Example 2:

A contractor have three steel warehouses with 5000, 6000, and 2500 tons, respectively. Currently, four different construction sites require steel with quantities of 6000, 4000, 2000, and 1500, respectively.

The transportation cost per ton is given in the following table. Calculate the optimal transportation cost and its corresponding basic variables.

	Site 1	**Site 2**	**Site 3**	**Site 4**
Warehouse1	3	2	7	6
Warehouse2	7	5	2	3
Warehouse3	2	5	4	5

Example 2:

Initial Transportation Tableau (Initial Feasible Solution)

Vogal's Approximation **Cost=__________**

	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3	2	7	6	5000
Warehouse 2	7	5	2	3	6000
Warehouse 3	2	5	4	5	2500
Demand	6000	4000	2000	1500	

Transportation Simplex Method

Optimizing the initial solution

- Lets assume that each cost ($c_{i,j}$) is made of two components u_i, and v_j for each row and column respectively.

$$c_{i,j} = u_i + v_j$$

- If we calculated the u_i and v_j given the assigned variables at the initial solution, we can identify the potential cost increase or decrease per unoccupied cell.

$$e_{i,j} = c_{i,j} - u_i - v_j$$

- Stepping stone method can help us achieve this in a systematic approach.

Transportation Simplex Method

MODI Method (for obtaining reduced costs)

Associate a number, u_i, with each row and v_j with each column.

Step 1: Set $u_1 = 0$.

Step 2: Calculate the remaining u_i's and v_j's by solving the relationship $c_{ij} = u_i + v_j$ for occupied cells.

Step 3: For unoccupied cells (i,j), the reduced cost $= c_{ij} - u_i - v_j$.

Transportation Simplex Method

- **Optimizing: Stepping Stone Method**
  - **Step 1:** For each unoccupied cell, calculate the reduced cost by the MODI method. Select the unoccupied cell with the most negative reduced cost. (For maximization problems select the unoccupied cell with the largest reduced cost.) If none, STOP.
  - **Step 2:** For this unoccupied cell generate a stepping stone path by forming a closed loop with this cell and occupied cells by drawing connecting alternating horizontal and vertical lines between them.

    Determine the minimum allocation where a subtraction is to be made along this path.

Transportation Simplex Method

- **Optimizing Stepping Stone Method (continued)**
  - **Step 3:** Add this allocation to all cells where additions are to be made, and subtract this allocation to all cells where subtractions are to be made along the stepping stone path.

    (Note: An occupied cell on the stepping stone path now becomes 0 (unoccupied). If more than one cell becomes 0, make only one unoccupied; make the others occupied with 0's.)

    GO TO STEP 1.

Example 2:

Initial Transportation Tableau (Initial Feasible Solution)

Vogal’s Approximation **Cost=________**

	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3 1000	2 4000	7	6	5000
Warehouse 2	7 2500	5	2 2000	3 1500	6000
Warehouse 3	2 2500	5	4	5	2500
Demand	6000	4000	2000	1500	

Example 2:

MODI Method

$u_1+v_1 = 3$

$u_1+v_2 = 2$

$u_2+v_1 =7$

$u_2+v_3 =2$

$u_2+v_4 = 3$

$u_3+v_1 = 2$

	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3 1000	2 4000	7	6	5000
Warehouse 2	7 2500	5	2 2000	3 1500	6000
Warehouse 3	2 2500	5	4	5	2500
Demand	6000	4000	2000	1500	

