Location Analysis and Planning

Chapter 8

The Need For Location Decisions

The Nature of Location Decisions

Strategic Importance of Location Decisions

strategy of being a low-cost producer

strategy of increasing profits by increasing market share

strategy that emphasizes convenience for the customer

Objectives of Location Decisions

Location Options

expand an existing facility

add new locations while retaining existing ones

shut down at one location and move to another

the option of doing nothing

General Procedure for Making Location Decisions

1. Decide on the criteria to use for evaluating location alternatives, such as increased revenues or community service.
2. Identify important factors, such as location of markets or raw materials.
3. Develop location alternatives:
   - Identify the general region for a location.
   - Identify a small number of community alternatives.
   - Identify site alternatives among the community alternatives.
4. Evaluate the alternatives and make a selection.

Factors that Affect Location Decisions

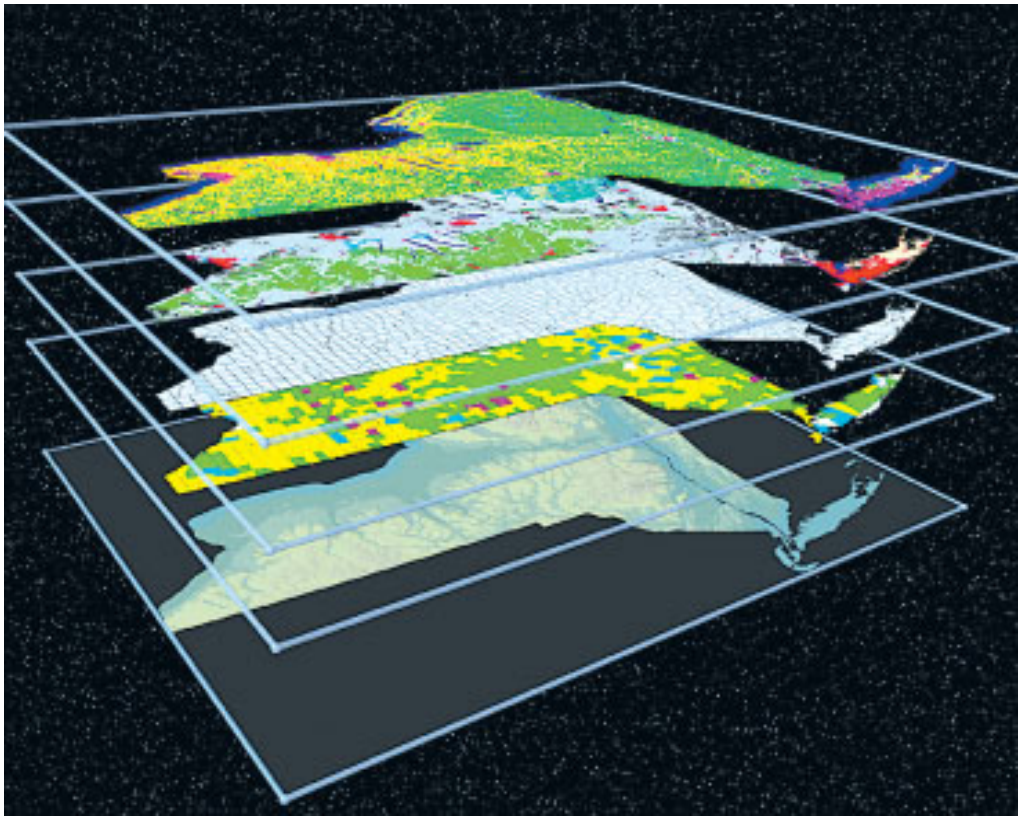
Regional Factors

Location of Raw Materials (necessity, perishability, and transportation costs)

Location of Markets (locate near the markets, distribution costs, the perishability of a finished product, GIS)

Labor Factors (cost and availability of labor, wage rates in an area, labor productivity and attitudes toward work, and unions)

Climate and Taxes



Community Considerations

Eg: airport expansion, changes in zoning, construction of nuclear facilities, and highway construction

desirability of a community as a place for its workers and managers to live

cost and availability of utilities, environmental regulations, taxes

Site-Related Factors

heavy manufacturing, the erection of large buildings, facilities with special requirements, soil conditions, load factors, and drainage rates

land costs, room for future expansion, current utility and sewer capacities and sufficient parking space for employees and customers

