International Journal of Sciences and Innovation Engineering
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
website: www.ijsci.com
Vol.02 No.06.
E-ISSN : 3049-0251
DOI: https://doi.org/10.70849/ijsci

Sequencing Problem in Hexadecagonl Fuzzy Number

V.Raju[1]
[1] Assistant Professor, Department of Mathematics, School of Basic Sciences, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai-600 117, Tamil Nadu, India

Article Info

Article History:

Published:06 June 2025

Publication Issue:
Volume 2, Issue 6
June-2025

Page Number:
332-338

Corresponding Author:
V.Raju

Abstract:

We intend to present the Hexadecagonal fuzzy number, a new fuzzy number, and its membership function in this study. We came up with a way to tackle the fuzzy sequencing problem by representing processing times with hexadecagonal fuzzy numbers. It is potential to make over fuzzy sequencing problem into ones with distinct, unequivocal values. A numerical example is provided to illustrate this change.

Keywords: Hexadecagonl Fuzzy number, Membership function, Fuzzy sequencing problem.

1. Introduction

It is Zadeh [1] who uses the fuzzy set. We encounter numerous decision-making scenarios in our daily lives. Every circumstance is unique. We make decisions based on whether a situation is obvious or unclear. Sequencing provides a sense of the order in which events are occurring or are about to occur. There, we are in the position of making decisions based on game theory, work sequencing, and other factors. The most crucial issue in the realm of computers is job sequencing. One of the most important applications of optimization techniques is the job scheduling problem. The primary goal of the sequencing problem is to determine the best order for the tasks to be performed on machines in order to reduce the overall time needed to do all of the tasks. Icosagonal fuzzy number was first presented by Raju and Jayagopal [2]. Icosikaioctagonal fuzzy numbers have been developed and introduced by both of them [3]. In this study, we have used the Hexadecagonl fuzzy number to investigate the sequencing problem. Hexadecagonal fuzzy numbers and their membership function have been employed. The fuzzy sequencing problem can be converted into a crisp valued problem using Pascal's triangle Graded Mean, and it is demonstrated with relevant instances. The processing time is regarded to be Hexadecagonl fuzzy number. We determine each machine's ideal order, idle time, and total elapsed time by solving the crisp sequencing issue.

2. PRELIMINARIES

In this section, we give the preliminaries that are required for this study.

Definition 2.1. *A fuzzy set A is defined by* $A = \{(x, \mu_A(x)) : x \in A, \mu_A(x) \in [0,1]\}$. *Here* x *is crisp set* A *and* $\mu_A(x)$ *is membership function in the interval* $[0,1]$.

Definition 2.2. *The fuzzy number A is a fuzzy set whose membership function must satisfy the following conditions.*

(i) A fuzzy set A of the universe of discourse X is convex

(ii) A fuzzy set A of the universe of discourse X is a normal fuzzy set if $x_i \in X$ exists

(iii) $\mu_A(x)$ is piecewise continuous

2.3 Ranking of Hexadecagonl fuzzy number:

Let I be a normal Enneadecagonal fuzzy number. The value $M(I)$, called as measure of I is calculated as

$$M(I) = \frac{e_1 + e_2 + e_3 + e_4 + e_5 + e_6 + e_7 + e_8 + e_9 + e_{10} + e_{11} + e_{12} + e_{13} + e_{14} + e_{15} + e_{16}}{16}$$

where $0 \le k_1 \le k_2 \le k_3 \le 1$

3.Definition:

A fuzzy number A = $(a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, \ldots\ldots a_{16})$ is Hexadecagonl fuzzy number and its membership function is given by

$$\mu_E(x) = \begin{cases} 0, \ for \quad x < e_1 \\ \frac{1}{4}\left(\frac{x - e_1}{e_2 - e_1}\right), \ for \quad e_2 \le x \le e_3 \\ \frac{1}{2}\left(\frac{x - e_3}{e_4 - e_3}\right), \ for \quad e_3 \le x \le e_4 \\ \frac{1}{2} \quad for \quad e_4 \le x \le e_5 \\ \frac{3}{4}\left(\frac{x - e_5}{e_6 - e_5}\right), \ for \quad e_5 \le x \le e_6 \\ \frac{3}{4}, \ for \quad e_6 \le x \le e_7 \\ \left(\frac{x - e_7}{e_8 - e_7}\right), \ for \quad e_7 \le x \le e_8 \\ 1, \ e_8 \le x \le e_9 \\ \left(\frac{e_{10} - x}{e_{10} - e_9}\right), \ for \quad e_9 \le x \le e_{10} \\ \frac{3}{4}, \ for \quad e_{10} \le x \le e_{11} \\ \frac{3}{4}\left(\frac{e_{12} - x}{e_{12} - e_{11}}\right), \ for \quad e_{11} \le x \le e_{12} \\ \frac{1}{2}, \ for \quad e_{12} \le x \le e_{13} \\ \frac{1}{2}\left(\frac{e_{14} - x}{e_{14} - e_{13}}\right), \ for \quad e_{13} \le x \le e_{14} \\ \frac{1}{4}, \ for \quad e_{14} \le x \le e_{15} \\ \frac{1}{4}\left(\frac{e_{16} - x}{e_{16} - e_{15}}\right), \ for \quad e_{15} \le x \le e_{16} \\ 0, \ for \quad e_{16} \le x \end{cases}$$

