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SOLVING FUZZY TRANSPORTATION PROBLEM USING HEXAGONAL NUMBER

[1]Madhav Fegade and [2]Aniket Muley
[1] Assistant Professor, [2] Associate Professor
[1]Department of Statistics, Digambarrao Bindu Arts, Commerce and Science College, Bhokar-431801 (M. S.) India
[2]School of Mathematical Sciences, Swami Ramanand Teerth Marathwada University, Nanded-431606 (M. S.) India

Abstract: In this paper, we have proposed one more estimation to find ideal responses for the fuzzy transportation problem. Here, situating technique is used to defuzzify the Hexagonal fuzzy numbers. This article gives framework that chops down the best game plan. The numerical model diagrams the authenticity of our proposed procedure.

Keywords: **Transportation, Fuzzy, Optimality, Ranking, Hexagonal Fuzzy Numbers.**

I. INTRODUCTION

Activities Research is a state of workmanship approach used for problem-tending to and autonomous bearing. It helps any relationship with achieving their best show under the given objectives or conditions. The transportation problem is one of the phenomenal locales noticed generally speaking which is valuable to handle authentic problems. Transportation problems expect to be a critical part in progress, dissemination, etc purposes and are a special occurrence of straight programming problems. It helps in restricting the cost work. There are different things that pick the cost of transport. It integrates the distance between the two regions, the way followed, technique for transport, the amount of units that are delivered, the speed of transport, etc. Along these lines, the focus here is to deliver the things with least transportation cost with basically no put down some a reasonable compromise in market revenue. The transportation model can moreover be used in making the spot decisions. In this paper, it is seen that there are a couple of assessment studies to convey the best ideal response for the transportation problems. The problem that ought to be settled is, to show up at monetarily adroit creation in various creation associations. [1-17]

Bagheri et al. (2020) inspected a transportation problem with fuzzy costs inside seeing unique and conflicting objectives using fuzzy data envelopment assessment approach. Kacher and Singh (2021) played out a purposeful and facilitated blueprint of various existing transportation problems and their increases made by different investigators. The central inspiration driving the study paper is to sum up the ongoing kind of various kinds of transportation problems and their exact progressions for the course of future experts to help them with portraying the groupings of problems to be handled and select the guidelines to be upgraded. Bagheri and Behnamian (2022) played out a precise composing review on the multi-creation line booking problems in the past eleven years and reported research openings.

Polat and Topaloğlu (2022) proposed a unique mathematical model for the arrangement of different sorts of milk from producers by multi-tank huge haulers with split movements, uncertain interest, organization time and vehicle speed conditions. A veritable relevant examination from a dairy association is tended to under different bet assessment circumstances. Undoubtedly, a couple of brand new benchmark models for the middle problem are presented and handled by utilizing a capable heuristics approach called superior iterative area search. Their disclosures of the survey showed that organized elements pioneers should design their arrangement networks with low, yet non-zero, risk levels. Sleiman et al. (2022) spread out a control strategy to hinder the stop up in the transportation network subject to added substance weaknesses. Qamsari et al. (2022) proposed an astute philosophy towards stock guiding problems with fuzzy time windows contemplating purchaser reliability for appearance ranges. Their audit secluded into three classes as shown by their features. These features have different degrees of importance as per the distributer's perspective. The satisfaction level of clients accepts a critical part in the decision of the supplier to fulfill their advantage in each period. Finally, they have thought of and proposed a genuine relevant examination of a blood apportionment structure model for Tehran. Verma (2022) focused on fuzzy most restricted way problem gives the briefest way to the pioneer having least possible detachment from source to objective. They proposed complete situating methodology to deal with the fuzzy most short way problem. The proposed approaches ensure that the fuzzy briefest distance is identical among all possible most restricted ways. Bharati (2022) portrays the hesitant fuzzy enlistment work and non-interest ability to deal with the weakness and faltering of the limits. Another course of action called hesitant intuitionistic fuzzy Pareto ideal game plan is described, and a couple of theories are communicated and illustrated. Taghavi et al. (2022) proposed one more model for the vehicle terminal region problem using data envelopment assessment with multi-objective programming approach. Their consideration is on to notice useful assignment plans for designating stations terminals. Also, they explored the ideal regions for sending terminals including an innate computation for tending to proposed model.

