

Assignment 1 - Linear Programming - Section A

Maxwell Bo

Chantel Morris

March 17, 2018

Sets

C Set of cities
 Q Set of quarters

Data

i_c Current number of barrels in city $c \in C$ ¹
 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 $c \in C$ ²

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

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

Constraints

$$x_{cq} \geq 0 \quad \forall c \in C, \forall q \in Q \quad (1)$$

$$s_{cq} \geq 0 \quad \forall c \in C, \forall q \in Q \quad (2)$$

$$\sum_{c \in C} x_{cq} \leq 10000 \quad \forall q \in Q \quad (3)$$

$$i_c + x_{cf} - d_{cf} = s_{cf} \quad \forall c \in C \quad (4)$$

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

$$s_{cl} \geq 3000 \quad \forall c \in C \quad (6)$$

$$s_{cq} \leq m_c \quad \forall c \in C, \forall q \in Q \quad (7)$$

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.
- Constraint (6) ensures that there at least 3000 barrels in storage in each port by the end of the last quarter.
- Constraint (7) ensures that we do not exceed the capacities of our facilities in each port.