iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** II **Month of publication:** February 2022

DOI: https://doi.org/10.22214/ijraset.2022.40310

Comparison of Transportation Problem in Operation Research

Dhivya Bharathi. S[1], M. Ramy[2]
[1]*M.SC Mathematics, Department of Mathematics, Dr SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamil Nadu, India*
[2]*Assistant Professor, Department of Mathematics, Dr SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamil Nadu, India*

Abstract: In Operations Research, the transportation problem is one of the predominant area and it is widely used as a decision making tool in many fields. We report the basic feasible solution and hence the methods to attain the optimal solution of the balanced transportation problem.
Keywords: Transportation Problem, North-West Corner Method, Least Cost Method, Vogel's Approximation Method.

I. INTRODUCTION

The transportation problem in Operations Research has wide applications in inventory control, production planning, scheduling, personal allocation and so forth. The objective is to minimize the cost of distribution a product from a number of sources or origins to a number of destinations. The characteristic of a transportation problem are such that it usually solved by a specialized method rather than by simplex method.

II. TRANSPORTATION PROBLEM

The transportation problem in operational research is concerned with finding the minimum cost of transporting a single commodity from a given number of sources to a given number of destinations. These types of problems can be solved by general network methods,but here we use a specific transportation algorithm.

The data of the model include

1) The level of supply at each source and the amount of demand at each destination.
2) The unit transportation cost of the commodity from each source to each destination.

Since there is only one commodity, a destination can receive its demand from more than one source. The objective is to determine how much should be shipped from each source to each destination so as to minimise the total transportation cost.

Types of transportation problem in Operation research:

a) *Balanced Transportation Problem:* In transportation problem when the total supply from all the sources is equal to the total demand in all destinations is said to be an balanced transportation problem.

$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$

b) *Unbalanced Transportation Problem:* In transportation problem when the sum of supply available from all sources is not equal to the sum of demands of all destinations is said to be an unbalanced transportation problem.

$$\sum_{i=1}^{m} a_i \neq \sum_{j=1}^{m} b_j$$

A transportation problem may have feasible solution only it is a balanced problem .An unbalanced problem can be made balanced by adding dummy supply centre or dummy demand centre as per the requirement.

III. SOLUTION OF THE TRANSPORTATION PROBLEM

1) Finding an initial basic feasible solution.
2) Checking for optimality.

Finding an initial basic feasible solutions there are three methods:

A. *Northwest Corner Method*

The method starts at the northwest corner cell of the tableaux_{11}.

1) Choose the cell in the north-west corner of the transportation and allocate as much as possible in the cell so that either the capacity of first row is exhausted or the destination requirement of the first column is exhausted.
2) If the demand is exhausted, move one cell right horizontally to the second column and allocate as much as possible.
3) If the supply is exhausted, move one cell down vertically to the second row and allocates as much as possible. If both the supply and demand are exhausted move one cell diagonally and allocate as much as possible.
4) Continue the above procedure until all the allocations are made.

B. *Least Cost Method*

The least cost method by assigning possible to the cell with smallest unit cost.

1) Find the cell with the least (minimum) cost in the transportation table.
2) Allocate the maximum feasible quantity to the cell.
3) Eliminate the row or column where an allocation is made.
4) Repeat the above steps for the reduced transportation table until all the allocations are made.

C. *Vogel's Approximation Method*

Vogel's Approximation Method is an improved version of the least cost method that generally produces better starting solutions.

1) Calculate the penalties for each row and each column. Here penalty means the difference between the two successive least cost in row and in column.
2) Select the row or column with the largest penalty.
3) In the selected row or column, allocate the maximum feasible quantity to the cell with the minimum cost.
4) Eliminate the row or column where all the allocations are made.
5) Write the reduced transportation table and repeat the step 1 to 4.
6) Repeat the procedure until all the allocations are made.

IV. ILLUSTRATIVE EXAMPLES

A. *Northwest Corner Method*

Example: Determine an initial basic feasible solution to the following transportation problem.