4. Processing of 'n' jobs through '2' machines:

Let 'n' jobs $A_1, A_2, \ldots, A_n$ be processing through 2 machines that is M_1 , M_2 respectively. Let R_{ij} be the fuzzy processing time taken by i^{th} job to be done by j^{th} machine. Using Johnson method, we can find optimal sequence, total elapsed time and idle time on machines. Here fuzzy times are taken as Hexadecagonal fuzzy number.

Jobs	Machine M I	Machine M II
A_1	R_{11}	R_{12}
A_2	R_{21}	R_{22}
A_3	R_{31}	R_{32}
A_4	R_{41}	R_{42}

5. Pascals Triangular graded mean for Hexadecagonal Fuzzy Number:

Consider $G_{I\cos koct} = (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, ...a_{19})$ be a Hexadecagonal fuzzy number .By taking the co efficient of fuzzy numbers from Pascal's triangle. Then the formula of Pascal's triangular graded mean for Hexadecagonal fuzzy number is

$$G(A) = \frac{\begin{pmatrix} 1a_1 + 15a_2 + 105a_3 + 455a_4 + 1365a_5 + 3003a_6 + 5005a_7 + 6435a_8 + 6435a_9 + \\ 5005a_{10} + 3003a_{11} + 1365a_{12} + 455a_{13} + 105a_{14} + 15a_{15} + a_{16} \end{pmatrix}}{32768}$$

The coefficients of $(a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, ...a_{18})$ are 1, 15, 105,455,1365,3003,5005,6435,6435,5005,3003,1365,455,105,15,1 respectively. These coefficients are taken from the Pascal's triangles.

Jobs	Machine I	Machine II
A_1	Low	Good
A_2	Medium	Very Good
A_3	Very Good	Medium
A_4	Good	Low

6. Procedure for solving fuzzy sequencing problem.

Step 1: Using Pascal graded mean, fuzzy sequencing problem is converted to a crisp valued problem.

Step 2: The optimal sequence for the crisp sequence problem is determined using crisp sequencing problem.

Step 3: After finding the optimal sequence. Determine the total elapsed fuzzy time and also the fuzzy ideal time on machines

7. Numerical example:

We are taking into account the fuzzy sequence problem. Let us take the processing time of 4 jobs are given in which all the elements are fuzzy quantifiers which signalize the linguistic variables that are taking the place of Hexadecagonal fuzzy numbers.

These qualitative datas are transformed into quantitative datas and which is shown in the below table. The processing time is between 1 to 76 and the minimum value is considered as 1 and maximum value is considered as 76 and is shown in the following table

Low	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16
Medium	17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32
Good	33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48
Very Good	49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64

The problem is shown in the table

Jobs	Machine I	Machine II
A_1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	33,34,35,36,37,38,39,40,41,42,43,44,45, 46,47,48
A_2	17,18,19,20,21,22,23,24,25,26,27,28, 29,30,31,32	49,50,51,52,53,54,55,56,57,58,59,60, 61,62,63,64
A_3	49,50,51,52,53,54,55,56,57,58,59,60, 61,62,63,64	17,18,19,20,21,22,23,24,25,26,27,28, 29,30,31,32
A_4	33,34,35,36,37,38,39,40,41,42,43,44,45, 46,47,48	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

Apply Pascal's triangular graded mean for Hexadecagonal fuzzy number, the fuzzy valued time connected to respective valued time

R_{11}= 8.5	R_{12}= 40.5
R_{21}=24.5	R_{22}= 56.5
R_{31}=56.5	R_{32}= 24.5
R_{41}=40.5	R_{42}= 8.5

The Optimum sequence is

R_{11}	R_{21}	R_{41}	R_{31}

Total elapsed time and idle time

	Machine I		Machine II	
Jobs	Time in	Time out	Time in	Time out
A_1	0	8.5	8.5	49
A_2	8.5	33	49	105.5
A_3	33	73.5	105.5	114
A_4	73.5	130	130	154.5

Total Elapsed time = 154.5Hrs

Idle time on Machine I = 24.5 Hrs

Idle time on Machine II = 24.5 Hrs

8. Conclusion

In this paper, we addressed the fuzzy sequencing problem by using hexadecagonal fuzzy numbers. The fuzzy sequencing problem involving hexadecagonal fuzzy numbers has been changed into a clear sequencing problem by using Pascal's Graded mean formula. Using this method, we found the best order, the total time taken, and the idle time for each machine.

