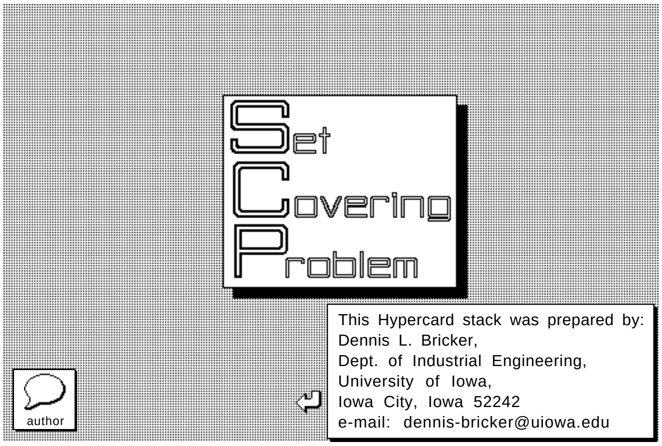
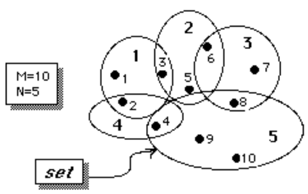


Given M points, and N sets each containing one or more points:

Let C_j = cost of set #j

$$a_{ij} = \begin{cases} 1 & \text{if point } i \text{ is an element of set } j \\ 0 & \text{otherwise} \end{cases}$$



$$A = \begin{bmatrix} 1&0&0&0&0 \\ 1&0&0&1&0 \\ 1&1&0&0&0 \\ 0&0&0&1&1 \\ 0&1&0&0&0 \\ 0&1&1&0&0 \\ 0&0&1&0&0 \\ 0&0&1&0&1 \\ 0&0&0&0&1 \\ 0&0&0&0&1 \end{bmatrix}$$

Define variables $X_j = \begin{cases} 1 & \text{if set } \#j \text{ is selected} \\ 0 & \text{otherwise} \end{cases}$

Set Covering Problem

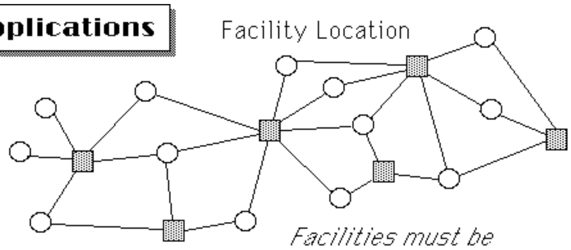
$$\text{Minimize } \sum_{j=1}^{N} C_j X_j$$

$$\text{subject to } \sum_{j=1}^{N} a_{ij} X_j \geq 1 \quad \text{for each } i=1, 2, \ldots M$$

$$X_j \in \{0,1\} \quad \text{for each } j=1, 2, \ldots N$$

Applications

Facility Location



▩ = potential facility site

◯ = customer location

C_j = cost of building facility j

Facilities must be selected to serve every customer. Possible links are indicated.

(customers are "points", facilities are "sets")

Applications

Information Retrieval

Retrieve a given set of *m* requests for information from a set of *n* files so that the length of the search is minimized.

C_j = length of file j

a_{ij} = 1 if the i^{th} information requested is in file j, 0 otherwise

(information requests are "points", and the files are the "sets")