	D_1	D_2	D_3	D_4	
C_1	6	4	1	5	14
C_2	8	9	2	7	16
C_3	4	3	6	2	5
	6	10	15	4	

Solution

Given

	D_1	D_2	D_3	D_4	
C_1	6	4	1	5	14
C_2	8	9	2	7	16
C_3	4	3	6	2	5
	6	10	15	4	

First allocation

	D_1	D_2	D_3	D_4	
C_1	(6) 6	4	1	5	14/8
C_2	8	9	2	7	16
C_3	4	3	6	2	5
	6/0	10	15	4	

Second allocation

(6) 6	(8) 4	1	5	14/8/0
8	9	2	7	16
4	3	6	2	5
6/0	10/2	15	4	

Third allocation

(6) 6	(8) 4	1	5	14/8/0
8	(2) 9	2	7	16/14
4	3	6	2	5
6/ 0	10/2/0	15	4	

Fourth allocation

(6) 6	(8) 4	1	5	14/8/0
8	(2) 9	(14) 2	7	16/14/0
4	3	6	2	5
6/0	10/2/0	15/1	4	

Fifth allocation

(6) 6	(8) 4	1	5	14/8/0
8	(2) 9	(14) 2	7	16/14/0
4	3	(1) 6	2	5/4
6/0	10/2/0	15/1/0	4	

Final allocation

(6) 6	(8) 4	1	5	14/8/0
8	(2) 9	(14) 2	7	16/14/0
4	3	(1) 6	(4) 2	5/4/0
6/0	10/2/0	15/1/0	4/0	

The Associated objective function value is
$(6\times 6) + (8\times 4)+(2\times 9)+(14\times 2)+(1\times 6)+(4\times 2)$
$=36+32+18+28+6+8$
=$128

B. Least Cost Method

6	4	1	5	14
8	9	2	7	16
4	3	6	2	5
6	10	15	4	

Solution:
Given transportation problem is

6	4	1	5	14
8	9	2	7	16
4	3	6	2	5
6	10	15	4	

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

First allocation

6	4	(14) 1	5	14/0
8	9	2	7	16
4	3	6	2	5
6	10	15/1	4	

Second allocation

6	4	(14) 1	5	14/0
8	9	(1) 2	7	16/15
4	3	6	2	5
6	10	15/1/0	4	

Third allocation

6	4	(14) 1	5	14/0
8	9	(1) 2	7	16/15
4	3	6	(4) 2	5/1
6	10	15/1/0	4/0	

Fourth allocation

6	4	(14) 1	5	14/0
8	9	(1) 2	7	16/15
4	(1) 3	6	(4) 2	5/1/0
610/9	15/1/0	4/0		

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

Fifth allocation

6	4	(14) 1	5	14/0
(6) 8	9	(1) 2	7	16/15/9
4	(1) 3	6	(4) 2	5/1/0

6/0 10/915/1/0 4/0

Final allocation

6	4	(14) 1	5	14/0
(6) 8	(9) 9	(1) 2	7	16/15/9/0
4	(1) 3	6	(4) 2	5/1/0
6/0	10/9/0	15/1/0	4/0	

Hence
The associated objective function value is
(14× 1)+(6× 8)+(9× 9)+(1× 2)+(1× 3)+(4× 2)
=14+48+81+2+3+8
=$156

3.Vogel's Approximation Method (VAM):

6	4	1	5	14
8	9	2	7	16
4	3	6	2	5

6 10 154

Solution
The given problem is balanced transportationproblem.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue II Feb 2022- Available at www.ijraset.com

First allocation

6	4	(14) 1	5	14/0
8	9	2	7	16
4	3	6	2	5
6	10	15/1	4	

Second allocation

8	9	(1) 2	7 16/15
4	3	6	2 5
6	1015/1/0		4

Third allocation

8	9	7	16/15
4	3	(4) 2	5/1
6	10	4/0	

Fourth allocation

8	9	16/15
4	(1) 3	5/1/0
6	10/9	

Fifth allocation

(6) 8	9	16/15/9
6/0	9	

Final allocation

6	4	(14) 1	5	14/0
(6) 8	(9) 9	(1) 2	7	16/15/9/0
4	(1) 3	6	(4) 2	5/1/0
6/0	10/9	15/1/0	4/0	

Hence the associated objective function value is
$(14\times 1)+(6\times 8)+(9\times 9)+(1\times 2)+(1\times 3)+(4\times 2)$
$=14+48+81+2+3+8$
$=\$156$

Comparison between the three methods

Northwest corner method is used when the purpose of completing demand and then the next and is used when the purpose of completing the supply and then the next. Advantage of northwest corner method is quick solution because computations take short time but yields a bad solution because it is very far from optimal solution.

