IEOR151

Lab 7: Location Models

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Dept of Industrial Engineering & Operations Research
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Admin info

- Midterm
  - Return on Monday class
  - Grade will be curved
- Bring laptop in next lab
  - Excel with solver installed

Distance

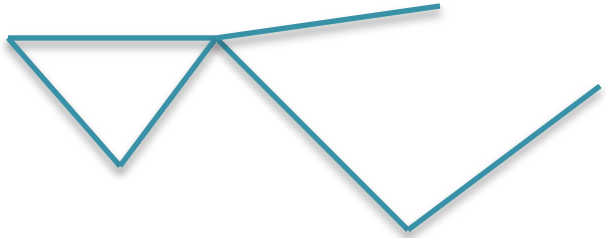
- 1-D: locate over a line
  - Distance between two points x_i and x_j

$$d_{ij} = |x_i - x_j|$$

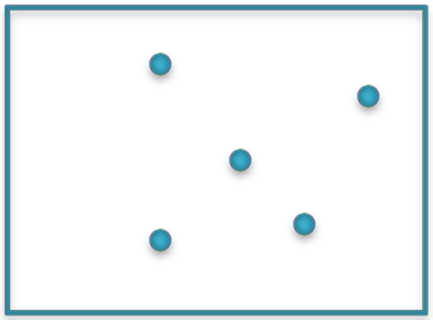
- 2-D: locate over a plane
  - Euclidian distance $\sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$
  - Manhattan(Metropolitan) distance $|x_i - x_j| + |y_i - y_j|$
- 3-D
  - Great-circle distance: locate over a sphere (the earth) $radius \times central\ angle$

Location problems

- Network problems



- Plane problems



Median problem

- Objective: minimize total demand weighted travel distance
  - P-median
  - Others

Cross-median location problem

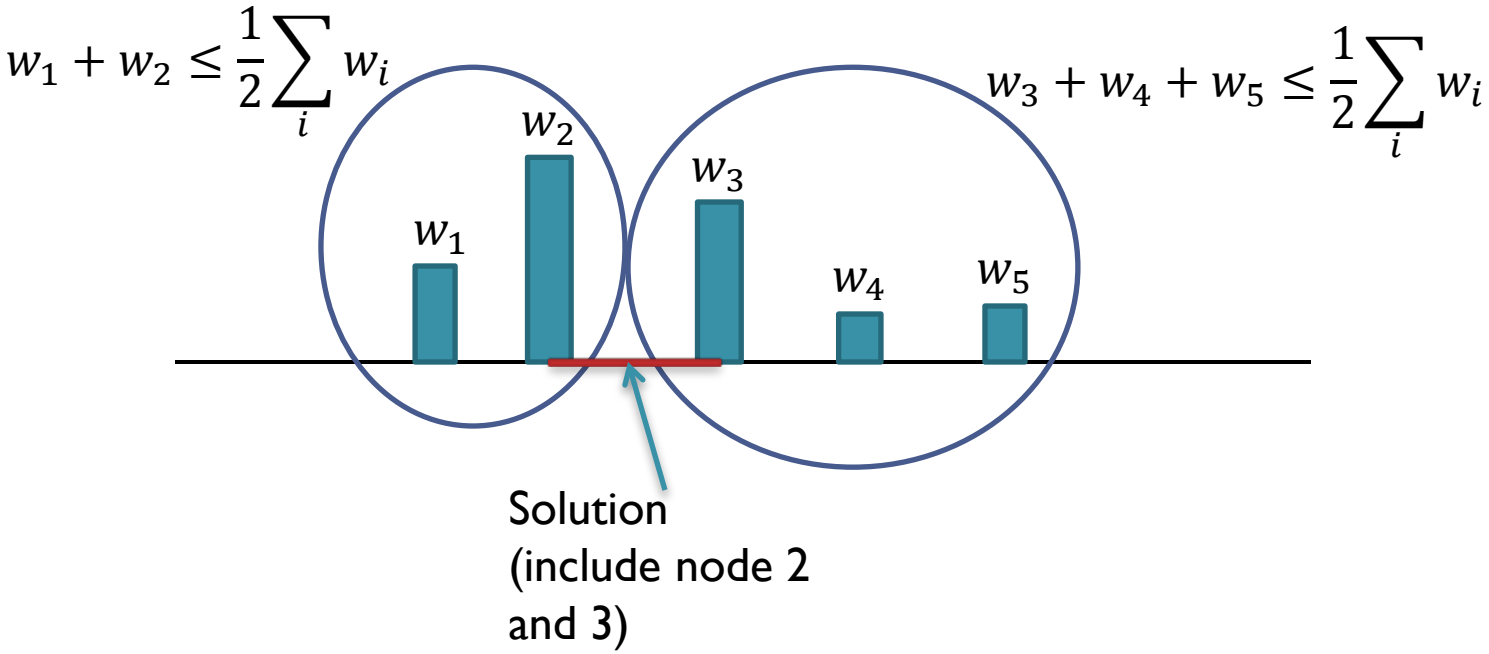
- Know demand locations (set M)and sizes.
- Find a service location (s) to minimize total demand weighted metropolitan distance traveled.
- Formulation

$$\sum_{i \in M} w_i |x_i - x_s| + \sum_{j \in M} w_j |y_j - y_s|$$

- Solve 1-median problems in each dimension respectively.

Cross-median location problem

- Solve 1-median problem
  - Step 1: calculate total demand $W = \sum_i w_i$
  - Step 2: find the location such that (i) total demand on left $\leq \frac{1}{2}W$; and (ii) total demand on right $\leq \frac{1}{2}W$



Cross-median location problem

- Example
  - Demand locations (in coordinates): A(6,2), B(8,6), C(5,9), D(3,4).
  - Demand sizes: A(2000), B(1000), C(3000), D(2000).
  - Recommend service location (x_s, y_s).
- Consider 1-median problems in each dimension.

Hoteling problem

- Two firms A and B locate their hotels along a street in order to maximize demand covered.
- Assumptions
  - Demands are uniformly distributed.
  - Customers go to the closest hotel.
- Results
  - Equilibrium: both A and B open their hotels at the midpoint of the street. (what if not?)