3.3.3: Center of Gravity Method

In order to minimize transportation costs, the centre of gravity method may be used to locate a facility that serves several area (or other facilities) such as a warehouse or distribution centre. This method uses an (X-Y) coordinate system to cover the geographical map of the areas under study, and identifies the x and y coordinates for the location of the new facility based on the coordinates of the other facilities and the volume (quantity) of demand for each area (facility). For example, in the following figure, each blue star represents a market area that needs to be served, and the size of area also shows the demand quantity for that market. We are looking for the whereabouts (i.e., $\bar{x}$ and $\bar{y}$) of the location for our facility to be set up to serve all these markets while minimizing our total transportation costs.

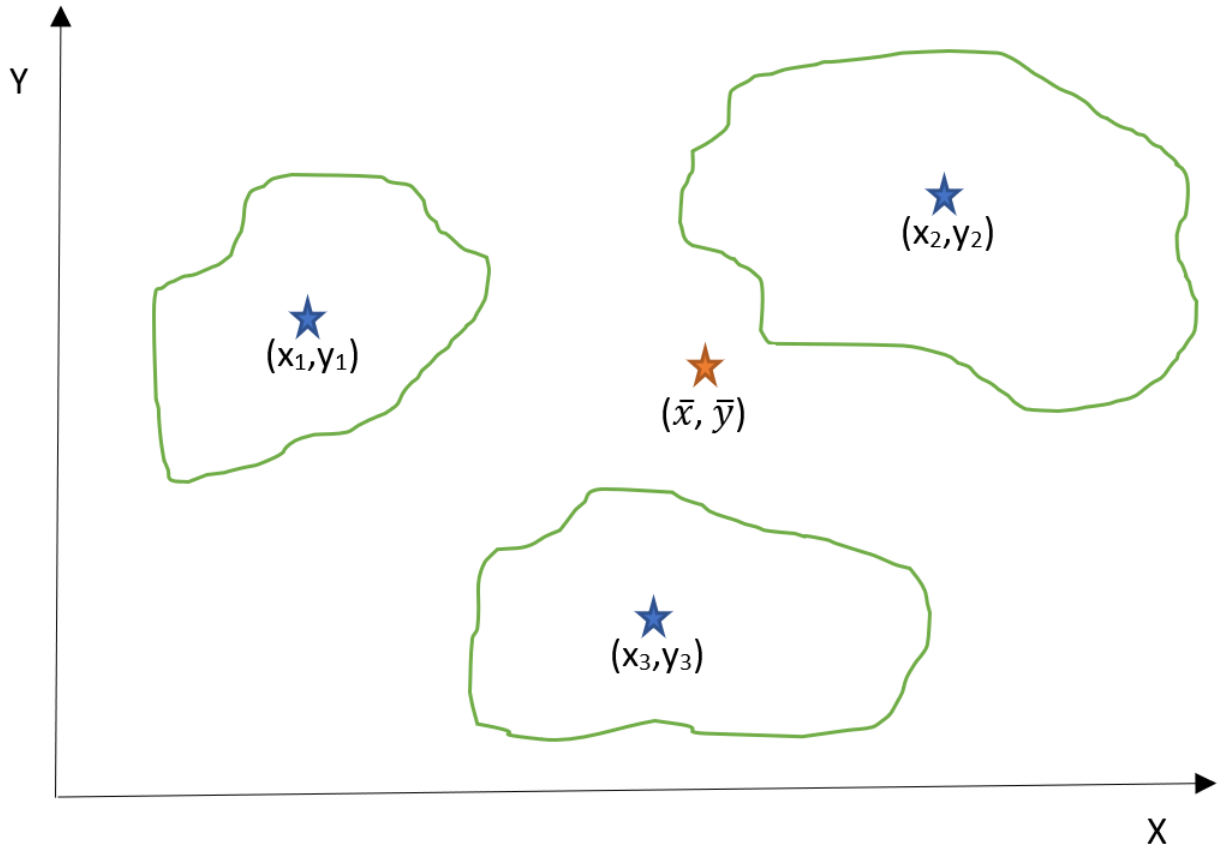

Figure 3.3.3.1: Three market areas on an X-Y coordinate axis.

In the following, we show the Centre of Gravity formulas. and use them in an example:

$$\bar{x} = \frac{\sum x_i Q_i}{\sum Q_i}$$

$$\bar{y} = \frac{\sum y_i Q_i}{\sum Q_i}$$

Figure 8.2:

$\bar{x}$ = the x coordinate for the new facility

$\bar{y}$ = the y coordinate for the new facility

x_i = x coordinate of destination (market) i

y_i = y coordinate of destination (market) i

Q_i = quantity to be transported to destination i

Example 3.3.3.1

Using the center of gravity method and the information on the location of the potential markets, determine where the new facility should be located to minimize the total transportation cost. Note that a selected point in the middle of each region is representing the regional market.

Solution

$$\bar{x} = \frac{1(600) + 3(400) + 6(550) + 2(800)}{600 + 400 + 550 + 800} = 2.9$$

$$\bar{y} = \frac{2(600) + 4(400) + 4(550) + 6(800)}{600 + 400 + 550 + 800} = 4.2$$