References

1. L.A. Zadeh, , Fuzzy sets, Information and Control, 8(3) ,1965, 338-353.
2. R.E.Bellman and L.A.Zadeh, Decision making in fuzzy environment, Management Science, 17, 1970, 141- 164.
3. V. Raju and R. Jayagopal, ''A new operation on Icosikaitetragonal fuzzy number'', Journal of Combinatorial Mathematics and Combinatorial Computing ,Volume 112(2020), Page no : 127-136
4. V.Raju and S.Ramachandran "Icosagonal fuzzy number in decision making problem"
5. International Journal of Trend in Scientific Research and Development , Volume 5,Issue 6,2021, Page no : 1194-1199
6. S. Sasikumar and V.Raju '' Study on Fuzzy game problem in Icosikaitetragonal Fuzzy number'' Annals of Romanian Society for Cell biology , Volume 25,Issue 6, 2021, Page No : 10500-10508
7. V.Raju and S.Maria Jesu Raja ''An Approach on Fuzzy game problem in Icosikaioctagonal Fuzzy number'' Journal of Xidian University, Volume 14, Issue 4, 2020, Page no: 1009-1016
8. V.Raju and S.Arul Amirtha Raja " Study on fuzzy sequencing problem in Icosikaioctagonal Fuzzy Numbers'' Journal of Xidian University, Volume 14, Issue 4, 2020, Page no: 3829-3837
9. V.Raju and S.Maria Jesu Raja '' Fuzzy decision making problem in Icosikaioctagonal Fuzzy number'' Journal of Xidian University, Volume 14, Issue 5, 2020, Page no: 3240-3248
10. R. Deepa and V. Raju ''Solving Fuzzy Transportation Problem using Icosikaioctagonal Fuzzy Numbers'' Journal of Shanghai Jiaotong University, Volume 16, Issue 7,2020 Page No: 162-173
11. S.Maria Jesu Raja and V.Raju '' Elucidating Fuzzy Assignment problem Employing Icosikaioctagonal Fuzzy Number '' Journal of Xi'an University of Architecture and Technology , Volume 12, Issue 6, 2020 ,Page no : 1681-1688
12. V.Ashok Kumar and V.Raju '' An Approach on Fuzzy Assignment problem in Icosagonal Fuzzy Number '' Journal of Xi'an University of Architecture and Technology, Volume 12, Issue 5, 2020 ,Page no : 3487-3493
13. V.Raju and M.ParuvathaVathana "Discourse on Fuzzy Game Problem in Icosagonal Fuzzy Number '' International journal of scientific research and review volume 8, Issue 3, 2019, Page no: 1384-1390
14. V.Raju , Ranking Function on Icosagonal Fuzzy Number for Solving Fuzzy Transportation Problem, ''Journal of Applied Science and Computations '' Volume VI, Issue IV, 2019, Page No: 3631-3640

15. V.Raju and M.ParuvathaVathana "An Icosagonal Fuzzy Number for solving Fuzzy Sequence Problem'' International journal of Research in Engineering, IT and Social Sciences'' Volume 9, Issue 5, 2019. Page no: 37-40
16. V.Raju and M.ParuvathaVathana " Fuzzy Critical path method with Icosagonal Fuzzy Numbers using Ranking Method'' A Journal of Composition Theory, Volume 12, Issue 9, 2019, Page no: 62-69
17. V. Raju and R. Jayagopal "An Approach on Icosikaioctagonal Fuzzy number-Traditional Operations on Icosikaioctagonal fuzzy number" A Journal of composition theory, Vol.XII, Issue X, 2019, Page No: 727-734
18. V. Raju and R. Jayagopal "An Arithmetic Operations of Icosagonal fuzzy number Using Alpha cut "International Journal of Pure and Applied Mathematics. Volume 120, No. 8, 2018, 137-145
19. V. Raju and R. Jayagopal'' A Rudimentary Operations on Octagonal Fuzzy Numbers '' International Journal of Research in Advent Technology Vol.6, No.6, June 2018,Page No: 1320-1323
20. V.Raju and M.Paruvatha Vathana '' Graceful labeling for some complete bi partite garaph'' Journal of computer and Mathematical sciences , Volume 9,Issue 12 ,2018, Page no : 2147-2152
21. R.Jayagopal and V.Raju ''Domination Parameters in shadow graph and Path connected graph'' International Journal of mathematics and its Applications , volume 6, Issue 2B,2018 , Page no : 167-172
22. K. Arulmozhi , V. Chinnadurai ''Bipolar fuzzy soft hyper ideals of ordered –hypersemigroups Γ ''International Journal of Scientific Research and Review Volume 8, Issue 1, 2019, Page No: 1134-1140