Pb2-areas: 200 x 3

200: residual areas.

x, y coordinates & # of residents

Pb2-shelters: 40 x 3.

40: potential shelter locations.

x, y coordinates & capacity.

Assume all the residents from the same residual area are assigned to the same shelter.

$x_j = 1$ if shelter j is built. and 0 otherwise.

$y_{ij} = 1$ if i assigned to j.

Goal ① Min total distance across all residents

② Min the largest distance required by any residents

Define Decision Variables:

$i = 1, \ldots, n \quad n \in [1, 200]$

$j = 1, \ldots, m \quad m \in [1, 40]$

Given coordinates

d_{ij}: distance between two points i, j

R_i: # of Resident in area i.

C_j: Capacity if site j is built

$$x_j = \begin{cases} 1 & \text{if } j \text{ is built} \\ 0 & \text{otherwise} \end{cases} \quad \forall j$$

$$y_{ij} = \begin{cases} 1 & \text{if } i \text{ assigned to } j \\ 0 & \text{otherwise} \end{cases} \quad \forall i, j$$

$$d_{ij} = |u_i - u_j| + |v_i - v_j|$$

Objective function.

$$\min \sum_{i=1}^{n} \sum_{j=1}^{m} x_{ij} * y_{ij} * d_{ij}$$

(when both x_{ij} & $y_{ij} = 1$, then count this distance)

S.t.

$$\sum_{i=1}^{n} R_i \leq C_j * y_{ij} \quad \forall i = 1 \dots n.$$

(j is fixed)

$$\sum_{j=1}^{m} x_j = 10$$

$$\sum_{j=1}^{m} y_{ij} \cdot x_j = 1 \quad \forall i = 1 \dots n.$$

#3: Every thing should be the same except:

md = maximum distance

$$\min md$$

s.t.

$$\sum_{i=1}^{n} R_i \leq C_j * y_{ij} \quad \forall i = 1 \ldots n, \quad (j \text{ is fixed})$$

$$\sum_{j=1}^{m} x_j = 10$$

$$\sum_{j=1}^{m} y_{ij} \cdot x_j = 1 \quad \forall i = 1 \ldots n,$$

$$m_d \geq d_{ij} \cdot y_{ij} \quad \forall i = 1 \dots n$$
$$\forall j = 1 \dots m.$$