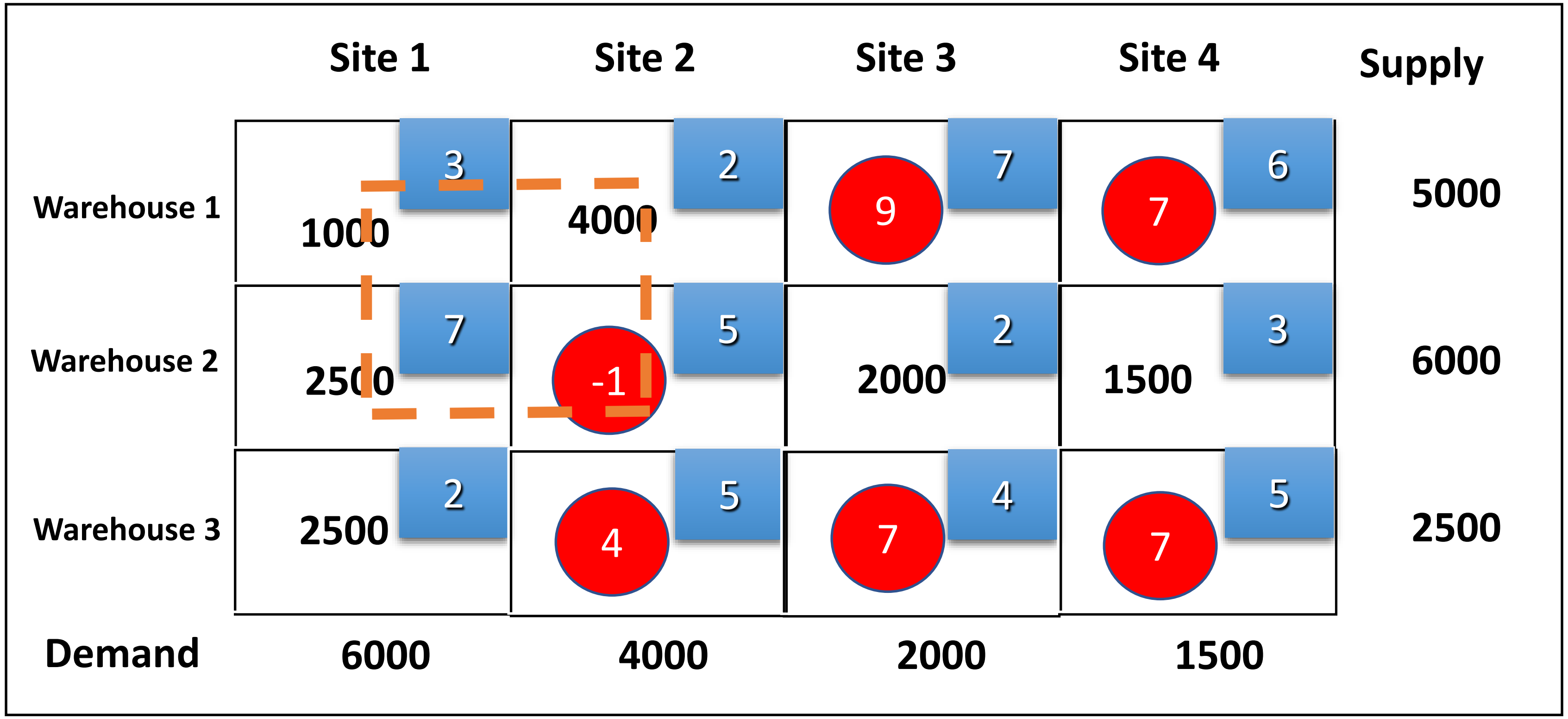
If we Set $u_1 = 0$

then $u_2 = 4$, $u_3 = -1$, $v_1 = 3$, $v_2 = {}_2$, $v_3 = -2$, and $v_4 =-1$

Example 2:

	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3 1000	2 4000	7 9	6 7	5000
Warehouse 2	7 2500	5 -1	2 2000	3 1500	6000
Warehouse 3	2 2500	5 4	4 7	5 7	2500
Demand	6000	4000	2000	1500	

Example 2:



	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3 1000	2 4000	7 9	6 7	5000
Warehouse 2	7 2500	5 -1	2 2000	3 1500	6000
Warehouse 3	2 2500	5 4	4 7	5 7	2500
Demand	6000	4000	2000	1500	

Example 2:

	Site 1	Site 2	Site 3	Site 4	Supply
Warehouse 1	3 3500	2 1500	7	6	5000
Warehouse 2	7	5 2500	2 2000	3 1500	6000
Warehouse 3	2 2500	5	4	5	2500
Demand	6000	4000	2000	1500	