Bera and Mondal (2022) oversaw multi-objective transportation problem under cost-subordinate credit period procedure. Here, the things are moved from a creation house to the retailers by wholesalers who go about as judges. For palatable weakness in the cost limit, it is considered to be Gaussian fuzzy number. The effect of cushiness on the model plan has been destitute down to additionally foster their advantage development and retailers can reduce their cost structure under the used expense subordinate credit time span system.

II. PRELIMINARIES

Definitions:

Fuzzy set: $\tilde{A}$ is fuzzy set on R is defined as a set ordered pairs$\tilde{A} = \{X_0, \mu_A(X_0) | X_0 \in \tilde{A}, \mu_A(X_0) \rightarrow [0,1]\}$, where $\mu_A(X_0)$is said to be the membership function.

Fuzzy number: $\tilde{A}$ is fuzzy set on R, likely bounded to the stated conditions given beneath

i. $\mu_A(X_0)$ is part by continuous

ii. There exist at one $X_0 \in R$ with $\mu_A(X_0) = 1$

iii. $\tilde{A}$ is a regular and convex

Hexagonal fuzzy number: A fuzzy number $\tilde{A}$ on R is said to be the hexagonal fuzzy number or linear number which is names as $(\tilde{a}_1\tilde{a}_2, \tilde{a}_3, \tilde{a}_{4,}\tilde{a}_5, \tilde{a}_6)$ if it membership function $\mu_A(X_0)$ has the following characteristic

$$\mu_A(X) = \begin{cases} 0, \quad X < \tilde{a}_1 \\ \frac{1}{2}\left(\frac{X - \tilde{a}_1}{\tilde{a}_2 - \tilde{a}_1}\right), \tilde{a}_1 \le X \le \tilde{a}_2 \\ \frac{1}{2} + \frac{1}{2}\left(\frac{X - \tilde{a}_2}{\tilde{a}_3 - \tilde{a}_2}\right) \quad, \tilde{a}_2 \le X \le \tilde{a}_3 \\ 1, \quad \tilde{a}_3 \le X \le \tilde{a}_4 \\ 1 - \quad \frac{1}{2}\left(\frac{X - \tilde{a}_4}{\tilde{a}_5 - \tilde{a}_4}\right), \tilde{a}_4 \le X \le \tilde{a}_5 \\ \frac{1}{2}\left(\frac{\tilde{a}_6 - X}{\tilde{a}_6 - \tilde{a}_5}\right), \tilde{a}_5 \le X \le \tilde{a}_6 \\ 0, X > , \tilde{a}_6 \end{cases}$$

III. RESEARCH METHODOLOGY

Algorithm

Step 1: Convert the given hexagonal fuzzy numbers to crisp number using following function:

$$R(\tilde{a}) = \frac{2a_1 + 3a_2 + 4a_3 + 4a_4 + 3a_5 + 2a_6}{18}$$

Step 2: Check whether the given transportation problem is balanced or unbalanced.

2.1: If it is balanced, then go to step 3.

2.2: If it is unbalanced, then add a dummy row or dummy column to fulfil the requirement.

Step 3: Find the First least and second least of each row and take the difference of them and the difference is divided by the number of rows in the given table of respective iteration.

Step 4: Find the First least and second least of each column and take the difference of them and the difference is divided by the number of columns in the given of respective iteration.

Step 5: After simplifying step 3 and 4, select the biggest proportion and assign however much as could be expected to the littlest component in the respective row (column) to fulfil the demand or to exhaust the availability.

Step 6: Assuming greatest proportion worth might happen at least a couple of times in the lines or segments then randomly select any one line or section yet not both.

Step 7: Repeat the step 3 to 6, until all the availability and demand will get exhausted or fulfilled.

