Mathematical Model for Food Selection Problem

Parameters

- K: Number of different types of food
- M: Number of nutrients to consider
- $Price_k$: Price of food k for $k = 1, 2, \ldots, K$
- $Demand_m$: Demand for nutrient m for $m = 1, 2, \ldots, M$
- $Nutrition_{k,m}$: Amount of nutrient m in food k for $k = 1, 2, \ldots, K$ and $m = 1, 2, \ldots, M$

Decision Variables

- x_k: Number of units purchased from food type k for $k = 1, 2, \ldots, K$

Objective Function

Minimize the total cost of the foods purchased:

$$\text{Minimize} \quad \sum_{k=1}^{K} Price_k \cdot x_k$$

Constraints

1. The total amount of each nutrient from all food types must meet or exceed the specific demand for that nutrient:

$$\sum_{k=1}^{K} Nutrition_{k,m} \cdot x_k \geq Demand_m \quad \text{for } m = 1, 2, \ldots, M$$

2. The number of units purchased from each food type is non-negative:

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