The Training Material on "Warehouse Management and Distribution Management" has been produced under Project Sustainable Human Resource Development in Logistic Services for ASEAN Member States with the support from Japan-ASEAN Integration Fund (JAIF).

Transportation Modeling – Transportation Matrix

The purpose of the transportation matrix is to establish the optimum shipment routings from several supply points to several receiving points with the objective of minimizing the overall transportation costs.

Worked Example on Transportation Matrix

	A1	A2	A3	Capacity
X1	$3	$5	$7	700
X2	$1	$6	$4	650
X3	$8	$2	$4	150
Requirements	500	600	400	1500

A1, A2 and A3 are warehouses while X1, X2 and X3 are factories. A1 to A3 store and distribute the products manufactured by X1 to X3.

Cost of shipping from X1 to A1

Total supply and demand.
Sum of row must be equal to sum of column

Solution

There are 2 major steps:

- Developing an initial solution of total transportation cost
- Optimizing the matrix to obtain the final total transportation cost

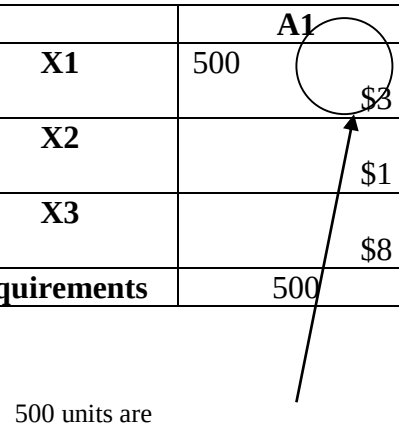
Step 1 – Developing an Initial Solution

Using North-West Corner Method

	A1	A2	A3	Capacity
X1	$3	$5	$7	700
X2	$1	$6	$4	650
X3	$8	$2	$4	150
Requirements	500	600	400	1500

a. Start at the upper left-hand cell or northwest corner of the table.
b. Exhaust the factory of each row before moving down to the next row.
c. Exhaust the warehouse of each column before moving down to the next row.
d. Check that all supply (capacity) and demands (requirements) are met.

	A1	A2	A3	Capacity
X1	500 $3	200 $5	$7	700
X2	$1	400 $6	250 $4	650
X3	$8	$2	150 $4	150
Requirements	500	600	400	1500



500 units are shipped from X1 to A1

The Initial Total Transportation Cost

Routing				
From	**To**	**Units Shipped**	**Cost per Unit**	**Total Cost**
X1	A1	500	3	1,500
X1	A2	200	5	1,000
X2	A2	400	6	2,400
X2	A3	250	4	1,000
X3	A3	150	4	600
			Total Costs	6,500

Step 2 – Final Total Transportation Costs

The Stepping Stone Method

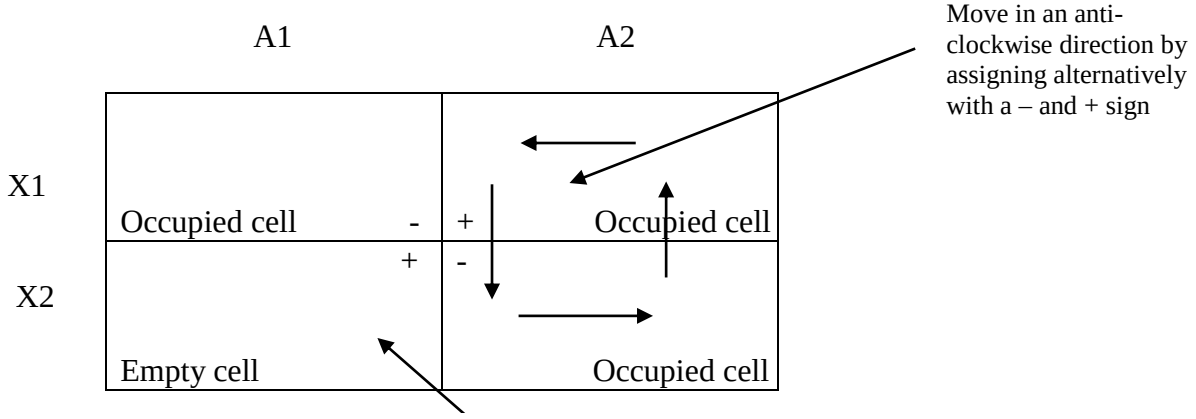
It is an iterative method used to evaluate the cost-effectiveness of shipping goods via transportation routes not currently used as per initial solution.

We need to test every unused cell. Follow the procedure as follows:

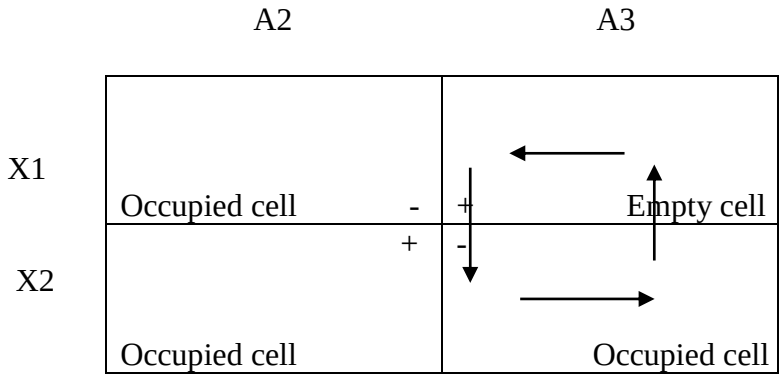
- Select any unused square to evaluate.
- Trace a closed path back to the original square via squares that are currently being used. The number of both used and unused squares must be equal or greater than 4 (1 unoccupied and other unoccupied).
- You may skip over an empty or used cell.
- Beginning with + sign at the unused cell, place alternate – and + signs on each of the cell.
- Compute the index for each closed route.

