Manager Cost District Model

Sets:

i = set of units {1,2, ... , 1700}

k = set of units {1,2, ... , 1700}

j = district {1,2, ... , 1700/3 (floor division) + 1}

Data:

M = cost of adding a manager

T = travel cost

d_{ik} = distance from unit i to k

Decision Variables:

x_{ij} = 1 if units i is a member of district j , 0 otherwise

Auxiliary Variables:

y_i = 1 if district j is not empty, 0 otherwise

z_{ik} = 1 if distance (i,k) must be counted i.e. iff x_{ij} = x_{kj} $\forall j$, 0 otherwise

Objective:

$$min \ M \sum_{j} y_j \ + \ T \sum_{(i,k)} z_{ik} * d_{ik}$$

Constraints:

$\sum_{i} x_{ij} \leq 3 \ \ \forall j$ **"All districts should have less than or equal to 3 units"**

$\sum_{j} x_{ij} \ = 1 \ \forall i$ "All units should belong to at least one district"

$z_{ik} \ = \ 0 \ \ \forall \ d_{ik} \geq 60$ "Don't count distance (i,k) if distance too big"

$y_j \geq y_{j+1}$ "Symmetry breaking, stops program if last district is empty"

$y_j \geq x_{ij} \ \forall i, \forall j$ "if unit i is a member of district j, then district j is not empty"

$$y_j \in \{0, 1\}$$

$$x_{ij} \in \{0, 1\}$$

$$z_{ik} \in \{0, 1\}$$