"COMPARATIVE ANALYSIS OF SUPREMUM METHOD USING LCM, MM, AND VAM THROUGH CALCULATING MULTIPLE EXAMPLES IN TP"

Mr. Jigarkumar Jayswal[#1], Dr. Chirag Patel[#2], Mr. Rahul Prajapati[#3], Ms.Kinnari Patel[#4], Ms. Honey Patel[#5]

[1]Assistant Professor in Science and Humanities, Smt.S.S.Patel Nootan Science and Commerce College, Sankalchand Patel University,Visnagar,India.

jayshreekrishna33@gmail.com

[2]Associate Professor in Science and Humanities, Smt.S.S.Patel Nootan Science and Commerce College, Sankalchand Patel University,Visnagar,India.

[3,4,5]Assistant Professor in Science and Humanities, Smt.S.S.Patel Nootan Science and Commerce College, Sankalchand Patel University,Visnagar,India.

ABSTRACT:

The role of Transportation Problem in Operations research is significant. Its primary goal is to move quantities of goods stored at different locations to diverse destinations in a way that minimizes transportation costs, maximizes profits, or reduces total time. To obtain an initial basic feasible solution to the linear programming problem, the North-West Corner Method, Matrix Minima Method and Vogel's Approximation Method can be used. By comparing their outcomes, we can present the results in a table.

I. INTRODUCTION:

Well Established Paradigm of Transportation Problem:

To fulfill their supply chain needs, many companies must transport their products from different locations to various destinations. This requires minimizing the overall cost of transportation for the Transportation Problem (T.P.). The general mathematical model for the T.P. involves m supply sources, denoted as $O_1, O_2, ..., O_m$, each with a specific supply capacity s_i (I = 1, 2, ..., m). These supplies must be transported to n destinations, $D_1, D_2, ..., D_n$, each with a specific demand requirement dj (j = 1, 2, ..., n). The cost of transporting one unit of product from source i to destination j is represented by Cij. To indicate the number of units shipped per route from source i to destination j, we use xij. The goal is to find a transportation schedule that meets the supply and demand requirements while minimizing the total transportation cost. In general, the problem can be expressed mathematically as follows:

Minimize (total cost) $Z = \sum_{i=1}^{m}\sum_{j=1}^{n} C_{ij} x_{ij}$ ---------(1)

Subject to the restriction,

$\sum_{j=1}^{n} x_{ij} = s_i$ Where i =1, 2… m --------- (2)

$\sum_{i=1}^{m} x_{ij} = d_j$ Where j= 1, 2…n --------- (3)

And $x_{ij} \geq 0$, ∀ i, j.

Well Established Transportation Table:

To / From	D_1	D_2	… … … …	D_n	Supply s_i
O_1	c_{11} x_{11}	c_{12} x_{12}	… … … …	c_{1n} x_{1n}	s_1
O_2	c_{21} x_{21}	c_{22} x_{22}	… … … …	c_{2n} x_{2n}	s_2
: :	: :	: :	… … … …	: :	: :
O_m	c_{m1} x_{m1}	c_{m2} x_{m2}	… … … …	c_{mn} x_{mn}	s_m
Demand d_j	d_1	d_2	… … … …	d_n	$\sum_{i=1}^{m} s_i = \sum_{j=1}^{n} d_j$

When the rim condition is satisfied then we said that the T.P. is balanced.

In this paper, we obtained an IBFS to problem by NWCM, Matrix Minima Method and VAM and compared their results and displayed in the tables. Vogel's Approximation Method is superior to NWCM and Matrix Minima Method. Also VAM gives feasible solution close to optimal solution.

II. IBFS BY NWCM, MATRIX MINIMA AND VAM:

Numerical Illustration:

Illustration 1.1

To / From	D_1	D_2	D_3	Supply
S_1	3	7	1	20
S_2	2	9	12	30
S_3	10	2	5	50
Demand	35	15	50	100

Illustration 1.1 Solutions by NWCM:

To / From	D_1	D_2	D_3	Supply
S_1	3 (20)	7	1	20
S_2	2 (15)	9 (15)	12	30
S_3	10	2	5 (50)	50
Demand	35	15	50	100

Total Transportation Cost by NWCM = 3*20+ 2*15+ 9*15+ 5*50 = Rs. 475

Illustration 1.1 Solutions by Matrix Minima Method:

To / From	D_1	D_2	D_3	Supply
S_1	3	7	1 (20)	20
S_2	2 (30)	9	12	30

S_3	10 5	2 15	5 30	50
Demand	35	15	50	100

Total Transportation Cost by Matrix Minima = 1*20+ 2*30+ 5*10+ 2*15 + 5*30 = Rs. 310

Illustration 1.1 Solution s by VAM:

