4.5.4 MINIMAX LOCATION PROBLEM

Objective- To locate the new emergency facility (X,Y) such that the maximum distance from the new emergency facility to any of the existing facilities is minimized

Fi(X,Y)= Distance between the new facilities and the existing facilities

Fi(X,Y)=|X-ai|+|Y-bi|

Fmax (X,Y)=maximum of the distance between the new facility and various existing facilities

Fmax(X,Y)= $\underbrace{max}_{1\le i\le m}$ {|X-a_i|+|Y-b_i|}

The distance between new facility and existing facility may be rectilinear or Euclidean

m=different shops in an industry

in the event of fire in any one of these shops a costly firefighting equipment showed reach the spot as soon as possible from its base location. Movements within any industry are rectilinear in nature. Our objective is to locate the new fire fighting equipment within the industry such that maximum distance it has to travel from its base location to any of the existing shops is minimized.

Step 1

Find c_1, c_2, c_3, c_4 and c_5,using following formula

$c_1 = \underbrace{min}_{1\le i\le m} (a_i + b_i)$ $c_2 = \underbrace{max}_{1\le i\le m} (a_i + b_i)$ $c_3 = \underbrace{min}_{1\le i\le m} (-a_i + b_i)$ $c_4 = \underbrace{max}_{1\le i\le m} (-a_i + b_i)$
$c_5 = \underbrace{max}_{1\le i\le m} (c_2 - c_1, c_4 - c_3)$

Step 2

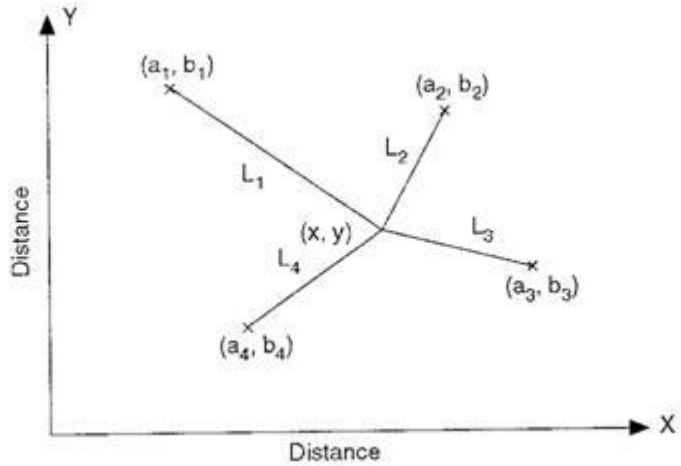
Find the points P_1 and P2 using the following formula

P1=[1/2$(c_1 - c_3)$, ½$(c_1 + c_3 + c_5)$]

P2=[1/2$(c_2 - c_4)$, ½$(c_2 + c_4 - c_5)$]

Step 3

Any pt(X*,Y*) on the line segment joining points P1 and P2 is a minimax location that minimize fmax(X,Y)



GRAPH OF MINIMAX LOCATION PROBLEM

EXAMPLE

In a foundry there are seven shops whose coordinates are summarized in the following table. The company is interested in locating a new costly fire fighting equipment in the foundry determine the minimax location of the new equipment

SL NO	EXISTING FACILITIES	CO-ORDINATE OF CENTROID
1	Sand plant	10,20
2	Molding shop	30,40
3	Pattern shop	10,120
4	Melting shop	10,60
5	Felting shop	30,100
6	Fabrication shop	30,140
7	Annealing shop	20,190

SOLUTION

The movement of new equipment is constrained within in the foundry the assumption of rectilinear distance more appropriate

The co ordinate of the centroid of the existing shops are

(a1,b1)=(10,20) (a2,b2)=(30,40) (a3,b3)=(10,120) (a4,b4)=(10,60) (a5,b5)=(30,100) (a6,b6)=(30,140) (a7,b7)=(20,140)

Step 1

$c_1 = \underbrace{min}_{1 \le i \le m} (a_i + b_i)$ = min [(10+20),(30+40),(10+120),(10+60),(30+100),(30+140),(20+190)]

=min[30,70,130,70,130,170,210]=30

$c_2 = \underbrace{max}_{1 \le i \le m} (a_i + b_i)$ = max[30,70,130,70,130,170,210]=210

$c_3 = \underbrace{min}_{1 \le i \le m} (-a_i + b_i)$=min[(-10+20),(-30+40),(-10+120),(-10+60),(-30+100),(-30+140),

(-20+190)]=min[10,10,110,50,70,110,170]=10

$c_4 = \underbrace{max}_{1 \le i \le m} (-a_i + b_i)$ =max[10,10,110,50,70,110,170]=170

$c_5 = \underbrace{max}_{1 \le i \le m} (c_2 - c_1, c_4 - c_3)$=max[(210-30),(170-10)]=max[180,160]=180

P1=[1/2$(c_1 - c_3)$, ½$(c_1 + c_3 + c_5)$]=[1/2(30-10),1/2(30+10+180)]=(10,110)

P2=[1/2$(c_2 - c_4)$, ½$(c_2 + c_4 - c_5)$]= [1/2(210-170),1/2(210+170-180)]=(20,100)

Any point X*,Y* on the line segment joining pts (10,110),(20,100) is a minimax location for the firefighting equipment.

4.6 Layout Design Procedure

Layout design procedures can be classified into manual methods and computerized methods.

Manual methods. Under this category, there are some conventional methods like travel chart and Systematic Layout Planning (SLP).

Computerized methods

Under this method, again the layout design procedures can be classified in to constructive type algorithm and improvement type algorithms.

Construction type algorithms

Automated Layout Design program (ALDEP)

Computerized Relationship Layout Planning (CORELAP)

Improvement type Algorithm

Computerized Relative Allocation of Facilities Technique (CRAFT)

4.6.1 Computerized Relative Allocation of Facilities Technique (CRAFT)

CRAFT algorithm was originally developed by Armour and Buffa. CRAFT is more widely used than ALDEP and CORELAP. It is an improvement algorithim.It starts with an initial layout and improves the layout by interchanging the departments pairwise so that transportation cost is minimized.

CRAFT requirements

1. Initial layout
2. Flow data
3. Cost per unit distance
4. Total number of departments
5. Fixed departments
   Number of such departments
   Location of those departments
6. Area of departments

4.7 Algorithms and models for Group Technology

In this section Rank Order Clustering (ROC) and Bond Energy Algorithms are the methods can be applied to Group Technology (GT).

*4.7.1 Rank Order Clustering Algorithm (*ROC)

This algorithm was developed by J.R King(1980).This algorithm considers the following data**.**

- Number of Components
- Component Sequence

Based on the component sequences, a machine-component incidence matrix is developed. The rows of the machine-component incidence matrix represent the machines which are required to processes the components. The columns of the matrix represent the component numbers.

STEPS IN ROC LOGARITHM

Step 0 : Input : Total no of components and component sequences

Step 1. From the machine component incidence matrix using the component sequences

Step 2. Compute binary equivalent of each row.

Step 3. Re arrange the rows of the matrix in rank wise (high to low from top to bottom)

Step 4. Compute binary equivalent of each column and check whether the column of the matrix