Step 9: To check if the number of allocations is m+n-1 or not. If it is less than m+n-1, then apply the MODI method to check the optimality of the given problem.

IV. RESULTS AND DISCUSSION

4.1: Numerical example: A resolution that affirms the fuzzy transportation problem which involves transportation cost, customer needs and demands and existence of products using hexagonal fuzzy numbers. Observe the following transportation problem as stated in Table 1 [13]:

Table 1: Given dataset

	D_1	D_2	D_3	D_4	Availability
O_1	(3,7,11,15,19,24)	(13,18,23,28,33,40)	(6,13,20,28,36,450	(15,20,25,31,38,45)	(7,9,11,13,16,20)
O_2	(16,19,24,29,34,39)	(3,5,7,9,10,12)	(5,7,10,13,17,21)	(20,23,26,30,35,40)	(6,8,11,14,19,25)
O_3	(11,14,17,21,25,30)	(7,9,11,14,18,22)	(2,3,4,6,7,9)	(5,7,8,11,14,17)	(9,11,13,15,18,20)
Demand	(3,4,,5,6,8,10)	(3,5,7,9,12,15)	(6,7,9,11,13,16)	(10,12,14,16,20,24)	

By using (Step 1) we have defuzzified the given transportation problem and represented Table 2. The given problem is a balanced one.

Table 2: Defuzzified Transportation problem

	D_1	D_2	D_3	D_4	Availability
O_1	13.11	25.72	69.5	28.77	12.5
O_2	26.72	7.72	12	28.77	13.5
O_3	19.5	13.27	5.11	10.94	14.28
Demand	5.89	8.39	10.22	15.78	

Table 3: Iteration I

	D_1	D_2	D_3	D_4	Supply	$\frac{2nd\ Min - 1st\ Min}{row}$
O_1	13.11	25.72	69.5	28.77	12.5	4.203
O_2	26.72	7.72	12	28.77	13.5	1.426
O_3	19.5	13.27	5.11	**14.28** 10.94	14.28	1.943←
Demand	5.89	8.39	10.22	15.78		
$\frac{2nd\ Min - 1st\ Min}{columnn}$	1.597	1.3875	1.722	4.457		

Table 4: Iteration II

	D_1	D_2	D_3	D_4	Supply	$\frac{2nd\ Min - 1st\ Min}{row}$
O_1	13.11	25.72	69.5	28.77	12.5	6.305
O_2	26.72	7.72	**10.22** 12	28.77	13.5	2.14
Demand	5.89	8.39	10.22	1.5		
$\frac{2nd\ Min - 1st\ Min}{columnn}$	3.4025	4.5	14.375 ↑	0		

Table 4: Iteration III

	D_1	D_2	D_4	Supply	$\frac{2nd\ Min - 1st\ Min}{row}$
O_1	13.11	25.72	28.77	12.5	6.35
O_2	26.72	**3.28** 7.72	28.77	3.28	9.5
Demand	5.89	8.39	1.5		
$\frac{2nd\ Min - 1st\ Min}{columnn}$	4.5366	6	0		

Table 5: Final Iteration

	D_1	D_2	D_4	Supply
O_1	**5.89** 13.11	**5.11** 25.72	**1.5** 28.77	12.5
Demand	5.89	8.39	1.5	

Total Cost =
$14.28 \times 10.94 + 10.22 \times 12 + 3.28 \times 7.72 + 5.89 \times 13.11 + 5.11 \times 25.72 + 1.5 \times 28.77 = 555.9869$

Table 6: Comparative results

Method	Optimum solution
Ranking Method [13]	7618
Fegade & Muley [18]	575.8137
Proposed Method	555.9869

CONCLUSION

In this paper, the proposed calculation gives the most ideal suitability of the fuzzy transportation problem for hexagonal fuzzy numbers. By and large, this calculation can be helpful for a wide range of fuzzy transportation problems. This approach could be summed up to determine comparative sorts of transportation problems. The proposed calculation helps in finding another office, an assembling plant or an office when at least two areas are getting looked at. Basically, the absolute transportation cost, dissemination cost or delivery cost and creation costs are to be limited by applying the model to the comparative sort of examinations.

