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Application of Three Estimates Fuzzy TOPSIS(TEFTOPSIS) Method using pentagonal Fuzzy Number in Analyzing the Causes for increase in Old Age Home

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Abstract: In this paper the three estimates(e_o,e_m,e_p) technique is adapted to get the experts opinion. Usually, triangular and trapezoidal numbers are used in Fuzzy TOPSIS. In this paper, Pentagonal fuzzy number is used for our analysis. The important common factors for preferring old age homes are analyzed by the proposed algorithm.

Keywords: TOPSIS, Fuzzy TOPSIS, Fuzzy Number, Old Age People, Old Age Home

I. INTRODUCTION

In our day to day life, the data obtained for decision making are known approximately. Zadeh[1] introduced the concept of fuzzy set theory to meet those problems. In 1978 Dubios and Prade defined fuzzy numbers as the fuzzy subset of the real line [2]. A fuzzy number is a quantity whose value is imprecise, not exact as in “ordinary” numbers [3,6]. Any fuzzy number can be defined as a function whose domain is a specified set. In many situations, fuzzy numbers depict the physical world more realistically than any single valued numbers. Fuzzy numbers enable us to create the mathematical model of linguistic variable. Fuzzy numbers are used in statistic, computer related techniques.

Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is one of the well-known method in Multiple Attribute Decision-Making (MADM). Hwang and Yoon [7] have introduced TOPSIS in 1981. An algorithmic procedure is used to rank the alternatives in TOPSIS. Wang and Chang [8] developed an evaluation approach based on TOPSIS in a fuzzy environment where the vagueness and subjectivity were handled with linguistic terms parameterized by triangular fuzzy numbers. A fuzzy multi-criteria decision analysis method based on the concepts of ideal and anti-ideal points was introduced by Kuo et al.[9].

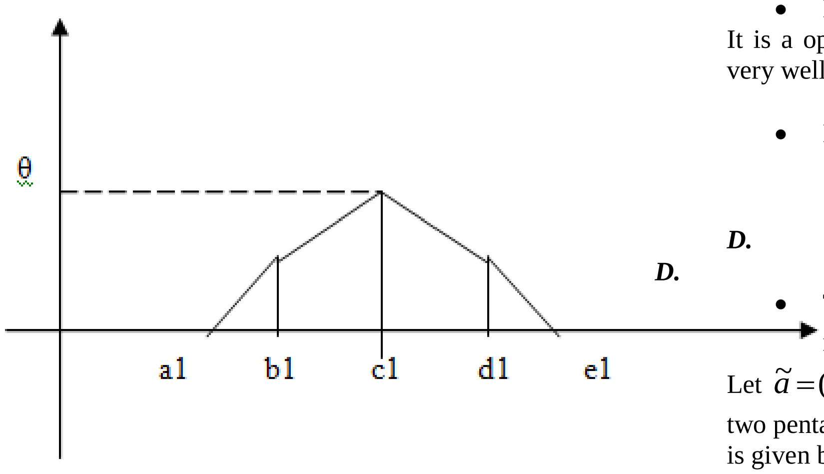
II. PENTAGONAL FUZZY NUMBER AND THE ALGEBRAIC OPERATION

A. *Fuzzy Number*

If a fuzzy set is convex and normalized, and its membership function is defined in ***R*** and piecewise continuous, it is called as fuzzy number. So fuzzy number (fuzzy set) represents a real number interval whose boundary is fuzzy. Fuzzy number is expressed as a fuzzy set defining a fuzzy interval in the real number ***R***. Since the boundary of this interval is ambiguous, the interval is also a fuzzy set.

A Fuzzy number Ã on R to be a Pentagon fuzzy number (PFN) if its membership function $\mu_{\tilde{A}}(x): R \rightarrow [0,1]$ is equal to following Eq (1).

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{(x-a)\theta}{b-a}, & a \le x \le b \\ \dfrac{(x-b)\theta}{c-b}, & b \le x \le c \\ \dfrac{(d-x)\theta}{d-c}, & c \le x \le d \\ \dfrac{(e-x)\theta}{e-d}, & d \le x \le e \\ 0, & otherwise \end{cases}$$



D.

The operational Laws of PFN $\tilde{A}_1=(a_1,b_1,c_1,d_1,e_1)$ and $\tilde{A}_2=(a_2,b_2,c_2,d_2,e_2)$ are shown below.

(a) Addition of the fuzzy number $\oplus$

$$\tilde{A}_1 \oplus \tilde{A}_2 = (a_1,b_1,c_1,d_1,e_1) \oplus (a_2,b_2,c_2,d_2,e_2) = (a_1+a_2, b_1+b_2, c_1+c_2, d_1+d_2, e_1+e_2)$$

(b) Subtraction of the fuzzy number Θ

$$\tilde{A}_1 \,\Theta\, \tilde{A}_2 = (a_1,b_1,c_1,d_1,e_1) \,\Theta\, (a_2,b_2,c_2,d_2,e_2) = (a_1-e_2, b_1-d_2, c_1-c_2, d_1-b_2, e_1-a_2)$$

B. Five-point linguistic scale of the Pentagonal fuzzy number

The five-point scales are not only easy to be used by the respondents and also widely used in TFNs and TrFNs. Therefore, here we define a new five-point linguistic scale of the Pentagonal fuzzy number.

Table I: The five-point linguistic scale of the Pentagonal fuzzy number

Linguistic Variable	*Linguistic scale of the Pentagonal Fuzzy Number*
Very Low(VL)	(0.0,0.1,0.2,0.3,0.4)
Low(L)	(0.1,0.2,0.3,0.4,0.5)
Medium(M)	(0.3,0.4,0.5,0.6,0.7)
High(H)	(0.5,0.6,0.7,0.8,0.9)
Very High(VH)	(0.6,0.7,0.8,0.9,1)

C. Three Time Estimates.

This technique, takes into account the uncertainty of activities into account.

