

Fuzzy Sequencing Problem in Octagonal Fuzzy Number

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Abstract: *The membership function of an octagonal fuzzy number is used in this paper. We outline a method for handling fuzzy sequencing problems where processing time is expressed as octagonal fuzzy numbers. A numerical example demonstrates how fuzzy sequencing problems are converted into crisp valued sequence problems.*

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

I. INTRODUCTION

The application of the hexagonal fuzzy number to the job sequencing problem is examined in this research. Zadeh [1] proposed the fuzzy set notion, which is pertinent since decision-making in real life frequently incorporates ambiguous (fuzzy) information, especially when it comes to the sequencing of events. Finding the best order for jobs on machines to save overall processing time is the goal of the job sequencing problem, a crucial problem in computer science and optimization. The authors use the Hexagonal fuzzy number and its membership function to tackle this issue. The fuzzy sequencing problem is transformed into a crisp (clear-valued) problem by using Pascal's triangle Graded Mean approach. Given that the processing times are represented as hexagonal fuzzy integers, the best order, idle time, and total elapsed time for the machines can be found by solving the resulting crisp problem. The uncertainty present in many decision-making situations, such as figuring out the sequencing (order of occurrence) of events, is addressed by Zadeh's invention of fuzzy sets. The task sequencing problem, which is essential to computer science and optimization methods, is a prime example

The objective of this topic is to determine how to run jobs on machines in a way that minimizes the overall time required to complete all tasks. The processing time in the sequencing problem is modeled in this work using the newly created Icosikaioctagonal fuzzy number [3], which is an extension of the Icosagonal fuzzy number [2]. The fuzzy sequencing problem is then converted into a crisp-valued equivalent by the authors using Pascal's triangle Graded Mean approach. The ideal job sequence, machine idle time, and total elapsed time are found by solving this clear problem.

II. PRELIMNARIES

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

2.1 Ranking of Hexagonal fuzzy number:

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



$$M(I) = \frac{e_1 + e_2 + e_3 + e_4 + e_5 + e_6 + e_7 + e_8}{8}$$

Definition 2.6

A fuzzy number $A = (a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8)$ is Octagonal fuzzy number and its membership function is given by

$$\mu_E(x) = \begin{cases} 0, & \text{for } x < a_1 \\ \frac{1}{2} \left(\frac{x - a_1}{a_2 - a_1} \right), & \text{for } a_1 \leq x \leq a_2 \\ 0.5, & \text{for } a_2 \leq x \leq a_3 \\ \frac{1}{2} + \frac{1}{2} \left(\frac{x - a_2}{a_4 - a_2} \right), & \text{for } a_3 \leq x \leq a_4 \\ 1, & \text{for } a_4 \leq x \leq a_5 \\ \frac{1}{2} + \frac{1}{2} \left(\frac{a_6 - x}{a_6 - a_5} \right), & \text{for } a_5 \leq x \leq a_6 \\ 0.5, & \text{for } a_6 \leq x \leq a_7 \\ \frac{1}{2} \left(\frac{a_8 - x}{a_8 - a_7} \right), & \text{for } a_7 \leq x \leq a_8 \\ 0, & \text{for } x > a_8 \end{cases}$$

III. PROCESSING OF ‘N’ JOBS THROUGH ‘2’ MACHINES:

Let ‘n’ jobs A_1, A_2, \dots, 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 Hexagonal 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}

V. PASCALS TRIANGULAR GRADED MEAN FOR ICOSAGONAL FUZZY NUMBER:

Consider $G_{Icoskocct} = (a_1, a_2, a_3, a_4, a_5, a_6)$ be a Hexagonal fuzzy number .By taking the co efficient of fuzzy numbers from Pascal’s triangle. Then the formula of Pascal’s triangular graded mean for Icosikaioctagonal fuzzy number is

$$G(A) = \frac{(1a_1 + 5a_2 + 10a_3 + 10a_4 + 5a_5 + 1a_6)}{720}$$

The coefficients of $(a_1, a_2, a_3, a_4, a_5, a_6)$ are 1, 5, 10, 10, 5, 1

respectively. These coefficients are taken from the Pascal’s triangles.

VI. 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

VII. 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 Icosikaioctagonal fuzzy numbers.

Jobs	Machine I	Machine II
A ₁	Low	Good
A ₂	Medium	Very Good
A ₃	Very Good	Medium
A ₄	Good	Low

These qualitative datas are transformed into quantitative datas and which is shown in the below table. The processing time is between 1 to 112 and the minimum value is considered as 1 and maximum value is considered as 112 and is shown in the following table

Low	1,2,3,4,5,6
Medium	9,10,11,12,13,14
Good	15,16,17,18,19,20
Very Good	21,22,23,24,25,26

The problem is shown in the table

Jobs	Machine I	Machine II
A ₁	1,2,3,4,5,6	15,16,17,18,19,20
A ₂	9,10,11,12,13,14	21,22,23,24,25,26
A ₃	21,22,23,24,25,26	9,10,11,12,13,14
A ₄	15,16,17,18,19,20	1,2,3,4,5,6

