MATH3202 - Linear Programming - Section A

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Sets

C	Set of cities
Q	Set of quarters

Data

i_c	Current number of barrels in city $c \in C$
d_{cq}	Predicted demand of barrels in $c \in C$ for quarter $q \in Q$
c_q	Predicted cost of dollars per barrel for quarter $q \in Q$
m_c	Maximum storage capacity of barrels in $c \in C$

Variables

x_{cq}	Number of barrels to deliver to city $c \in C$ in quarter $q \in Q$
s_{cq}	Number of barrels to store in city $c \in C$ at the end of quarter $q \in Q$

Objective

$$\min \sum_{c\in C} \sum_{q \in Q} 25 s_{cq} + \ c_q x_{cq}$$

Constraints

$$x_{cq} \geq 0 \qquad \forall c \in C,\ \forall q \in Q \tag{1}$$

$$s_{cq} \geq 0 \qquad \forall c \in C,\ \forall q \in Q \tag{2}$$

$$\sum_{c \in C} x_{cq} \leq 10000 \qquad \forall q \in Q \tag{3}$$

$$i_c + x_{cq} - d_{cq} = s_{cq} \qquad \forall c \in C,\ \forall q \in \{f\} \tag{4}$$

$$s_{c(q-1)} + x_{cq} - d_{cq} = s_{cq} \qquad \forall c \in C,\ \forall q \in Q \setminus \{f\} \tag{5}$$

$$s_{cl} \geq 3000 \qquad \forall c \in C \tag{6}$$

$$s_{cq} \leq m_c \qquad \forall c \in C,\ \forall q \in Q \tag{7}$$

where f is the first quarter, and l is the last quarter, where $f, l \in Q$.

- Constraints (1) and (2) are basic non-negativity constraints on our variables.
- Constraints (3) ensures that the amount shipped per quarter does not exceed the ships capacity.
- Constraints (4) and (5) describe a recursive relationship between initial supplies, new deliveries, demand, and the amount stored at the end of each quarter.
- Constarint (6) ensures that there at least 3000 barrels in storage in each port by the end of the last quarter.
- Constarint (7) ensures that we do not exceed the capacities of our facilities in each port.