



**Damietta University  
Faculty of Commerce  
English Program**

**Production and Operations Management**

**Second Year, Week 11: 21 April 2020**

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# Location Strategies

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# Location Strategies

## Transportation Models



# Outline

- ▶ Transportation Modeling
- ▶ Developing an Initial Solution
- ▶ The Stepping-Stone Method
- ▶ Special Issues in Modeling



# Stepping-Stone Method

1. Select any unused square to evaluate
2. Beginning at this square, trace a closed path back to the original square via squares that are currently being used  
*(Just move horizontally and vertically)*
3. Beginning with a plus (+) sign at the unused corner, place alternate minus and plus signs at each corner of the path just traced

# Stepping-Stone Method

4. Calculate an improvement index by first adding the unit-cost figures found in each square containing a plus sign and subtracting the unit costs in each square containing a minus sign
5. Repeat steps 1 through 4 until you have calculated an improvement index for all unused squares. If all indices are  $\geq 0$ , you have reached an optimal solution.

# Stepping-Stone Method

From \ To	(A) Albuquerque	(B) Boston	(C) Cleveland	Factory capacity
(D) Des Moines	100 <span>\$5</span>	<span>\$4</span>	<span>\$3</span>	100
(E) Evansville	200 <span>\$8</span>	100 <span>\$4</span>	<span>\$3</span>	300
(F) Fort Lauderdale	<span>\$9</span>	<span>\$7</span>	200 <span>\$5</span>	300
Warehouse requirement	300	200	200	700

The impact on the cost

Des Moines-Boston index  
 $= \$4 - \$5 + \$8 - \$4$   
 $= +\$3$

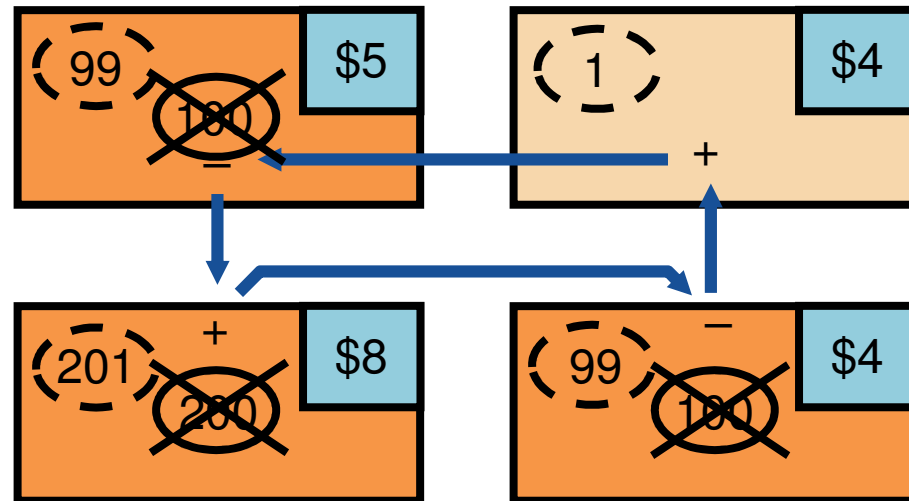


Figure C.5

# Stepping-Stone Method

From \ To	(A) Albuquerque	(B) Boston	(C) Cleveland	Factory capacity
(D) Des Moines	100 \$5	\$4	Start \$3	100
(E) Evansville	200 \$8	100 \$4	\$3	300
(F) Fort Lauderdale	\$9	100 \$7	200 \$5	300
Warehouse requirement	300	200	200	700

Diagram illustrating the Stepping-Stone Method. The table shows the current allocation of units from three factories (Des Moines, Evansville, Fort Lauderdale) to three warehouses (Albuquerque, Boston, Cleveland). The current allocation is: Des Moines to Albuquerque (100), Evansville to Albuquerque (200) and Boston (100), and Fort Lauderdale to Boston (100) and Cleveland (200). The Stepping-Stone Method involves shifting units from Des Moines to Cleveland (+200) and from Evansville to Cleveland (-100) to improve the solution. The cost changes are: Des Moines to Cleveland (+\$3), Evansville to Albuquerque (-\$8), Evansville to Boston (+\$4), Fort Lauderdale to Boston (-\$7), and Fort Lauderdale to Cleveland (+\$5). The net change in cost is \$3 - \$8 + \$4 - \$7 + \$5 = -\$3.

Des Moines-Cleveland index

$$= \$3 - \$5 + \$8 - \$4 + \$7 - \$5 = +\$4$$

Figure C.6



# Stepping-Stone Method

From \ To	(A) Albuquerque	(B) Boston	(C) Cleveland	Factory capacity
(D) Des Moines	100 \$5	\$4	\$3	100

(E) Evansville

(F) Fort Lauderdale

Warehouse  
requirement

Evansville-Cleveland index

$$= \$3 - \$4 + \$7 - \$5 = +\$1$$

(Closed path = EC - EB + FB - FC)

Fort Lauderdale-Albuquerque index

$$= \$9 - \$7 + \$4 - \$8 = -\$2$$

(Closed path = FA - FB + EB - EA)

# Stepping-Stone Method

1. If an improvement is possible, choose the route (unused square) with the largest negative improvement index  
(Here it's only one negative index, **FA**)
2. On the closed path for that route, select the smallest number found in the squares containing minus signs
3. Add this number to all squares on the closed path with plus signs and subtract it from all squares with a minus sign

# Stepping-Stone Method

From \ To	(A) Albuquerque	(B) Boston	(C) Cleveland	Factory capacity
(D) Des Moines	100 \$5	\$4	\$3	100
(E) Evansville	200 \$8 - ←	100 \$4 +	\$3	300
(F) Fort Lauderdale	\$9 + ↓	100 \$7 ↑	200 \$5 -	300
Warehouse requirement				

1. Add 100 units on route FA
2. Subtract 100 from route FB
3. Add 100 to route EB
4. Subtract 100 from route EA

Figure C.7

# Stepping-Stone Method

From \ To	(A) Albuquerque	(B) Boston	(C) Cleveland	Factory capacity
(D) Des Moines	100 \$5	\$4	\$3	100
(E) Evansville	100 \$8	200 \$4	\$3	300
(F) Fort Lauderdale	100 \$9	\$7	200 \$5	300
Warehouse requirement	300	200	200	700

$$\begin{aligned} \text{Total Cost} &= \$5(100) + \$8(100) + \$4(200) + \$9(100) + \$5(200) \\ &= \$4,000 \end{aligned}$$

Figure C.8

Thank you