To / From	D_1	D_2	D_3	Supply
S_1	3 5	7	1 15	20
S_2	2 30	9	12	30
S_3	10	2 15	5 35	50
Demand	35	15	50	100

Total Transportation Cost by VAM = 3*5+ 1*15+ 2*30+ 2*15 + 5*35 = Rs. 295

Illustration 1.2

To / From	1	2	3	4	Availability
A	21	16	25	13	11
B	17	18	14	23	13
C	32	27	18	41	19
Requirement	6	10	12	15	43

Illustration 1.2 Solutions by NWCM:

To / From	1	2	3	4	Availability
A	21 6	16 5	25	13	11
B	17	18 5	14 8	23	13
C	32	27	18 4	41 15	19
Requirement	6	10	12	15	43

Total Transportation Cost by NWCM = 6*21+ 5*16+ 5*18+ 8*14+4*18+ 15*41 = Rs. 1095

Illustration 1.2 Solutions by Matrix Minima Method:

To / From	1	2	3	4	Availability
A	21	16	25	13 11	11
B	17 1	18	14 12	23	13
C	32 5	27 10	18 4	41 4	19
Requirement	6	10	12	15	43

Total Transportation Cost by Matrix Minima = 11*13+ 1*17+ 12*14+ 5*32 + 10*27+4*41 =

Rs. 922

Illustration 1.2 Solutions by VAM:

To / From	1	2	3	4	Availability
A	21	16	25	13 / 11	11
B	17 / 6	18 / 3	14	23 / 4	13
C	32	27 / 7	18 / 12	41	19
Requirement	6	10	12	15	43

Total Transportation Cost by VAM = 11*13+ 6*17+ 3*18+ 4*23 + 7*27+12*18 = Rs. 796

Illustration 1.3

To / From	A	B	C	D	E	F	Availability
I	6	12	9	6	9	10	5
II	7	3	7	7	5	5	6
III	6	5	9	11	3	11	2
IV	6	8	11	2	2	10	9
Requirement	4	4	6	2	4	2	22

Illustration 1.3 Solutions by NWCM:

To / From	A	B	C	D	E	F	Availability
I	6 / 4	12 / 1	9	6	9	10	5
II	7	3 / 3	7 / 3	7	5	5	6
III	6	5	9 / 2	11	3	11	2

IV	6	8	11 1	2 2	2 4	10 2	9
Requirement	4	4	6	2	4	2	22

Total Transportation Cost by NWCM = 6*4+12*1+3*3+7*3+9*2+11*1+2*2+2*4+2*10 = Rs. 127

Illustration 1.3 Solutions by Matrix Minima Method:

To From	A	B	C	D	E	F	Availability
I	6 4	12	9 1	6	9	10	5
II	7	3 4	7	7	5	5 2	6
III	6	5	9 2	11	3	11	2
IV	6	8	11 3	2 2	2 4	10	9
Requirement	4	4	6	2	4	2	22

Total Transportation Cost by Matrix Minima = 6*4+9*1+3*4+5*2+9*2+11*3+2*2+2*4+ =

Rs. 118

Illustration 1.3 Solutions by VAM:

To From	A	B	C	D	E	F	Availability
I	6 1	12	9 4	6	9	10	5
II	7	3 4	7	7	5	5 2	6
III	6	5	9 2	11	3	11	2
IV	6 3	8	11	2 2	2 4	10	9
Requirement	4	4	6	2	4	2	22

Total Transportation Cost by VAM = 6*1+9*4+3*4+5*2+9*2+6*3+2*2+2*4 = Rs. 112

III. Result Analysis

Method	Illustration 1.1 (In Rs.)	Illustration 1.2 (In Rs.)	Illustration 1.3 (In Rs.)
NWCM	475	1095	127
MATRIX MINIMA	310	922	118
VAM	295	796	112

III. Conclusion

In this Paper, we have seen that from result analysis, Vogel's Approximation Method is superior to NWCM and Matrix Minima Method for finding an Initial Basic Feasible Solution.

IV. References

[1]. J K Sharma, " Operations Research Theory and Applications",4th Editions,Macmillan Publishers India Ltd.

[2]. F.L.Hitchcock, "The distribution of a product from several sources to Numerous localities",Journal of Mathematical Physics, 20(1941), 224-230.

[3]. G.B.Dantzig, "Application of the simplex method to a transportation problem, Activity Analysis of production and allocation", (T.C. Koopmans ed.), Wiley, New York, (1951), 359- 373.

[4]. Neetu M.Sharma and Ashok P.Bhadane, "An alternative method to north west corner method for solving transportation problem", International Journal for Research in Engineering Application & Management, 1(12)(2016), 1-3.

[5]. M.Sathyavathy, M.Shalini, "Solving Transportation Problem with Four Different Proposed Mean Method and Comparison with Existing Methods for Optimum Solution".