Pt7

Sets

- F : Farms
- P : Facilities
- T : Tankers

Data

- $Supply_f$ - milk supply from each farm $f \in F$ (L)
- $Distance_{fp}$ - distance between farm $f \in F$ and processing facility $p \in P$ (km)
- $PMin_p$ - minimum daily processing at processing facility $p \in P$ (L)
- $PMax_p$ - maximum daily processing at processing facility $p \in P$ (L)
- $Maintenance_t$ - daily cost of maintenance for tanker $t \in T$
- $TRound$ - cost of round trip travel ($/km)
- $DMax$ - maximum number of kilometers a tanker can be used for each day (assuming an average speed of 60km/h)

Variables

- W_{pt} - binary assignment of tankers $t \in T$ to processing facilities $p \in P$
- X_{pft} - binary assignment of farms $f \in F$ to processing facilities $p \in P$ and tankers $t \in T$

Objective function

$$\min\Big(\sum_{p\in P}\sum_{f\in F}\sum_{t\in T}\big(X_{pft}\times Distance_{fp}\times TRound\big)+\sum_{p\in P}\sum_{t\in T}\big(W_{pt}\times Maintenance_t\big)\Big)$$

Constraints

- Total milk processed at processing facility $p \in P$ cannot exceed the processing capacity.

$$\sum_{f\in F}\sum_{t\in T}X_{pft}\times Supply_f \le PMax_p, \quad \forall p \in P$$

- Total milk processed at processing facility $p \in P$ must meet the minimal operational requirement.

$$\sum_{f\in F}\sum_{t\in T}X_{pft}\times Supply_f \ge PMin_p, \quad \forall p \in P$$

- Each tanker $t \in T$ for processing facility $p \in P$ cannot be operational for more than 10 hours (600km).

$$\sum_{f\in F}X_{pft}\times Distance_{fp}\times 2 \le DMax, \quad \forall p \in P,\ t \in T$$

- If a tanker $t \in T$ is used, the binary tanker variable must be set.

$$X_{pft}=1 \implies W_{pt}=1, \quad \forall p \in P,\ t \in T,\ f \in F$$

- Tankers must be used in order, i.e., tanker 1 and then tanker 2 etc.,

$$W_{pt}=1 \implies W_{p(t-1)}=1, \quad \forall p \in P,\ t \in T,\ t>0$$

- Each farm $f \in F$ must be assigned to exactly one processing facility and one tanker.

$$\sum_{p\in P}\sum_{t\in T}X_{pft}=1, \quad \forall f \in F$$