REFERENCES

[1] Baykasoğlu, A., & Subulan, K. 2019. A direct solution approach based on constrained fuzzy arithmetic and metaheuristic for fuzzy transportation problems. Soft Computing, 23(5): 1667-1698.

[2] Bharati, S. K. 2021. Transportation problem with interval-valued intuitionistic fuzzy sets: impact of a new ranking. Progress in Artificial Intelligence, 10(2): 129-145.

[3] Chakraborty, D., Jana, D. K., & Roy, T. K. 2015. Arithmetic operations on generalized intuitionistic fuzzy number and its applications to transportation problem. OPSEARCH, 52(3): 431-471.

[4] Ebrahimnejad, A. 2016. Fuzzy linear programming approach for solving transportation problems with interval-valued trapezoidal fuzzy numbers. Sādhanā, 41(3): 299-316.

[5] Ghosh, S., Küfer, K. H., Roy, S. K., & Weber, G. W. 2022. Carbon mechanism on sustainable multi-objective solid transportation problem for waste management in Pythagorean hesitant fuzzy environment. Complex & Intelligent Systems:1-29.

[6] Gupta, P., & Mehlawat, M. K. 2007. An algorithm for a fuzzy transportation problem to select a new type of coal for a steel manufacturing unit. Top, 15(1): 114-137.

[7] Kashav, V., Garg, C. P., & Kumar, R. 2021. Ranking the strategies to overcome the barriers of the maritime supply chain (MSC) of containerized freight under fuzzy environment. Annals of Operations Research: 1-46.

[8] Toutouh, J., & Alba, E. 2017. Parallel multi-objective metaheuristics for smart communications in vehicular networks. Soft Computing, 21(8): 1949-1961.

[9] Mahmoodirad, A., Allahviranloo, T., & Niroomand, S. 2019. A new effective solution method for fully intuitionistic fuzzy transportation problem. Soft computing, 23(12): 4521-4530.

[10] Nishad, A. K. 2020. A New Ranking Approach for Solving Fully Fuzzy Transportation Problem in Intuitionistic Fuzzy Environment. Journal of Control, Automation and Electrical Systems, 31(4): 900-911.

[11] Palanivel, K. 2016. Fuzzy commercial traveler problem of trapezoidal membership functions within the sort of α optimum solution using ranking technique. Afrika Matematika, 27(1): 263-277.

[12] Patra, K. 2022. Fuzzy risk analysis using a new technique of ranking of generalized trapezoidal fuzzy numbers. Granular Computing, 7(1): 127-140.

[13] Rubeelamary S., Sivaranjani S.2020. Method for Solving Fuzzy Transportation Problem Using Hexagonal Fuzzy Number. The International journal of analytical and experimental modal analysis. 12 (1): 22-26.

[14] Samanta, S., & Jana, D. K. 2019. A multi-item transportation problem with mode of transportation preference by MCDM method in interval type-2 fuzzy environment. Neural Computing and Applications, 31(2): 605-617.

[15] Sarkar, B., & Biswas, A. 2021. Pythagorean fuzzy AHP-TOPSIS integrated approach for transportation management through a new distance measure. Soft Computing, 25(5): 4073-4089.

[16] Singh, S. K., & Yadav, S. P. 2015. Efficient approach for solving type-1 intuitionistic fuzzy transportation problem. International journal of system assurance engineering and management, 6(3): 259-267.

[18] Sun, Y. 2020. Fuzzy approaches and simulation-based reliability modeling to solve a Road–Rail intermodal routing problem with soft delivery time windows when demand and capacity are uncertain. International Journal of Fuzzy Systems,22(7): 2119-2148.

[19] Madhav Fegade and Aniket Muley. 2022. Solution of Fuzzy Transportation Problem Using Hexagonal Number. Journal of Emerging Technologies and Innovative Research 9(5): 371-374