Industrial parks

Level	Factors	Considerations
Regional	Location of raw materials or supplies	Proximity, modes and costs of transportation, quantity available
	Location of markets	Proximity, distribution costs, target market, trade practices/restrictions
	Labor	Availability (general and for specific skills), age distribution of workforce, work attitudes, union or nonunion, productivity, wage scales, unemployment compensation laws
Community	Quality of life	Schools, churches, shopping, housing, transportation, entertainment, recreation, cost of living
	Services	Medical, fire, and police
	Attitudes	Pro/con
	Taxes	State/local, direct and indirect
	Environmental regulations	State/local
	Utilities	Cost and availability
	Development support	Bond issues, tax abatement, low-cost loans, grants
Site	Land	Cost, degree of development required, soil characteristics and drainage, room for expansion, parking
	Transportation	Type (access roads, rail spurs, air freight)
	Environmental/legal	Zoning restrictions

Multiple Plant Manufacturing Strategies

Product Plant Strategy

Market Area Plant Strategy

Process Plant Strategy

Service and Retail Locations

How can sales, market share, and profit be optimized for the entire set of locations? Solutions might include some combination of upgrading facilities, expanding some sites, adding new outlets, and closing or changing the locations of some outlets.

What are the potential sales to be realized from each potential solution?

Where should outlets be located to maximize market share, sales, and profits without negatively impacting other outlets? This can be a key cause of friction between the operator of a franchise store and the franchising company.

What probable effects would there be on market share, sales, and profits if a competitor located nearby?

Manufacturing/Distribution	Service/Retail
Cost focus	**Revenue focus**
Transportation modes/costs	Demographics: age, income, education
Energy availability/costs	Population/drawing area
Labor cost/availability/skills	Competition
Building/leasing costs	Traffic volume/patterns
	Customer access/parking

Global Locations

Facilitating Factors

Trade Agreements

Technology

Benefits

Markets

Cost savings

Legal and regulatory

Financial

Other

Disadvantages

Transportation costs

Security costs

Unskilled labor

Import restrictions

Criticisms

Risks

Political

Terrorism

Economic

Legal

Cultural

Factors relating to foreign locations

Foreign government	a. Policies on foreign ownership of production facilities Local content requirements Import restrictions Currency restrictions Environment regulations Local product standards Liability laws b. Stability issues
Cultural differences	Living circumstances for foreign workers and their dependents Religious holidays/traditions
Customer preferences	Possible "buy locally" sentiment
Labor	Level of training and education of workers Work ethic Possible regulations limiting number of foreign employees Language differences
Resources	Availability and quality of raw materials, energy, transportation infrastructure
Financial	Financial incentives, tax rates, inflation rates, interest rates
Technological	Rate of technological change, rate of innovations
Market	Market potential, competition

Evaluating Location Alternatives

Locational Cost-Profit-Volume Analysis

1. Determine the fixed and variable costs associated with each location alternative.
2. Plot the total-cost lines for all location alternatives on the same graph.
3. Determine which location will have the lowest total cost for the expected level of output. Alternatively, determine which location will have the highest profit.

Assumptions

Fixed costs are constant for the range of probable output.

Variable costs are linear for the range of probable output.

The required level of output can be closely estimated.

Only one product is involved.

$$\text{Total cost} = \text{FC} + v \times Q$$

where

FC = Fixed cost

v = Variable cost per unit

Q = Quantity or volume of output

Example

Fixed and variable costs for four potential plant locations are shown below:

