International Journal of Engineering & Technology, 7 (4.10) (2018) 473-475

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

A Tactical Strategy in Transportation Problems Using Statistical Process

P. Sumathi[1], C.V. Sathiya Bama[2]

[1]Department of Mathematics, Bharath Institute of Higher Education and Research
Chennai - 600 073, Tamilnadu, India
[2]Department of Mathematics, Bharath Institute of Higher Education and Research
Chennai - 600 073, Tamilnadu, India
**Corresponding author E-mail: sathiyavenu84@gmail.com , psumathi16@rediffmail.com*

Abstract

In this paper, a new algorithm is projected for finding initial basic feasible solution (IBFS) using average and also compared various methods of transportation problems. The proposed approach is also discussed with various numerical problems.

Keywords: *Transportation Problem, Optimal Solution, Initial Basic Feasible Solution, Average.*

1. Introduction

Transportation (TP) problem is use to reduce the transportation cost for industries with the number of sources and number of destinations while satisfying the supply limit and demand requirement. TP problem was originally established by Hitchcock [6]. Dantzig [5] developed different methods for finding IBFS and then by Charnes et. al [4]. The process of solving transportation problems are as follows

1. Mathematical formulation of the transportation problem.
2. Finding initial basic feasible solution.
3. Optimize the initial basic feasible solution.

Some conventional methods to find the minimum transportation cost are North West Corner Method (NWC), Least cost method (LCM), Vogel's Approximation Method (VAM) are considered to provide initial basic feasible solution [8].

Many researchers have developed different methods for determining an initial basic feasible solution. In \A new approach to solve transportation problem", a new technique using allocation table method (ATM) was discussed to get initial basic feasible solution by Mollah mesbahuddhin Ahmed et al [14].

Neetu M. Sharma et al [16] proposed an alternative method to North West Corner method by using coeffcient of range (COR).

Aminur Rahman khan et al [3] introduced a new heuristic for finding an initial basic feasible solution using sum approach.

A new approach to solve transportation problem based upon average total opportunity cost (ATOC) was proposed by S.M. Abdul Kalam Azad et al [1].

In this paper, a new technique is presented to find initial basic feasible solution using statistical tool called average. It is very easy to understand and apply. Numerical examples are illustrated and comparative analysis done for various problems taken from [1], [3], [8], [14], [16]. In section 2 algorithms for proposed method is presented. Numerical illustrations were presented in section 3. Comparative analysis for various approaches was presented in section 4 and section 5 concludes the proposed approach.

2. Algorithm for Proposed Method

Step 1: Formulate a transportation table from the given problem.
Step 2: Make sure that the transportation problem is balanced or not, if not, formulate it balanced.
Step 3: For each row of transportation table identify the maximum and minimum cost. Find out the average among them for every row. Display them at the side of the transportation table by placing them in the corresponding rows. Likewise, calculate the average for every column.
Step 4: Classify the row or column with the highest average between all the rows and columns. If tie occurs, use any random tie breaking choice.
Step 5: Let the largest average corresponds to the i^{th} row and let c_{ij} be the smallest in the i^{th} row. Assign the maximum feasible amount xij = min(a_i; b_j) in (i; j) and cross either the ith row or the jth column in the normal way.
Step 6: Go to step 3 until the cell requirements are satisfied.

3 Numerical Examples with Illustration

3.1 Find Initial Basic Feasible Solution for the Following Transportation Problem

	A	B	C	D	SUPPLY
P	11	13	17	14	250
Q	16	18	14	10	300
R	21	24	13	10	400
DEMAND	200	225	275	250	

<table>
<tr><td>25</td><td></td><td>22
5</td><td></td><td rowspan="2">17</td><td rowspan="2" colspan="2">14</td><td rowspan="2">25
0</td><td rowspan="2">1
4</td><td rowspan="2">14</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td></td><td>1
1</td><td></td><td>1
3</td></tr>
<tr><td>17
5</td><td></td><td colspan="2">18</td><td>14</td><td>12
5</td><td></td><td>30
0</td><td>1
4</td><td>13</td><td>13</td><td>12</td></tr>
</table>

16			10					
21	24	275 13	125 10	400	17	15.5	15.5	15.5
200	225	275	250					
16	**18.5**	15	12					
16	-	15	12					
18.5	-	13.5	10					
-	-	**13.5**	10					

Transportation cost = 25 × 11 + 225 ×13 + 175 × 16 + 125 ×10 + 275 × 13 + 125 × 10 = 12075.

3.2 Find the Initial Basic Feasible Solution for the Following Problem

	A1	A2	A3	A4	AVAILABILITY
R1	5	3	6	2	19
R2	4	7	9	1	37
R3	3	4	7	5	34
REQUIREMENT	16	18	31	25	

5	3	19 6	2	19	4	-	-	-
12 4	7	9	25 1	37	5	5	4	3
4 3	18 4	12 7	5	34	5	5	4	**4**
16	18	31	25					
4	5	**7.5**	4					
3.5	5.5	**8**	3					
3.5	**5.5**	-	3					
3.5	-	-	3					

Transportation cost = 19×6+12×4+25×1+4×3+18×4+12×7 = 355.

4. Comparative Analysis

Various size of small scale transportation problems were analyzed by using NWCR, LCM, VAM, COR, ATOC, SUM APPROACH, ATM and also by PROPOSED METHOD. The comparative results were given in the Table 1.

