Datathon 2023

NTT data

November 2023

Contents

1   Supositions

- Price of product in year n is last year's price multiplied by a ratio γ (inflation)

- Central storage center that supplies all hospitals (stores their "almacenable" products)

- Environtmental cost $\quad \propto \quad$ #orders

- Unlimited transit (limited indirectly by maximum capacity of storage center)

- Products are distributed to hospitals in a uniform way (Not exactly: elaborate later)

- Mensual orders

2   Extras

- For products of "transito" we group them by day manually

3 Parameters

> **Note.** Vamos a agrupar las compras de todos los hospitales en una única compra centralizada

Initial definition:

- $I = \{\text{index of product}\}$

Constantes:

- γ: factor multiplicativo del precio de año a año (inflación $+ \dots$)
- c_i: storage cost for a product i (unitary) for a day
- C_{max}^i: maximum quantity of product i that we can store

Precalculados

- $v^i(t)$: consumption velocity of product i at time t
- $\xi^i(t)$: all hospitals unified demand of product i at time t

Constants to change by client:

- β: extra quantity factor in order (resilience)
- P_{max} : # orders $\quad \propto \quad CO_2$ emissions

4 Variables

- $p^i(t)$: quantity of product i demanded at time $t \in \{1, \ldots, 12\}$

- $\delta(t)$: boolean (binary) variable to determine if there is an order at time $t \in \{1, \ldots, 12\}$

5 Restrictions

⚠ **Remark** ⚠. Fijamos i. Ajustamos un modelo para cada producto

Definition 1. We define $S^i(t)$ as the inventory of product i at time t:

$$S^i(t+1) = -\sum_{t'=1}^{t} v^i(t') + \sum_{t'=1}^{t} \delta(t') \cdot p^i(t').$$

Capacity restriction:

$$S^i(t) \leq C_{max}^i.$$

Restriction to verify we have enough inventory

$$S^i(t) + \sum_{t'=1}^{t-1} v^i(t') \geq \beta \cdot \sum_{t'=1}^{t-1} \xi^i(t').$$

Restriction to only do P_{max} orders:

$$\sum_{t=1}^{12} \delta(t) = P_{max}.$$

Basic restricitions:

$$S^i(t) \geq 0$$
$$p^i(t) \geq 0.$$

Restrictions over variables:

$$\delta(t) \in \{0, 1\}.$$

⚠ **Remark** ⚠. ESTO SE DEBE VERIFICAR $\forall t = 1, \ldots, 12$

6 Objetivos

- <u>Minimizar precio</u>

Formula a minimizar:

$$\min \sum_{t} S^i(t) \cdot c_i.$$