Transportation problem

Variables: x_{ij} the amount to transport from inventory $i \in S$ to shop $j \in T$

Objective: $\min \sum_{i \in S j \in T} c_{ij} x_{ij}$ where c_{ij} is the unit transportation cost from S_i to T_j

Subject to:

$$
\begin{aligned}
x_{ij} &\geq 0 && \forall i \in S, j \in T && \\
\sum_{j \in T} x_{ij} &\leq cap_i && \forall i \in S && cap_i \text{ is the capacity at } S_i \\
\sum_{i \in S} x_{ij} &= dem_j && \forall j \in T && dem_j \text{ is the demand at } T_j
\end{aligned}
$$

1 Including transportation between inventories and shops

Let's define a new set for all the places: $L = S \cup T$.

Variables: x_{ij} the amount to transport from place $i \in L$ to place $j \in L$

Objective: $\min \sum_{i \in L j \in L} c_{ij} x_{ij}$ where c_{ij} is the unit transportation cost from place i to place j

Subject to:

$$
\begin{aligned}
\sum_{j \in L} x_{ij} &\leq cap_i + \sum_{k \in S} x_{ki} && \forall i \in S && cap_i \text{ is the capacity at } S_i \\
\sum_{i \in L} x_{ij} &= dem_j + \sum_{k \in T} x_{jk} && \forall j \in T && dem_j \text{ is the demand at } T_j
\end{aligned}
$$