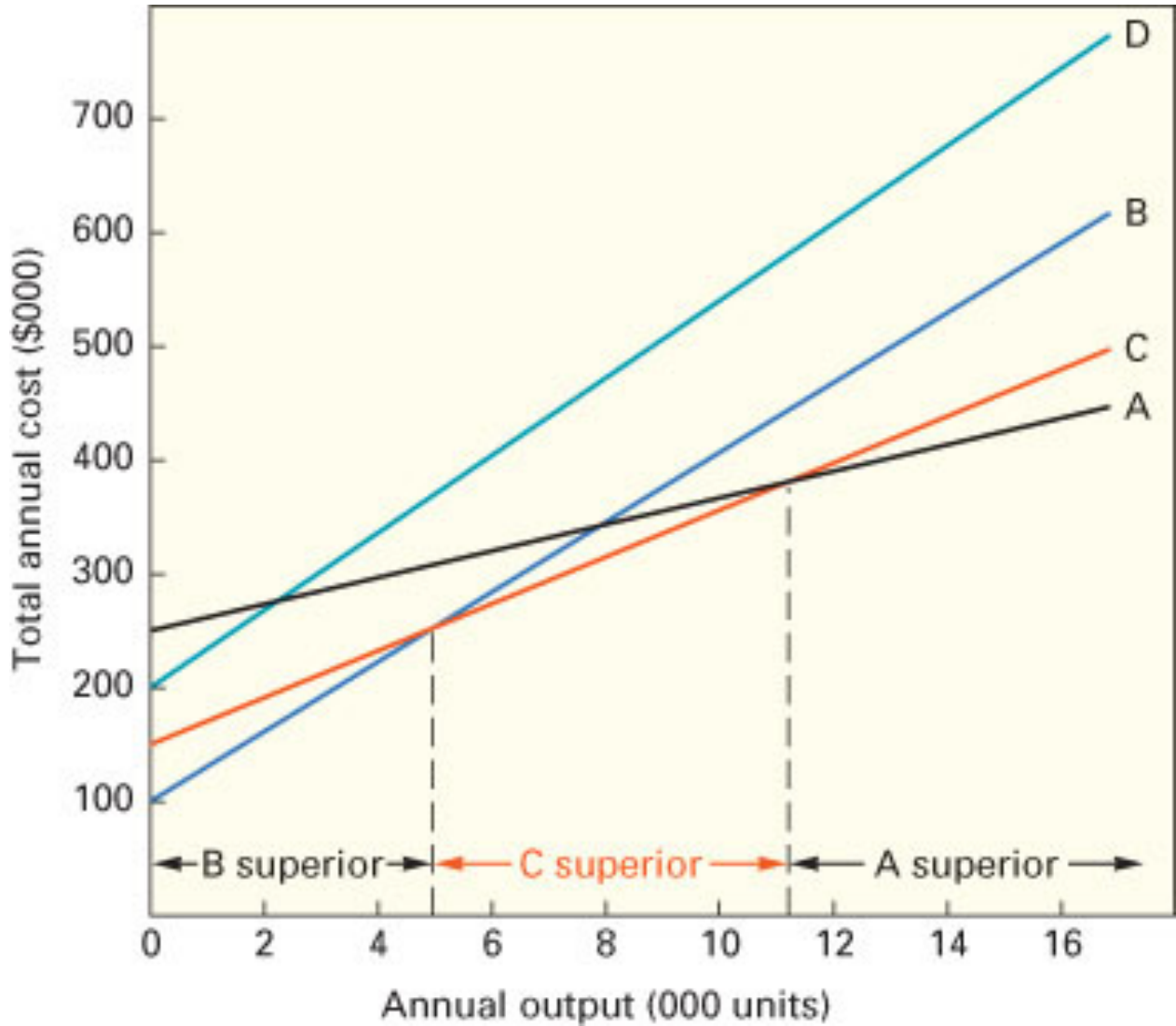
Location	Fixed Cost per Year	Variable Cost per Unit
A	$250,000	$11
B	100,000	30
C	150,000	20
D	200,000	35

a. Plot the total-cost lines for these locations on a single graph.

b. Identify the range of output for which each alternative is superior (i.e., has the lowest total cost).

c. If expected output at the selected location is to be 8,000 units per year, which location would provide the lowest total cost?

	Fixed Cost	+	Variable Cost	=	Total Cost
A	$250,000	+	$11(10,000)	=	$360,000
B	100,000	+	30(10,000)	=	400,000
C	150,000	+	20(10,000)	=	350,000
D	200,000	+	35(10,000)	=	550,000