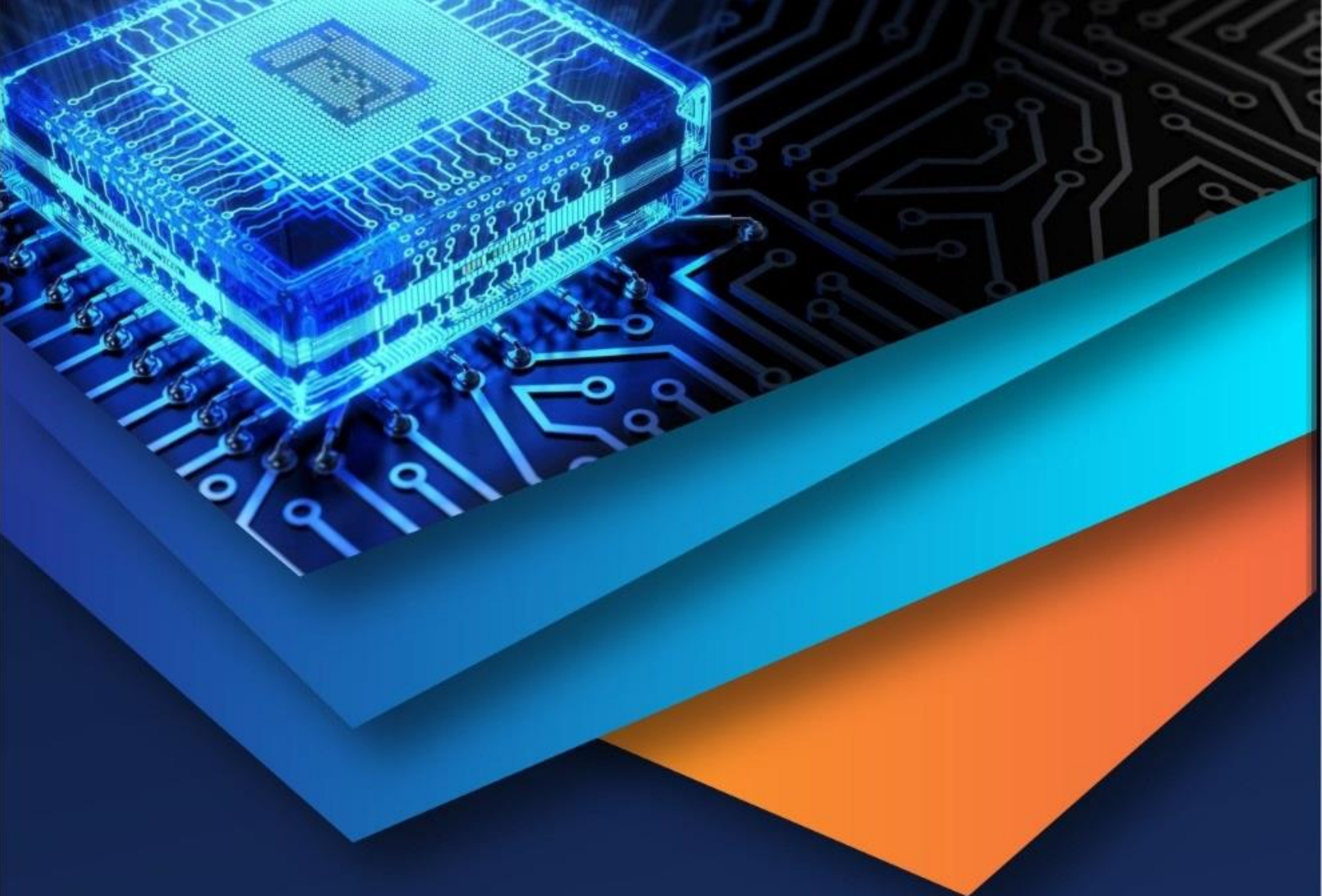
Vogel's approximation method and Least cost method are used to obtain the shortest route. Advantage of Vogel's approximation method and Least cost method yields the best starting basic solution because gives initial solution near to optimal solution but the solution of Vogel's approximation methods is slow because computations take long time. The cost of transportation with Vogel's approximation method and Least cost method is less than northwest corner method.

V. CONCLUSION

The transportation problem is one of the most frequently encountered applications in real life situations. The transportation problem indicates the amount of consignment to be transported from various origins to different destinations so that the total transportation cost is minimized without violating the availability constraints and the requirement constraints.

REFERENCES

[1] S. I. Gass, On solving the transportation problem, Journal of Operational Research Society 35(12), 1113-1114, 1990.
[2] R. R.K. Sharma and K. D. Sharma, A new dual based procedure for the transportation problem, European Journal of Operations Research 144, 560-564, 2003.
[3] H. Wagner, Principles of Operations Research, New Jersey: Prentice- Hall, Englewood cliffs, 1969.
[4] W. L. Winston, Operations Research Applications and Algorithms, California: Wadsworth Publishing, 1991.
[5] P.K Gupta and D.S. Hira, Operation Research, S. Chand, New Delhi, India, 1992.
[6] Hamdy A. Taha, Operations Research an introduction, University of Arkansas, Fayetteville, 1997.
[7] V. Sundaresan, K.S. Ganapathy Subramanian, K. Ganesan, Resource Management Techniques (Operation Research).



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY