How to Cite:
Sahib, M. S. A., & Shiker, M. A. K. (2022). Employing the median to reach the IBFS for T.P. *International Journal of Health Sciences*, *6*(S6), 9330–9337.
https://doi.org/10.53730/ijhs.v6nS6.12431

Employing the median to reach the IBFS for T.P.

Mohammed S. Abdul Sahib
Department of Mathematics, College of Education for Pure Sciences, University of Babylon, Babil - Iraq
Email: mohammed.saheb.pure332@student.uobabylon.edu.iq

Mushtak A. K. Shiker
Department of Mathematics, College of Education for Pure Sciences, University of Babylon, Babil - Iraq
*Corresponding author email: mmttmmhh@yahoo.com, pure.mushtaq@uobabylon.edu.iq

***Abstract*---**Industries must prepare to move their goods from production centers to end-users while keeping transportation costs as low as possible to maximize revenues. The transportation issue is a procedure that evaluates and minimizes the expenses associated with transportation. It is a well-debated topic in practical research because of its broad range of applications in various sectors such as scheduling, human resource management, product mix difficulties, and many others. This is an issue that affects more than just transportation and distribution. Finding a first fundamental solution to the transportation issue is a precondition for reaching the best answer to the transportation problem. In this study, we describe a novel technique for obtaining an initial basic feasible solution IBFS to transportation problems that uses a median. The proposed methodology is explained via numerical examples.

***Keywords*---**transportation problem (TP), IBFS, optimal solution (OP).

Introduction

A valuable and practical use of linear programming, both in its formulation and solution, has been the TP algorithm (LP). The (TP) subgroup of (LP) is concerned with issues of economic improvement, such as cost reduction, when it comes to our daily effectiveness [1, 2]. When it comes to moving goods from numerous supply assets to multiple demand locations, transportation models focus on the most efficient manner of doing so [3, 4]. Identifying the most cost-effective method of distribution for the product while still satisfying the requirements of each

Manuscript submitted: 9 April 2022, Manuscript revised: 18 June 2022, Accepted for publication: 27 July 2022

destination is the key objective of this project. It was created in 1941 by Hitchcock F. L. [5] and has been around ever since. When Tjalling C. Koopmans wrote his article in 1947 [6], he was attempting to address the question of (TP). They are two of the most significant advancements in transportation model research that have occurred in recent years. If you want a quick and easy way to solve (TP), you may utilize simplex approaches like the one developed by Dantzig G. B. in 1951. However, since (TP) has so many variables and restrictions, this method is impractical.

In order to create an IBFS that takes transportation costs into account, a significant number of researchers have published revisions. Some of the ways that may be used to compute an IBFS include the “North-West Corner technique,” the “Least-Cost Method,” and the “Vogel's Approximation Method” (TP). VAM was shown to be the most effective method based on the study. IBFS results are combined with MODI and SSM to arrive at the (OS) from the (MODI) and (SSM) distribution techniques (TP). Of all of these strategies, OS (OS) is by far the most important distinction, as opposed to a plausible solution that would result in lesser objective value at the end of the day, in most cases. "Balanced transportation" and "unbalanced transportation" are two classifications of transportation. Balanced transportation dilemmas occur when the number of sources equals the number of demands. Aside from that, it is called a transportation problem [7]. An increasing number of approaches to calculate a (IBFS) have been given during the past several years. It was found that the inferred cost method (ICM) developed by Ashraful Babu and colleagues (2014) is superior than or comparable to other approaches (VAM). The authors introduced many papers to solve the problems in different fields of sciences such as reliability [8- 17] and optimization [18- 43]. But in this work, we propose a new modification to (VAM), its outcomes are near of (OS). There are several drawbacks to the North-West Corner Method and Least Cost Method which was utilized by many authors.

Transportation problems

The classical transportation problem examines a collection of nodes or places referred to as plants (S_1, S_2, S_3,...,S_m) that have a ready-to-ship product and another set of sites referred to as destinations (D_1, D_2, D_3,..., D_n) that need this commodity. The data set contains information on the commodity's availability at each plant (s_1, s_2, s_3, ... , s_m), the commodity's demand at each destination (d_1, d_2, ... , d_n), and the cost of shipping the commodity per unit from each plant to each destination, C_{ij}. The purpose is to determine the quantity of material that must be transported from each facility to each destination, x_{ij}, in order to meet requirements while incurring the fewest shipping costs feasible. A tableau (Table 1) and a network diagram (Figure 1) of the transportation issue are presented.

Table 1
Transportation Tableau

Destination / Plants	D_1	D_2	D_3		D_{n-1}	D_n	Supply quantity
S_1	x_{11}	x_{12}	x_{13}	…	$x_{1,m-1}$	$x_{1,n}$	s_1
S_2	x_{21}	x_{22}	x_{23}	…	$x_{2,m-1}$	$x_{2,n}$	s_2
S_3	x_{31}	x_{32}	x_{33}	…	$x_{3,m-1}$	$x_{3,n}$	s_3
.	.		.	.	.	.	.
.	.		.	.	.	.	.
.	.		.	.	.	.	.
	.						
	.						
	.						
S_{m-1}	$x_{m-1,1}$	$x_{m-1,2}$	$x_{m-1,3}$	…	$x_{m-1,n-1}$	$x_{m-1,n}$	s_{m-1}
S_m	$x_{n,1}$	$x_{n,2}$	$x_{n,3}$	…	$x_{m,n-1}$	$x_{m,n}$	s_m
Demand quantity	d_1	d_2	d_3	…	d_{n-1}	d_n	

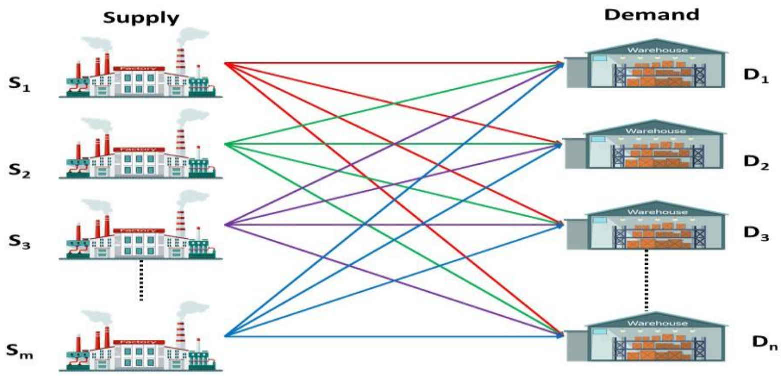

Figure 1. Network representation of general transportation problem

Please keep in mind that there are no costs associated with the fictitious destination and that the basic solution must be acceptable for the transport model. There are many possible ways to find the first solution, each of which requires a different amount of time and work [21].

Transportation Model Problem

Consider the following transportation model problem:

Minimized (Z) $\sum_{i=1}^{m} \sum_{j-1}^{n} C_{ij}\ X_{ij}$ (1)

Subject to $\sum_{j-1}^{n} X_{ij} = a_{ij}$ (2)

$\sum_{j-1}^{n} X_{ij} = b_{ij}$ (3)

$X_{ij} \geq 0$ (4)

Proposed Method

The researcher's approaches are easy to execute and may also serve as the fundamental answer to the issue of balanced and unbalanced transportation in order to get an effective solution (optimal or near optimal).

New Median Technique

The median is calculated as follows:

The values are arranged in increasing order of importance (or descending), if costs number is even, the median represents the arithmetic mean between two values of the order $\frac{n}{2}$ and $\frac{n}{2}+1$, the median represents the value of the order $\frac{n+1}{2}$ if costs number is odd .The following are the fundamental phases in this method:

- The transfer schedule must be balanced.
- Calculate the median for each column only
- Choose the highest value resulting from Step (2) in all columns and then choose the cell with the lowest cost to give the proper supply to meet the needs (demand).
- If the resulting values in more than one column are equal, we choose to allocate the cell with the lowest cost.
- The row filled in the application does not enter into the following calculation.
- Repeat steps (2- 4) and after completing the filling of cells we calculate the total cost.

To make the proposed method clear and easy to understand, here are some examples:

Example 1:

	S1	S2	S3	S4	supply
D1	3 100	4	6	0	100
D2	7	3 80	8	0	80
D3	6 10	4 30	5	0 50	90
D4	7	5	2 60	0 60	120
demand	110	110	60	110	390
	6.5	4	5.5	0	
	7	4	5	0	
	-	4	5	0	
	-	4	-	0	
	-	5.5	-	0	

Cost = (3*100) + (3*80) + (6*10) + (4*30) + (0*50) + (2*60) + (0*60) = 840
Cost (**VAM**) = 880

While the suggested technique outperformed the Vogel approximation method in the majority of situations, there are certain unusual or few circumstances where the proposed method outperforms the Vogel approximation method, as seen below:

	S1	S2	S3	S4	supply
D1	4	5 1	6	0 11	**12**
D2	3 6	1 4	5 1	0	**11**
D3	2	4	4 7	0	**7**
demand	**6**	**5**	**8**	**1**	
	3	4	5	0	
	3.5	3	5.5	0	
	3.5	3	-	0	
	-	3	-	0	

Cost = (20*4) + (14*5) + (9*1) + (15*5) + (10*2) + (9*7) + (6*5) = 347
Cost (**VAM**) = 308

Conclusion

In these days, many companies seek to provide customers with cost-effective goods as possible. As a solution to this problem, the transport model provides a comprehensive framework for determining the most effective means of delivering items to customers. In this article it is recommended to use a new strategy to discover an initial basic practical answer to the challenges of transportation using the median. The efficiency of the proposed method was further examined by calculating the full cost to reduce transport difficulties, and it was discovered that it is no worse than traditional techniques. Finally, it can be said that the proposed technique has the potential to give an initial or optimal basic solution by ensuring that transportation costs are kept to a minimum.

References

1. Dewi, N. P. R. C. (2020). Digital marketing strategy on travel tourism businesses in marketing 4.0 era. International Research Journal of Management, IT and Social Sciences, 7(3), 58-64. https://doi.org/10.21744/irjmis.v7n3.898
2. F. H. Abd Alsharify, G.A. Mudhar, and Z. A. H. Hassan, A modified technique to compute the minimal path sets for the reliability of the complex network, Journal of Physics: Conference Series, 1999(1) 012083, 2021.
3. F. H. Abd Alsharify, Z. A. H. Hassan, Computing the reliability of a complex network using two techniques, Journal of Physics: Conference Series, 1963(1) 012016, 2021.

4. F. L. Hitchcock, The distribution of a product from several sources to numerous localities. Journal of mathematics and physics, 20(1- 4), 224-230, 1941.
5. G. Abdullah and Z. A. H. Hassan, A Comparison Between Genetic Algorithm and Practical Swarm to Investigate the Reliability Allocation of Complex Network, J. Phys.: Conf. Ser. 1818 (1) 012163, 2021.
6. G. Abdullah and Z. A. H. Hassan, Use of Bees Colony algorithm to allocate and improve reliability of complex network, Journal of Physics: Conference Series, 1999(1) 012081, 2021.
7. G. Abdullah and Z. A. H. Hassan, Using of Genetic Algorithm to Evaluate Reliability Allocation and Optimization of Complex Network, I.O.P. Conf. Ser.: Mater. Sci. Eng. 928(4) 0420333, 2020.
8. G. Abdullah and Z. A. H. Hassan, Using of particle swarm optimization (PSO) to addressed reliability allocation of complex network, J. Phys.: Conf. Ser. 1664 (1) 012125, 2020.
9. H. A. Hussein and M. A. K. Shiker, A modification to Vogel's approximation method to solve transportation problems, J. Phys.: Conf. Ser. no. 1591, 012029, 2020.
10. H. A. Hussein and M. A. K. Shiker, Two new effective methods to find the optimal solution for the assignment problems, Journal of Advanced Research in Dynamical and Control Systems, vol.12, no. 7, pp. 49- 54, 2020.
11. H. A. Hussein, M. A. K. Shiker, and M. S. M. Zabiba, A new revised efficient of VAM to find the initial solution for the transportation problem, J. Phys.: Conf. Ser. no. 1591, 012032, 2020.
12. H. A. Mueen and M. A. K. Shiker, A New projection technique with gradient property to solve optimization problems, J. Phys.: Conf. Ser. 1963, 012111, 2021.
13. H. A. Mueen and M. A. K. Shiker, Using a new modification of trust region spectral (TRS) approach to solve optimization problems, J. Phys.: Conf. Ser. 1963, 012090, 2021.
14. H. A. Wasi and M. A. K. Shiker, A modified of FR method to solve unconstrained optimization, J. Phys.: Conf. Ser. 1804, 012023, 2021.
15. H. A. Wasi and M. A. K. Shiker, A new hybrid CGM for unconstrained optimization problems, J. Phys.: Conf. Ser. no. 1664, 012077, 2020.
16. H. A. Wasi and M. A. K. Shiker, Nonlinear conjugate gradient method with modified Armijo condition to solve unconstrained optimization, J. Phys.: Conf. Ser. 1818, 012021, 2021.
17. H. A. Wasi and M. A. K. Shiker, Proposed CG method to solve unconstrained optimization problems, J. Phys.: Conf. Ser. 1804, 012024, 2021.
18. H. H. Dwail and M. A. K. Shiker Using a trust region method with nonmonotone technique to solve unrestricted optimization problem, J. Phys.: Conf. Ser. 1664, 012128, 2020.
19. H. H. Dwail and M. A. K. Shiker Using trust region method with BFGS technique for solving nonlinear systems of equations, J. Phys.: Conf. Ser. 1818, 012022, 2021.
20. H. H. Dwail and M. A. K. Shiker, Reducing the time that TRM requires to solve systems of nonlinear equations, IOP Conf. Ser.: Mater. Sci. Eng. 928, 042043, 2020.
21. H. H. Dwail et al., A new modified TR algorithm with adaptive radius to solve a nonlinear systems of equations, J. Phys.: Conf. Ser. 1804, 012108, 2021.

22. H. H. Dwail, M. M. Mahdi, and M. A. K. Shiker, CG method with modifying β_k for solving unconstrained optimization problems, Journal of Interdisciplinary Mathematics, DOI: 10.1080/09720502.2022.2040854. 2022.
23. H. J. Kadhim and M. A. K. Shiker, Solving QAP with large size 10 facilities and 10 locations, Journal of Positive School Psychology, **6**: 2, p. 5465 – 5471. 2022.
24. H. J. Kadhim, M. A. K. Shiker and H. A. Hussein, A New technique for finding the optimal solution to assignment problems with maximization objective function, J. Phys.: Conf. Ser. 1963 012104, 2021.
25. H. J. Kadhim, M. A. K. Shiker and H. A. Hussein, New technique for finding the maximization to transportation problems J. Phys.: Conf. Ser. 1963, 012070, 2021.
26. K. H. Hashim and M. A. K. Shiker, Using a new line search method with gradient direction to solve nonlinear systems of equations, J. Phys.: Conf. Ser. 1804, 012106, 2021.
27. K. H. Hashim et al., Solving the Nonlinear Monotone Equations by Using a New Line Search Technique, J. Phys.: Conf. Ser. 1818, 012099, 2021.
28. L. A. Issa, and Z. A. H. Hassan, Use of a modified Markov models for parallel reliability systems that are subject to maintenance, Journal of Physics: Conference Series, 1999(1) 012087, 2021.
29. L. H. Hashim et al., An application comparison of two negative binomial models on rainfall count data, J. Phys.: Conf. Ser.1818, 012100, 2021.
30. L. H. Hashim et al., An application comparison of two Poisson models on zero count data, J. Phys.: Conf. Ser. 1818 012165, 2021.
31. M. A. K. Shiker and K. Amini, A new projection-based algorithm for solving a large scale nonlinear system of monotone equations, Croatian operational research review, vol. 9, no. 1, pp. 63- 73, 2018.
32. M. A. K. Shiker and Z. Sahib A modified trust-region method for solving unconstrained optimization, Journal of Engineering and Applied Sciences, vol. 13, no. 22, pp. 9667– 9671, 2018.
33. M. M. Mahdi and M. A. K. Shiker, A New Class of Three-Term Double Projection Approach for Solving Nonlinear Monotone Equations J. Phys.: Conf. Ser. 1664, 012147, 2020.
34. M. M. Mahdi and M. A. K. Shiker, A new projection technique for developing a Liu-Storey method to solve nonlinear systems of monotone equations, J. Phys.: Conf. Ser. 1591, 012030, 2020.
35. M. M. Mahdi and M. A. K. Shiker, Solving systems of nonlinear monotone equations by using a new projection approach, J. Phys.: Conf. Ser. 1804, 012107, 2021.
36. M. M. Mahdi and M. A. K. Shiker, Three terms of derivative free projection technique for solving nonlinear monotone equations, J. Phys.: Conf. Ser. no. 1591, 012031, 2020.
37. M. M. Mahdi and M. A. K. Shiker, Three-Term of New Conjugate Gradient Projection Approach under Wolfe Condition to Solve Unconstrained Optimization Problems, Journal of Advanced Research in Dynamical and Control Systems, vol. 12, no. 7, pp. 788- 795, 2020.
38. M. M. Mahdi, H. H. Dwail, and M. A. K. Shiker, Hybrid spectral algorithm under a convex constrained to solve nonlinear equations, Journal of Interdisciplinary Mathematics, DOI: 10.1080/09720502.2022.2040851. 2022.

39. M. S. A. Sahib M S A, and M. A. K. Shiker, Employing the golden ratio to reach the BFS for T.P. International Journal of Health Sciences, *6*: 2, p. 14894–14901. 2022.
40. N. K. Dreeb, et al., Using a New Projection Approach to Find the Optimal Solution for Nonlinear Systems of Monotone Equation, J. Phys.: Conf. Ser. 1818, 012101, 2021.
41. S. A. K. Abbas, Z. A. H. Hassan, Increase the Reliability of Critical Units by Using Redundant Technologies, Journal of Physics: Conference Series, 1999(1) 012107, 2021.
42. S. A.K. Abbas, Z. A. H. Hassan, Use of ARINC Approach method to evaluate the reliability assignment for mixed system, Journal of Physics: Conference Series, 1999(1) 012102, 2021.
43. Saxena, A. (2017). The impact of nutrition on the overall quality of life adolescent girls are living across the city of Kota. International Journal of Life Sciences, 1(1), 40–48. https://doi.org/10.21744/ijls.v1i1.21
44. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, *6*(1), i-v. https://doi.org/10.53730/ijhs.v6n1.5949
45. T.C. Koopmans, Optimum utilization of the transportation system. Econometrica: Journal of the Econometric Society, vol. 17, pp. 136-146, 1949.
46. Z. A. H. Hassan and E. K. Mutar, Geometry of reliability models of electrical system used inside spacecraft, 2017 Second Al-Sadiq International Conference on Multidisciplinary in I.T. and Communication Science and Applications (AIC-MITCSA), pp. 301-306. 2017.