The Transportation Model

Factor Rating

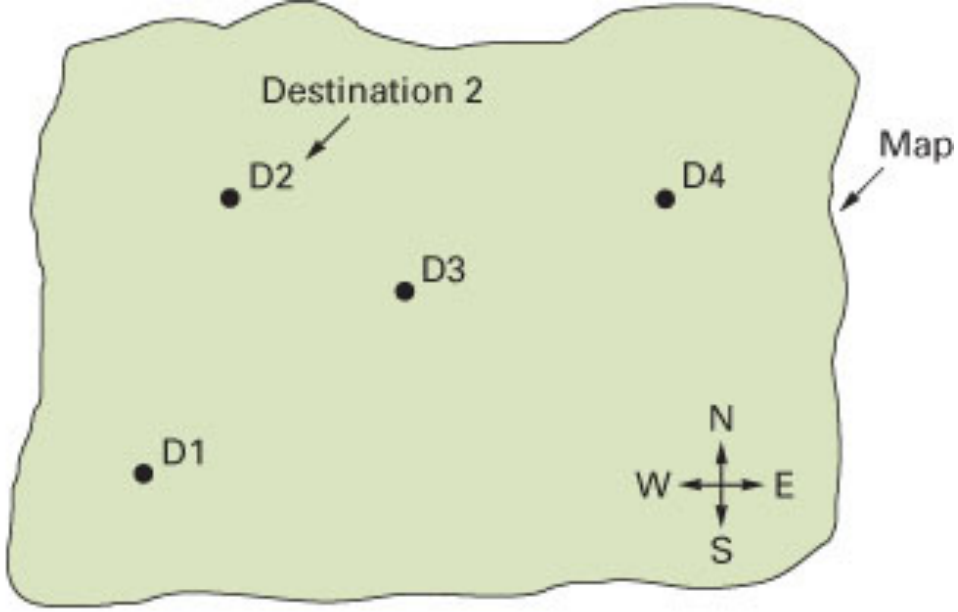
Example

A photo-processing company intends to open a new branch store. The following table contains information on two potential locations. Which is the better alternative?

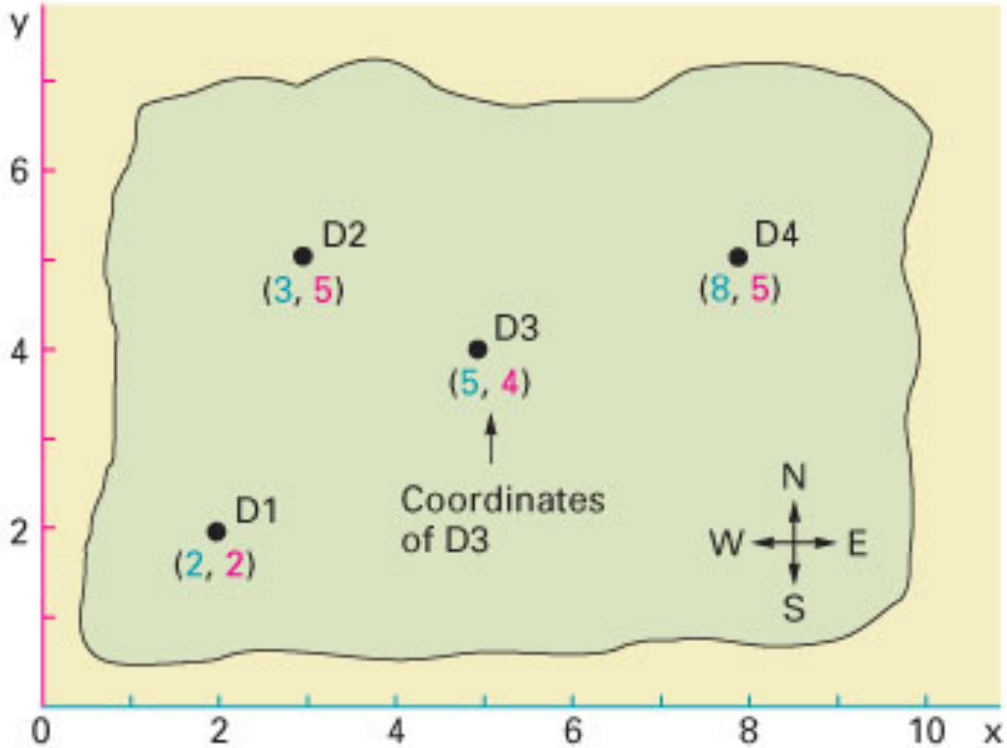
		SCORES (OUT OF 100)		WEIGHTED SCORES	
Factor	**Weight**	**Alt. 1**	**Alt. 2**	**Alternative 1**	**Alternative 2**
Proximity to existing store	.10	100	60	.10(100) = 10.0	.10(60) = 6.0
Traffic volume	.05	80	80	.05(80) = 4.0	.05(80) = 4.0
Rental costs	.40	70	90	.40(70) = 28.0	.40(90) = 36.0
Size	.10	86	92	.10(86) = 8.6	.10(92) = 9.2
Layout	.20	40	70	.20(40) = 8.0	.20(70) = 14.0
Operating costs	.15	80	90	.15(80) = 12.0	.15(90) = 13.5
	1.00			70.6	82.7

