MB106
QUANTITATIVE TECHNIQUES

MODULE I

LECTURE 11

Transportation Problems

TRANSPORTATION MODEL

Example:

A company has four warehouses and six stores. The warehouses altogether have a surplus of 22 units of a given commodity divided among them as follows:

Warehouses	1	2	3	4
Surplus	5	6	2	9

The six stores altogether need 22 units of the commodity. Individual requirements at stores 1, 2, 3, 4, 5 and 6 are 4, 4, 6, 2, 4 and 2 units respectively.

Cost of shipping one unit of commodity from warehouse I to store j in rupees is given in the matrix below:

		STORES					
WAREHOUSES		1	2	3	4	5	6
	1	9	12	9	6	9	10
	2	7	3	7	7	5	5
	3	6	5	9	11	3	11
	4	6	8	11	2	2	10

How should the products be shipped from the warehouses to the stores so that the transportation cost is minimized.

TRANSPORTATION MATRIX

Method :

1. Express supply from origins, requirements at destinations and cost of shipping from origin to destinationin the form of a matrix.
2. If the supply and requirements do not balance, a dummy origin or destination is created to balance the supply and requirements.

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
	1	2	3	4	5	6	
WAREHOUSES 1	9 4	12	9	6	9	10	5/1
2	7	3	7	7	5	5	6
3	6	5	9	11	3	11	2
4	6	8	11	2	2	10	9
Demand	**4/0**	**4**	**6**	**2**	**4**	**2**	

If supply and requirements balance, the problem is **SELF CONTAINED**. Here supply=demand=22

NORTH WEST CORNER RULE CONTINUED

1. Start from the north west corner of the transportation matrix.
2. If $D_1 < S_1$ set $x_{11} = D_1$ and proceed to cell (1,2) i.e. horizontally.
   If $D_1 = S_1$ set $x_{11} = D_1$ and proceed to cell (2,2) i.e. diagonally.
   If $D_1 > S_1$ set $x_{11} = S_1$ and proceed to cell (2,1) i.e. vertically.
   here D_i represents demand at the i^{th} origin and S_j represents supply at the j^{th} destination.
3. Repeat step 2 till the south east corner is reached.

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
	1	2	3	4	5	6	
WAREHOUSES 1	9 4	12 1	9	6	9	10	5/1/0
2	7	3	7	7	5	5	6
3	6	5	9	11	3	11	2
4	6	8	11	2	2	10	9
Demand	**4/0**	**4/3**	**6**	**2**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES							Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9 4	12 1	9	6	9	10	5/1/0
	2	7	3 3	7	7	5	5	6/3
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
Demand		**4/0**	**4/3/0**	**6**	**2**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
	1	2	3	4	5	6	
WAREHOUSES 1	9 4	12 1	9	6	9	10	5/1/0
WAREHOUSES 2	7	3 3	7 3	7	5	5	6/3/0
WAREHOUSES 3	6	5	9	11	3	11	2
WAREHOUSES 4	6	8	11	2	2	10	9
Demand	**4/0**	**4/3/0**	**6/3**	**2**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
	1	2	3	4	5	6	
WAREHOUSES 1	9 4	12 1	9	6	9	10	5/1/0
2	7	3 3	7 3	7	5	5	6/3/0
3	6	5	9 2	11	3	11	2/0
4	6	8	11	2	2	10	9
Demand	**4/0**	**4/3/0**	**6/3/1**	**2**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9 4	12 1	9	6	9	10	5/1/0
	2	7	3 3	7 3	7	5	5	6/3/0
	3	6	5	9 2	11	3	11	2/0
	4	6	8	11 1	2	2	10	9/8
Demand		**4/0**	**4/3/0**	**6/3/1/0**	**2**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9 4	12 1	9	6	9	10	5/1/0
	2	7	3 3	7 3	7	5	5	6/3/0
	3	6	5	9 2	11	3	11	2/0
	4	6	8	11 1	2 2	2	10	9/8/6
Demand		**4/0**	**4/3/0**	**6/3/1/0**	**2/0**	**4**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9 4	12 1	9	6	9	10	5/1/0
	2	7	3 3	7 3	7	5	5	6/3/0
	3	6	5	9 2	11	3	11	2/0
	4	6	8	11 1	2 2	2 4	10	9/8/6/2
Demand		**4/0**	**4/3/0**	**6/3/1/0**	**2/0**	**4/0**	**2**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

North West Corner Rule:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9 4	12 1	9	6	9	10	5/1/0
	2	7	3 3	7 3	7	5	5	6/3/0
	3	6	5	9 2	11	3	11	2/0
	4	6	8	11 1	2 2	2 4	10 2	9/8/6/2/0
Demand		**4/0**	**4/3/0**	**6/3/1/0**	**2/0**	**4/0**	**2/0**	

Z=4X9+1X12+3X3+3X7+2X9+1X11+2X2+4X2+2X10=Rs. 139/-

MATRIX MINIMA OR LEAST COST METHOD- CONTINUED

1. Allocate maximum possible in the lowest cost cell considering all rows and columns. This allocation is made subject to row and column constraints.
2. If the demand is fulfilled, strike off the column. If supply is exhausted, strike off the row. If both are fulfilled, strike off both.
3. Proceed to the next least cost cell not struck off.

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5/
	2	7	3	7	7	5	5	6/
	3	6	5	9	11	3	11	2/
	4	6	8	11	2	2 4	10	9/5
Demand		**4/**	**4/**	**6/**	**2/**	**4/0**	**2/**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5/
	2	7	3	7	7	5	5	6/
	3	6	5	9	11	3	11	2/
	4	6	8	11	2 2	2 4	10	9/5/3
Demand		**4/**	**4/**	**6/**	**2/0**	**4/0**	**2/**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5/
	2	7	3 4	7	7	5	5	6/2
	3	6	5	9	11	3	11	2/
	4	6	8	11	2 2	2 4	10	9/5/3
Demand		4/	4/0	6/	2/0	4/0	2/	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5/
	2	7	3 4	7	7	5	5 2	6/2/0
	3	6	5	9	11	3	11	2/
	4	6	8	11	2 2	2 4	10	9/5/3
Demand		**4/**	**4/0**	**6/**	**2/0**	**4/0**	**2/0**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5/
	2	7	3 4	7	7	5	5 2	6/2/0
	3	6	5	9	11	3	11	2/
	4	6 3	8	11	2 2	2 4	10	9/5/3/0
Demand		**4/1**	**4/0**	**6/**	**2/0**	**4/0**	**2/0**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9	6	9	10	5
	2	7	3 4	7	7	5	5 2	6/2/0
	3	6 1	5	9	11	3	11	2/1
	4	6 3	8	11	2 2	2 4	10	9/5/3/0
Demand		**4/1/0**	**4/0**	**6**	**2/0**	**4/0**	**2/0**	

TRANSPORTATION PROBLEM-FINDING A BASIC FEASIBLE SOLUTION

Matrix Minima Method:

	STORES						Supply
WAREHOUSES		1	2	3	4	5	6	
	1	9	12	9 5	6	9	10	5/0
	2	7	3 4	7	7	5	5 2	6/2/0
	3	6 1	5	9 1	11	3	11	2/1/0
	4	6 3	8	11	2 2	2 4	10	9/5/3/0
Demand		**4/1/0**	**4/0**	**6/1/0**	**2/0**	**4/0**	**2/0**	

Z=9X5+3X4+5X2+6X1+9X1+6X3+2X2+2X4=Rs. 112/-

- TILL WE MEET AGAIN IN THE NEXT CLASS.....