ldots, K$
- $Capacity_s$: Capacity of machine s for the spare parts for $s = 1, 2, \ldots, S$

Decision Variables

- x_k: Quantity of spare part k to produce for $k = 1, 2, \ldots, K$

Objective Function

Maximize the total profit from producing the spare parts:

$$\text{Maximize } Z = \sum_{k=1}^{K} Profit_k \cdot x_k$$

Constraints

1. Quantities of each spare part must be non-negative:

$$x_k \geq 0 \quad \text{for } k = 1, 2, \ldots, K$$

2. Time to produce each spare part must not exceed the available machine time:

$$\sum_{k=1}^{K} Time_{ks} \cdot x_k \leq Capacity_s \quad \text{for } s = 1, 2, \ldots, S$$