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

$R_{11} = 3.5$	$R_{12} = 17.5$
$R_{21} = 11.5$	$R_{22} = 23.5$
$R_{31} = 23.5$	$R_{32} = 11.5$
$R_{41} = 17.5$	$R_{42} = 3.5$

A ₁	A ₂	A ₄	A ₃
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The Optimum sequence is

Total elapsed time and idle time

Jobs	Machine I		Machine II	
	Time in	Time out	Time in	Time out
A ₁	0	3.5	3.5	21
A ₂	3.5	15	21	44.5
A ₄	15	32.5	44.5	48
A ₃	32.5	56	48	59.5



Total Elapsed time = 59.5 Hrs
Idle time on Machine I = 3.5 Hrs
Idle time on Machine II = 3.5 Hrs

VIII. CONCLUSION:

In this paper, we have solved fuzzy sequencing problem by using Hexagonal fuzzy numbers. The Fuzzy sequencing problem of Hexagonal Fuzzy Numbers has been transformed into crisp sequencing problem using Pascal's Graded mean formula. By this method, we got the result of optimal sequence, total elapsed time and idle time for each machine.

REFERENCES

1. L.A. Zadeh, , Fuzzy sets, Information and Control, 8(3) ,1965, 338-353.
2. V.Raju, " Sequencing Problem in Icosikaitetragonal Fuzzy Number", International journal of advanced research in science, communication and Technology,, volume 5, issue 9, 2025. Page number : 62-66
3. V.Raju, " Fuzzy Decision Making Problem in Hexadecagonal Fuzzy Number", International journal of advanced research in science, communication and Technology,, volume 5, issue 9, 2025. Page number : 69-73
4. V.Raju, " Study on fuzzy transportation problem in Icosikaitetragonal fuzzy number", International journal of advanced research in science, communication and Technology,, volume 5, issue 7, 2025. Page number : 849-856
5. V.Raju, "Enneadecagonal fuzzy number in critical path method", International journal of research publication and reviews, volume 6, issue 3, 2025. Page number : 6428-6431
6. V.Raju, "Decision making problem in Enneadecagonal fuzzy number", International journal of research publication and reviews, volume 5, issue 5, 2024. Page number : 9808-9812
7. V.Raju " Assignment problem in Enneadecagonal fuzzy number "International journal of progressive research in engineering management and Science , volume 4, issue 3, 2024 page number:368-371
8. Ravichandran and V.Raju , "An approach on fuzzy decision making problem in icosikaitetragonal fuzzy number " International journal of creative research thoughts,volume 11, issue 8, 2023, page number :d553-d561
9. M.Thirugnana sambandan and V.Raju, "Fuzzy sequencing problem in Enneadecagonal fuzzy number" International journal of latest engineering science, volume 5 , issue 6,2022.page number: 11-16
10. P.Vinayagamoorthy and V.Raju "Fuzzy assignment problem in Icosikaitetragonal fuzzy number"International journal of creative research thoughts, Volume 10, issue 10,2022 Page number b18-b25
11. R. Dhananchezhian and V.Raju "Fuzzy transportation problem in Enneadecagonal fuzzy number" Journal of electronics information technology science and Management, Volume 12, Issue 9, 2022, page number 34-45
12. A.Janarthanan and V.Raju "Fuzzy game problem with Enneadecagonal fuzzy number "Journal of Xidian University, Volume 16, Issue 5, 2022, Page number: 676-686
13. V.Raju and S.Ramachandran "Icosagonal fuzzy number in decision making problem" International Journal of Trend in Scientific Research and Development , Volume 5,Issue 6, 2021, Page no : 1194-1199
14. 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
15. 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
16. V.Raju and S.Maria Jesu Raja "An Approach on Fuzzy game problem in Icosikaoctagonal Fuzzy number" Journal of Xidian University, Volume 14, Issue 4, 2020, Page no: 1009-1016
17. V.Raju and S.Arul Amirtha Raja " Study on fuzzy sequencing problem in Icosikaoctagonal Fuzzy Numbers" Journal of Xidian University, Volume 14, Issue 4, 2020, Page no: 3829-3837
18. V.Raju and S.Maria Jesu Raja " Fuzzy decision making problem in Icosikaoctagonal Fuzzy number" Journal of Xidian University, Volume 14, Issue 5, 2020, Page no: 3240-3248



19. 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
20. 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
21. 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
22. 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
23. 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
24. 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
25. 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
26. 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
27. 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
28. 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
29. V.Raju and M.Paruvatha Vathana “ Graceful labeling for some complete bipartite graph” Journal of computer and Mathematical sciences , Volume 9,Issue 12 ,2018, Page no : 2147-2152
30. 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
31. V.Raju,” Sequencing Problem in Hexadecagonal Fuzzy Number, “International Journal of Sciences and Innovation Engineering”Volume 2, Issue 6,2025, Page number:332-338
32. V.Raju, “ Decision Making Problem in Hexagonal Fuzzy Number”, International Journal of Sciences and Innovation Engineering, Volume 2 , Issue 10,2025,Page number: 575-580

