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ENNEADECAGONAL FUZZY NUMBER IN CRITICAL PATH METHOD

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ABSTRACT :

This article's goal is to identify the fuzzy network's critical path.To determine how long each tasktakes,we work using Enneadecagonal fuzzy numbers. With fuzzy number ranking,the Enneadecagonal fuzzy number yields the critical path, as demonstrated by the numerical example The critical path from the starting point to the ending point is indicated by an enneadecagonal fuzzy number

Keywords: Enneadecagonal fuzzy numbers, Fuzzy set, Fuzzy numbers, Ranking function.

1. Introduction:

Zadeh is responsible for designing, developing, and introducing fuzzy concepts to the world [1]. In our daily life, we are facing problems in many situations. Fortunately or sadly, we are making decisions in those circumstances. Because there is not enough information, their decisions are frequently ambiguous. However, fuzzy was the key to using the principles of fuzziness to deal with imprecise data. In engineering, project management, and planning, the critical route method is a very helpful tool. Liang and Han[2] created and presented an algorithm to carry out critical path analysis in a fuzzy environment. Enneadecagonal fuzzy numbers were first presented by Raju. Enneadecagonal fuzzy numbers are utilized in this paper to determine the critical path. To determine the key path, we use a new ranking method for Enneadecagonal fuzzy numbers to the anticipated time of each task in the fuzzy project network.

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

Definition 2.3 An α-cut of fuzzy set A is classical set defined as ${}^{\alpha}[A] = \{x \in X | \mu_A(x) \geq \alpha\}$

Definition 2.4 A fuzzy set A is a convex fuzzy set iff each of its α-cut ${}^{\alpha}A$ is a convex set.

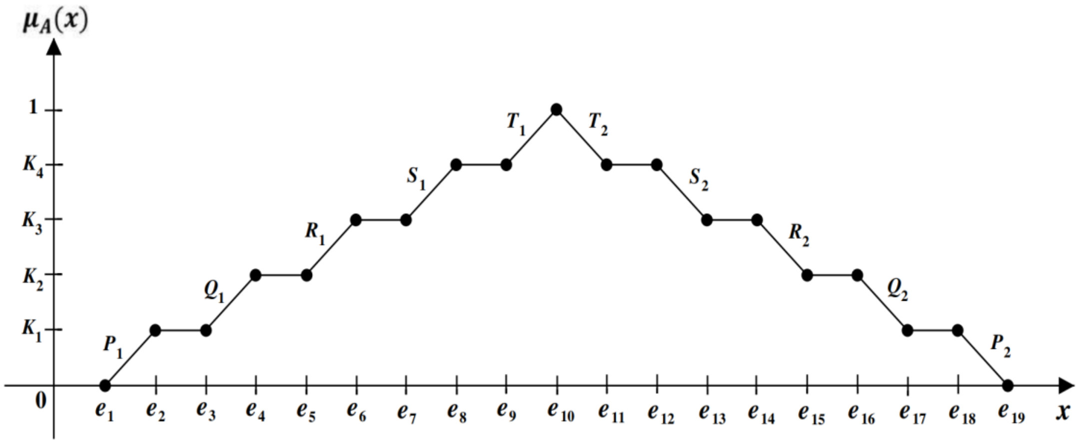
2.5 Ranking of Enneadecagonal fuzzy number:

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

$$M(I) = \frac{e_1 + e_2 + e_3 + e_4 + e_5 + e_6 + e_7 + e_8 + e_9 + e_{10} + e_{11} + e_{12} + e_{13} + e_{14} + e_{15} + e_{16} + e_{17} + e_{18} + e_{19}}{19}$$

$$where \;\; 0 \leq k_1 \leq k_2 \leq k_3 \leq k_4 \leq 1$$

Definition 2.6 Graphical representation of Enneadecagonal fuzzy number



Definition 2.7

A fuzzy number A = $(a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}, \ldots\ldots.a_{19})$ is Enneadecagonal fuzzy number and its membership function is given by

