

Datathon 2023

NTT data

November 2023

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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)
- Environmental cost \propto #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 + ...)
- 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 \propto CO_2 emissions

4 Variables

- $p^i(t)$: quantity of product i demanded at time $t \in \{1, \dots, 12\}$
- $\delta(t)$: boolean (binary) variable to determine if there is an order at time $t \in \{1, \dots, 12\}$

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 (En el día 2 del mes):

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

Capacity restriction:

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

Restriction to verify we have enough inventory

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

Restriction to only do P_{max} orders:

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

Basic restrictions:

$$\begin{aligned} S^i(t) &\geq 0 \\ p^i(t) &\geq 0. \end{aligned}$$

Restrictions over variables:

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

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

6 Objetivos

- Minimizar precio

Formula a minimizar:

$$\min \sum_t S^i(t) \cdot c_i.$$