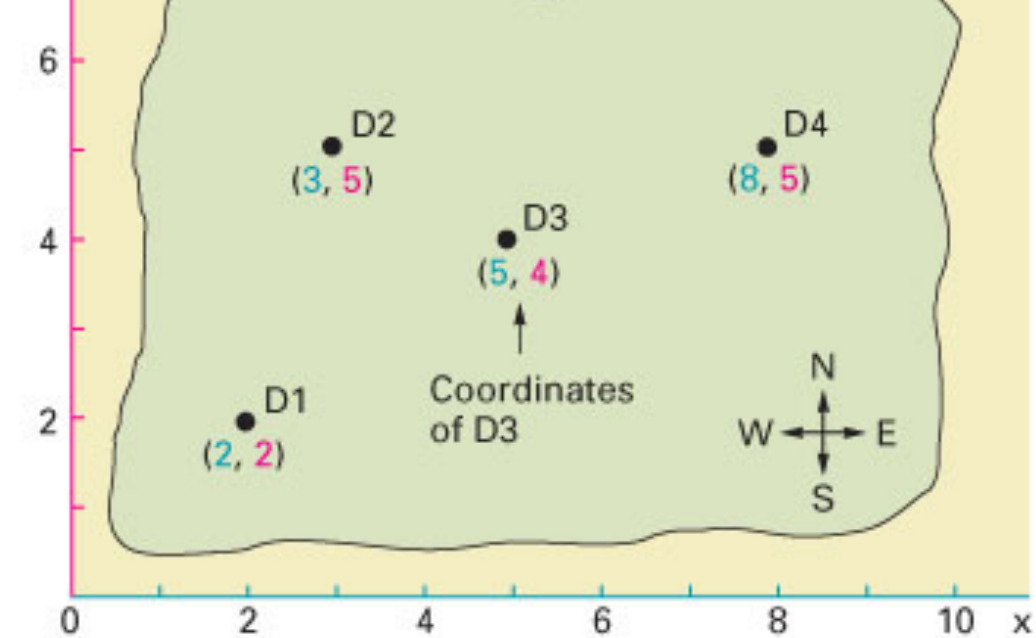
The Center of Gravity Method

A. Map showing destinations

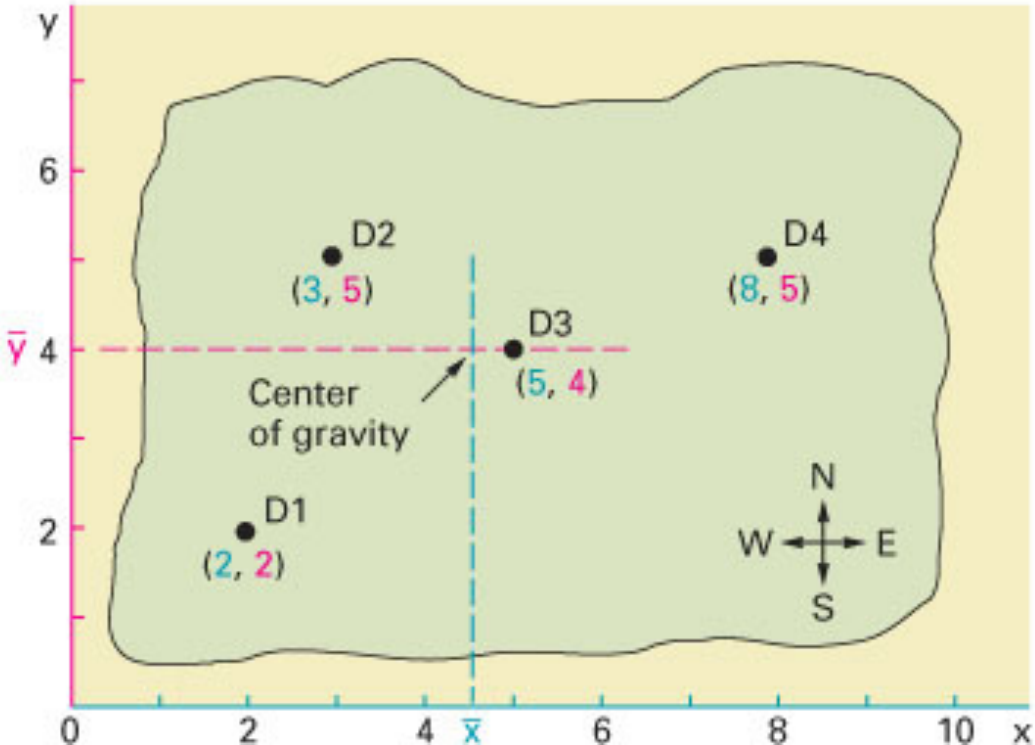


B. Add a coordinate system





C. Center of gravity



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

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

where

Q_i = Quantity to be shipped to destination i

x_i = x coordinate of destination i

y_i = y coordinate of destination i

Example

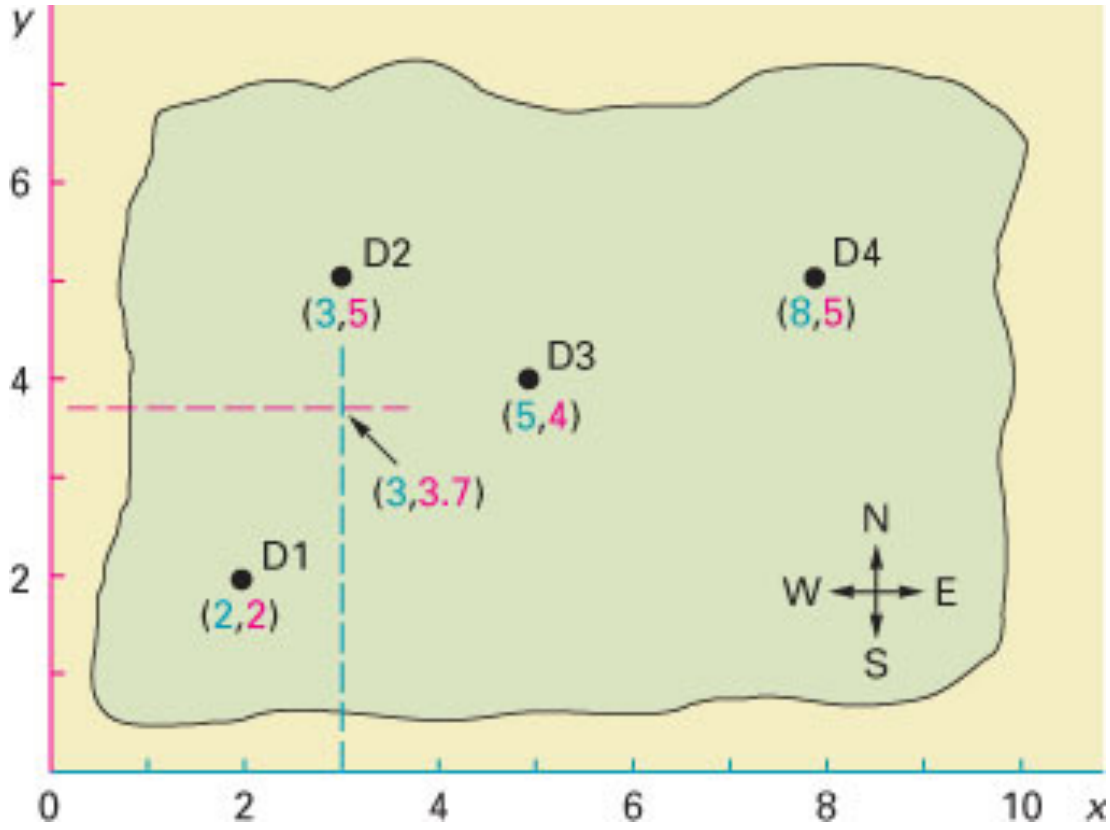
Destination	x,	y
D1	2,	2
D2	3,	5
D3	5,	4
D4	8,	5
	18	16

$$\bar{x} = \frac{\Sigma x_i}{n} = \frac{18}{4} = 4.5 \qquad \bar{y} = \frac{\Sigma y_i}{n} = \frac{16}{4} = 4$$

Destination	x, y	Weekly Quantity
D1	2, 2	800
D2	3, 5	900
D3	5, 4	200
D4	8, 5	100
		2,000

$$\bar{x} = \frac{\Sigma x_i Q_i}{\Sigma Q_i} = \frac{2(800) + 3(900) + 5(200) + 8(100)}{2{,}000} = \frac{6{,}100}{2{,}000} = 3.05 \text{ [round to 3]}$$

$$\bar{y} = \frac{\Sigma y_i Q_i}{\Sigma Q_i} = \frac{2(800) + 5(900) + 4(200) + 5(100)}{2{,}000} = \frac{7{,}400}{2{,}000} = 3.7$$


y
6
4
2
0
2
4
6
8
10
x
D2
(3,5)
D4
(8,5)
D3
(5,4)
(3,3.7)
D1
(2,2)
N
W
E
S