S. NO	PROBLEM DIMENSION		PROPOSED METHOD	NWCR	LCM	VAM	COR	AVERAGE PENALTY	SUM APPROACH	ATM
1.	3	4	3320	4120	4620	3320	3620	3320	3320	3320
2.	3	4	2850	4400	2900	2850	2850	2850	2850	2850
3.	3	4	240	320	248	240	248	241	241	240
4.	3	4	12075	12200	12825	12075	12200	12200	12200	12825
5.	3	4	355	580	367	355	369	355	355	370
6.	3	4	796	1095	922	796	796	796	796	799
7.	3	4	2221	2897	2238	2221	2238	2221	2221	2696
8.	3	4	104	131	105	104	104	104	104	105
9.	3	3	5920	6600	6460	5920	5920	5920	5920	7240
10.	4	3	295	455	295	295	355	295	295	295

5. Conclusion

In this paper, a tactical technique were used for finding an initial basic feasible solution using a statistical tool "Average" for the TP problem has been presented. Various size of transportation problem has analyzed. Finally observed that the minimum cost is unique and the cost is same as VAM Method. And also the proposed approach cost is reduced compared with other researcher's approach with minimum computational work.

References

[1] S.M. Abul Kalam, Azad, Md. Bellel Hossain, Md. Mizanur Rahman, An Algorithmic Approach to solve Transportation Problems with the average total opportunity cost method, International Journal of Scientific and Research Publications, 7(2) (2017).

[2] M.M. Ahmed, M.A. Islam, M. Katun, S. Yesmin, M.S. Uddin, New Procedure of finding an initial basic feasible solution of time minimizing Transportation Problems, Open Journal of Applied Sciences (2015).

[3] Aminur Rahman Khan, Adrian Vilcu, Nahid Sultana, Syed Sabbhir Ahmed, Determination of Initial Basic Feasible Solution of a Transportation problem, TOCM-SUM Approach (2015).

[4] A. Charnes, W.W. Cooper, A. Henderson, An Introduction to linear programming, John Wiley & sons, New York (1953).

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

[6] F.L. Hitchcock, The distribution of a product from several sources to numerous localities, Journal of mathematics and physics (1941).

[7] A.T. Hamdy, Operations Research, An Introduction, 8th Edition, Pearson Prentice Hall, Upper Saddle River (2007).

[8] Kanti Swarup, P.K. Gupta, Man Mohan, Introduction to Management Science, Sultan chand and sons, New Delhi (2017).

[9] H.S. Kasana, K.D. Kumar, Introductory Operations Research: Theory and Applications, Springer International Edition, New Delhi (2005).

[10] A. Karpagam, P. Sumathi, Innovative method for solving fuzzy linear programming problems with symmetric trapezoidal fuzzy numbers, International Journal of Latest Research in Science and Technology, 3(6) (2014), 95-98.

[11] A. Karpagam, P. Sumathi, New approach to solve fuzzy linear programming problems by ranking function, Bonfring International Journal of Data Mining, 4(4) (2014), 22-25.

[12] O. Kirca, A. Stair, A Heuristic for Obtaining an Initial Solution for the Transportation Problem, Journal of the Operational Research Society (1900).

[13] Md. Mizanur Rahman, Md. Bellel Hossain, Md. Mosharraf Hossain, A New Approach for minimization of Transportation Time: An Algorithmic Approach, Imperial journal of interdisciplinary Research (IJIR), 2(7) (2016).

[14] Mollah Mesbahuddin Ahmed, Aminur Rahman Khan, Md. Sharif Uddin, Farque Ahmed, A new approach to solve transportation problem, Jahangirnagar University, Scientific Research Publishing Inc. (2016).

[15] M. Mathirajan, B. Meenakshi, Experimental Analysis of some variants of Vogel's Approximation Method, Asia-Pacific Journal of Operational Research (2004).

[16] Neetu M. Sharma, Ashok P. Bhadane, An Alternative method to North West Corner method for solving transportation problem, International Journal for Research in Engineering Application & Management (IJREAM), 1(12) (2016).

[17] S. Paulraj, P. Sumathi, A Comparative study of redundant constraints identification methods in linear programming problems, Mathematical Problems in Engineering, (2010), Article ID 723402, 16 pages.

[18] S. Paulraj, P. Sumathi, A new approach for selecting constraint in linear programming problems to identify the redundant constraints, International Journal of Scientific and Engineering Research, 3(3) (2012).

[19] N.V. Reinfield, W.R. Vogel, Mathematical Programming, Prentice hall, Englewood cli_s (1958).

[20] P. Sumathi, S. Paulraj, Identification of redundant constraints in large scale linear programming problems with minimal

computational effort, Applied Mathematical Sciences, 7(80) (2013), 3963-3974.
[21] P. Sumathi,A New tactic for finding irrelevant constraints in linear programming problems, International Journal of Scientific and Engineering Research, 6(3) (2015), 66-69.
[22] P. Sumathi, A New approach to solve linear programming problems with intercept values, Journal of Information and Optimization Sciences, 7(4) (2016), 95-510.
[23] P. Sumathi, A. Gangadhara, New technique to detect redundant constraints in large scale linear programming problems, International Journal of Scientific and Engineering Research, 3(6) (2014), 236-238.
[24] P. Sumathi, A. Gangadhara, Selection of constraints with a new approach in scale linear programming problems, Applied Mathematical Sciences, 8(27) (2014), 1311-1321.
[25] P. Sumathi, V. Preethy, A New Approach in Assignment Problems, International Journal of Pure and Applied Mathematics, 113(13) (2017), 122-131.