

Problem 5–2

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Variables:

- $x_{i,l}$ demonstrates the amount of product l that is produced in refinery i
- $e_{i,l}$ demonstrates the amount of product l that is exported from refinery i
- $s_{i,l}^s$ demonstrates the amount of product l that is stored in node i under scenario s
- $b_{i,l}^s$ demonstrates the amount of product l that is bought from the competitor in node i under scenario s
- $y_{i,j,l,m}$ demonstrates the amount of product l that is sent from node i to node j with method m

Objective Function:

$$\begin{aligned} \min \quad & \sum_{i \in I} \sum_{j \in I} \sum_{m \in \{1,2,3,4\}} \sum_{l \in L} c_{i,j,l,m} * y_{i,j,l,m} + \sum_{i \in I_r} \sum_{l \in L} ExC_{i,l} * e_{i,l} + \\ & \sum_{s \in S} p_s \left[\sum_{i \in I_d \cup I_c} \sum_{l \in L} IC_{i,l} * s_{i,l}^s + \sum_{i \in I_c} \sum_{l \in L} ShC_{i,l} * b_{i,l}^s \right] \end{aligned}$$

s.t.

$$\sum_{i \in I} \sum_{m \in \{1,2,3,4\}} y_{i,j,l,m} - \sum_{i \in I} \sum_{m \in \{1,2,3,4\}} y_{j,i,l,m} = \begin{cases} d_{j,l}^s + s_{j,l}^s - b_{j,l}^s & \forall l \in L, j \in I_d \cup I_c, s \in S \\ -x_{j,l} + e_{j,l} & \forall l \in L, j \in I_r \end{cases}$$

$$y_{i,j,l,m} \leq a_{i,j,l,m} * M \quad \forall l \in L, i, j \in I, m \in \{1, 2, 3, 4\}$$

$$\underline{Rec}_{j,l,m} \sum_{i \in I} y_{i,j,l,m} \leq \overline{Rec}_{j,l,m} \quad \forall j \in I, l \in L, m \in \{1, 2, 3, 4\}$$

$$\underline{Send}_{j,l,m} \sum_{i \in I} y_{j,i,l,m} \leq \overline{Send}_{j,l,m} \quad \forall j \in I, l \in L, m \in \{1, 2, 3, 4\}$$

$$x_{i,l} \leq b_{i,l} \quad \forall i \in I_r, l \in L$$

$$s_{i,l}^s \leq f_{i,l} \quad \forall i \in I_c \cup I_d, l \in L, s \in S$$