- Repeat the process for all unused cells. If there are 4 empty cells, then there must be 4 indices.

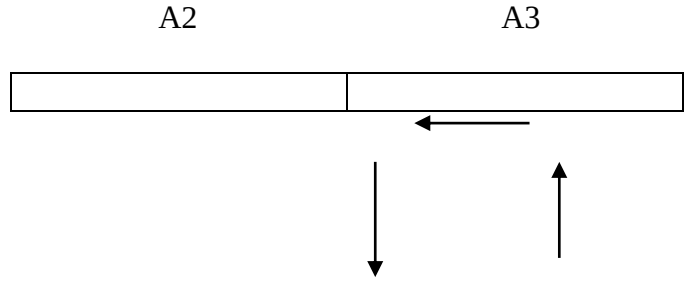
	A1	A2	A3	Capacity
X1	500 $3	200 $5	$7	700
X2	$1	400 $6	250 $4	650
X3	$8	$2	150 $4	150
Requirements	500	600	400	1500



The index for X1X2A1A2 = [+1] +



The index for X1X2A2A3 = [+7] + [-5] + [+6] + [-4] = 4



X2	Occupied cell -	+ Occupied cell
X3	+ Empty cell	- Occupied cell

The index for X2X3A2A3 = [+2] + [-4] + [+4] + [-6] = -4

	A1	A2	A3
X1	-	+	
X2		-	+
X3	+		-

The index for X1X2X3A1A2 A3= [+8] + [-4] + [+4] + [-6] + [+5] + [-3] = 4

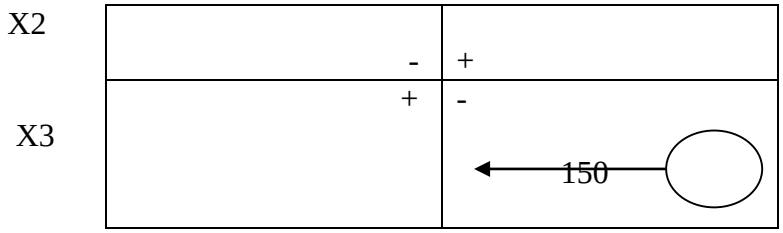
Selecting the Right Route that will Minimize Total Transportation Cost

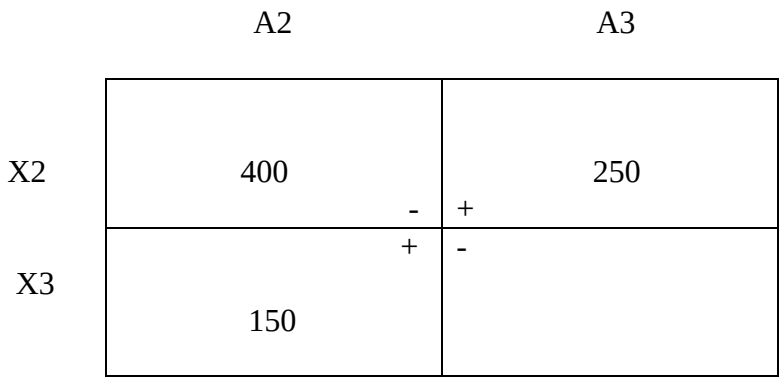
Because the X2X3A2A3 has the most negative index, a cost saving can be attained by making use of this route.

	A2	A3
X2	400 Occupied cell -	250 + Occupied cell
X3	+ Empty cell	- 150 Occupied cell

- Select the cells with the – signs. Identify the lower shipped quantity (150).
- Transfer 150 to the unoccupied cell.

A2	A3
400	250





	A1	A2	A3	Capacity
X1	500 $3	200 $5	$7	700
X2	$1	250 $6	400 $4	650
X3	$8	150 $2	$4	150
Requirements	500	600	400	1500

Ensure that the sum in the column or row is equal to the requirements or capacity

	A1	A2	A3	Capacity
X1	500 $3	200 $5	$7	700
X2	$1	250 $6	400 $4	650
X3	$8	150 $2	$4	150
Requirements	500	600	400	1500

Computing the Optimum Transportation Costs

Routing				
From	**To**	**Units Shipped**	**Cost per Unit**	**Total Cost**
			Total Costs	

The initial transportation cost = $6,500

The final transportation cost =

Analysis

Comparing the final routing and initial routing. **What is your analysis?**

Initial Transportation Routing

Routing				
From	**To**	**Units Shipped**	**Cost per Unit**	**Total Cost**
X1	A1	500	3	1,500
X1	A2	200	5	1,000
X2	A2	400	6	2,400
X2	A3	250	4	1,000
X3	A3	150	4	600
			Total Costs	6,500

Final Transportation Routing

Routing				
From	**To**	**Units Shipped**	**Cost per Unit**	**Total Cost**
			Total Costs	