$$\mu_E(x) = \begin{cases} 0,\ for\ x < e_1 \\ k_1\left(\dfrac{x-e_1}{e_2-e_1}\right),\ for\ e_1 \le x \le e_2 \\ k_1,\ for\ e_2 \le x \le e_3 \\ k_1 + (k_2-k_1)\left(\dfrac{x-e_3}{e_4-e_3}\right),\ for\ e_3 \le x \le e_4 \\ k_2,\ for e_4 \le x \le e_5 \\ k_2 + (k_3-k_2)\left(\dfrac{x-e_5}{e_6-e_5}\right),\ for\ e_5 \le x \le e_6 \\ k_3,\ e_6 \le x \le e_7 \\ k_3 + (k_4-k_3)\left(\dfrac{x-e_7}{e_8-e_7}\right),\ for\ e_7 \le x \le e_{8/} \\ k_4,\ for\ e_8 \le x \le e_9 \\ k_4 + (1-k_4)\left(\dfrac{x-e_9}{e_{10}-e_9}\right),\ for\ e_9 \le x \le e_{10} \\ k_4 + (1-k_4)\left(\dfrac{e_{10}-x}{e_{11}-e_{10}}\right),\ for\ e_{10} \le x \le e_{11} \\ k_4,\ for\ e_{11} \le x \le e_{12} \\ k_3 + (k_4-k_3)\left(\dfrac{e_{12}-x}{e_{13}-e_{12}}\right),\ for\ e_{12} \le x \le e_{13} \\ k_3,\ for\ e_{13} \le x \le e_{14} \\ k_2 + (k_3-k_2)\left(\dfrac{e_{14}-x}{e_{15}-e_{14}}\right),\ for\ e_{14} \le x \le e_{15} \\ k_2,\ for\quad e_{15} \le x \le e_{16} \\ k_1 + (k_2-k_1)\left(\dfrac{e_{16}-x}{e_{17}-e_{16}}\right),\ for\ e_{16} \le x \le e_{17} \\ k_1,\ for\ e_{17} \le x \le e_{18} \\ k_1\left(\dfrac{e_{18}-x}{e_{19}-e_{18}}\right),\ for\ e_{18} \le x \le e_{19} \\ 0,\ for\ x > e_{19} \end{cases}$$

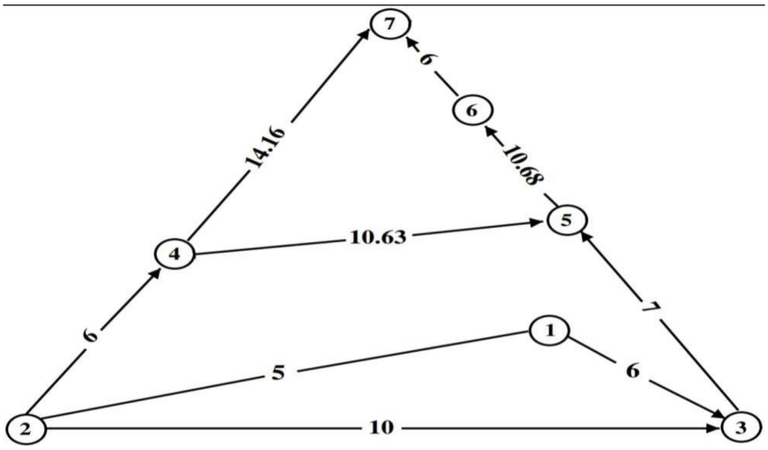
3.Numerical example :

Activity duration of each activity in a fuzzy project network.

Activity	Fuzzy activity time
1-2	-4,-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14
1-3	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15
2-3	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19
2-4	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15
3-5	-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16
4-5	0,1,2,4,5,6,7,8,9,10,11,12,13,14,16,18,20,22,24
4-7	0,1,2,3,4,5,6,7,9,10,11,13,14,15,17,19,21,22,25
5-6	1,2,3,6,8,9,10,12,13,15,16,17,19,20,22,23,25,28,30
6-7	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15

Expected durations and their activities are shown in a fuzzy project network

Activity	Fuzzy activity time	Expected Duration
1-2	-4,-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14	5
1-3	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	6
2-3	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19	10
2-4	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	6
3-5	-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	7
4-5	0,1,2,4,5,6,7,8,9,10,11,12,13,14,16,18,20,22,24	10.63
4-7	0,1,2,3,4,5,6,7,9,10,11,13,14,15,17,19,21,22,25	14.16
5-6	1,2,3,6,8,9,10,12,13,15,16,17,19,20,22,23,25,28,30	10.68
6-7	-3,-2,-1,0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	6



Possible paths in the networks:

S.No	Possible Paths in the network	Total Durations
1	$1 \to 2 \to 3 \to 5 \to 6 \to 7$	38.68
2	$1 \to 2 \to 4 \to 5 \to 6 \to 7$	38.31
3	$1 \to 2 \to 4 \to 7$	25.16
4	$1 \to 3 \to 5 \to 6 \to 7$	29.68

Critical Path of the project is $1 \to 2 \to 3 \to 5 \to 6 \to 7$ (38.68 days)

Conclusion:

To find the fuzzy critical path, we have created a basic ranking method. In order to determine the critical path, we represented the activity duration in the project network using enneadecagonal fuzzy numbers. When identifying the critical activity conditions and the critical path, enneadecagonal fuzzy numbers work better.

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