

SHOP ORDERING PROBLEM

PARAMETERS AND DECISION VARIABLES:

for simulation in python
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θ : set of products

→ num-products

Δ_i : set of suppliers with product i

→ num-suppliers

T : time period

→ time-period

CF_j : fixed cost for supplier j

→ min-fixed-cost $\leq CF_j \leq$ max-fixed-cost

e_i^z : extracost due to unsatisfied demand

→ min-extracost $\leq e_i^z \leq$ max-extracost

C_{ij} : cost of one item i from supplier j

→ min-cost $\leq C_{ij} \leq$ max-cost

$u()$: discount function

h_i : unitary holding cost for product i

→ min-holding-cost $\leq h_i \leq$ max-holding-cost

I_i^z : inventory of product i @ time z

D_i^z : demand of product i @ time z

M : arbitrary big number

→ M

p_i : selling price of product i

→ min-price $\leq p_i \leq$ max-price

T_i : time for the product i to arrive

→ min-time-steps $\leq T_i \leq$ max-time-steps

O_{ij}^z : amount of product i ordered from supplier j @ time z

$y_j^z = \begin{cases} 1 & \text{if supplier } j \text{ is chosen for an order @ time } z \\ \emptyset & \text{otherwise} \end{cases}$

$b_i^z = \max [D_i^z - I_i^z, 0]$

MODEL:

OBJECTIVE FUNCTION:

$$\max \left[\min(D_i^{\tilde{z}}, I_i^{\tilde{z}}) \cdot p_i - \left[\sum_{j \in \Delta_i} \sum_{\tilde{z} \in T} C_{Fj} y_j^{\tilde{z}} + \sum_{i \in \theta} \sum_{j \in \Delta_i} \sum_{\tilde{z} \in T} c_{ij} \cdot O_{ij}^{\tilde{z}} + \right. \right. \\ \left. \left. - \sum_{j \in \Delta_i} u \left(\sum_{i \in \theta} \sum_{\tilde{z} \in T} O_{ij}^{\tilde{z}} \right) + \sum_{i \in \theta} \sum_{\tilde{z} \in T} h_i I_i^{\tilde{z}} + \sum_{i \in \theta} \sum_{\tilde{z} \in T} \tilde{e}_i \tilde{b}_i \right] \right]$$

SUBJECT TO:

$$I_i^{\tilde{z}} = I_i^{\tilde{z}-1} + O_i^{\tilde{z}-T_i} - D\tilde{z}$$

$$b_i^{\tilde{z}} \geq D_i^{\tilde{z}} - I_i^{\tilde{z}}$$

$$\sum_{i \in \theta} O_{ij}^{\tilde{z}} \leq M \cdot y_j^{\tilde{z}} \quad \forall j \in \Delta_{\theta}, \forall \tilde{z} \in T$$

$$O_{ij}^{\tilde{z}} \geq 0 \quad \forall i \in \theta, \forall j \in \Delta_{\theta}, \forall \tilde{z} \in T$$

$$y_j^{\tilde{z}} \in \{0, 1\} \quad \forall j \in \Delta_{\theta}, \forall \tilde{z} \in T$$

instance. py

- initial condition on Inventory and demand

$\delta_j \theta_i \rightarrow$

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c_{ij}	c_{ij}	c_{ij}	NaN
	c_{ij}	c_{ij}	

supplier j does not have product i