- Optimistic estimate:

It is a opinion of the expert when everything goes on very well during the activity.

- Pessimistic estimate:

It is a opinion of the expert when almost everything goes against our will and a lot of difficulties is faced

- Most likely estimate:

It is a opinion of the expert when sometimes things go on very well and sometimes things goes on very bad

- Expected opinion of the expert,

$$t_e = \frac{t_o + 4t_m + t_p}{6} \qquad (2)$$

D. Three Estimates Fuzzy TOPSIS(TEFTOPSIS):

- The distance between two pentagonal fuzzy numbers

Let $\tilde{a}=(a_1,a_2,a_3,a_4,a_5)$ and $\tilde{b}=(b_1,b_2,b_3,b_4,b_5)$ be two pentagonal fuzzy numbers. The distance between them is given by

$$d(\tilde{a},\tilde{b})=\sqrt{\frac{1}{5}\left[(a_1-b_1)^2+(a_2-b_2)^2+(a_3-b_3)^2+(a_4-b_4)^2+(a_5-b_5)^2\right]} \quad ($$

E. Algorithm for Three Estimates Fuzzy TOPSIS(TEFTOPSIS):

Step 1: The weights of evaluation dimensions

(1) Obtain the experts opinion (Linguistic values) in the estimation format.

$$D=\begin{pmatrix}\begin{pmatrix}r_{111}\\r_{112}\\r_{113}\end{pmatrix} & \begin{pmatrix}r_{121}\\r_{122}\\r_{123}\end{pmatrix} & \cdots & \begin{pmatrix}r_{1n1}\\r_{1n2}\\r_{1n3}\end{pmatrix}\\ \begin{pmatrix}r_{211}\\r_{212}\\r_{213}\end{pmatrix} & \begin{pmatrix}r_{221}\\r_{222}\\r_{223}\end{pmatrix} & \cdots & \begin{pmatrix}r_{211}\\r_{212}\\r_{213}\end{pmatrix}\\ \vdots & \vdots & \vdots & \vdots\\ \begin{pmatrix}r_{n11}\\r_{n12}\\r_{n13}\end{pmatrix} & \begin{pmatrix}r_{n21}\\r_{n22}\\r_{n23}\end{pmatrix} & \cdots & \begin{pmatrix}r_{nn1}\\r_{nn2}\\r_{nn3}\end{pmatrix}\end{pmatrix} where\ r_{ij}, \forall i,j, i=1,2,\ldots,m,\ j=1,2,\ldots n$$

are linguistic variables which can be gescribed by pentagonal number

(1) Apply the Numerical values of the Linguistic values.
(2) Using Estimation formula(2) , find the expected opinion.
(3) Combine the three experts opinion using arithmetic average, which is the decision matrix D .

Let the decision matrix

$$D=\begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n}\\ r_{21} & r_{22} & \cdots & r_{21}\\ \vdots & \vdots & \vdots & \vdots\\ r_{11} & r_{11} & \cdots & r_{nn}\end{pmatrix} where\ r_{ij}, \forall i,j, i=1,2,\ldots,m,\ j=1,2,\ldots n$$

Step 2: Get the weights of the attributes from experts

$$W=(w_1, w_2, \ldots w_n)$$

Step 3: Find the aggregated weights of the attributes

Step 4: Construct the normalized decision matrix by using the following formula.

$$R = r_{ij} = \left(\frac{a_{ij}}{e_{ij}^{+}}, \frac{b_{ij}}{e_{ij}^{+}}, \frac{c_{ij}}{e_{ij}^{+}}, \frac{d_{ij}}{e_{ij}^{+}}, \frac{e_{ij}}{e_{ij}^{+}} \right) where\ e_{ij}^{+} = \max(e_{ij})$$

Step 5: According to different importance of the attributes, Find the weighted normalized decision matrix as

$$V = \begin{pmatrix} v_{11} & v_{12} & \cdots & v_{1j} \\ v_{21} & v_{22} & \cdots & v_{2j} \\ \vdots & \vdots & \vdots & \vdots \\ v_{i1} & v_{i2} & \cdots & v_{ij} \end{pmatrix} v_{ij} = r_{ij}(\times) w_j, i = 1,2,...m, j = 1,2,...n.$$

Where, v_{ij} is a normalized PeFN and varies in closed interval [0, 1].

Step 6: Find the Fuzzy Positive Ideal Solution(FPIS) S^+ , Fuzzy Negative Ideal Solution(FNIS)S^-

$$S^{+} = (v_{i1}^{+}, v_{i2}^{+}, \cdots v_{ij}^{+})\ where$$

$$v_{ij}^{+} = \max v_{ij}$$

$$= (\max a_{ij}, \max b_{ij,}\ \max c_{ij}, \max d_{ij,}\ \max e_{ij})$$

$$S^{-} = (v_{i1}^{-}, v_{i2}^{-}, \cdots v_{ij}^{-})\ where$$

$$v_{ij}^{-} = \min v_{ij}$$

$$= (\min a_{ij}, \min b_{ij,}\ \min c_{ij}, \min d_{ij,}\ \min e_{ij})$$

Step 7: Find the Fuzzy Positive Distance(FPD) and Fuzzy Negative Distance(FND) between each weighted normalized matrix to FPIS and FNIS (using the formula (3)).

Step 8: Find the closeness co efficient.

$$CC_i = \frac{FND}{FPD + FPD}$$

Step 9: Rank the alternatives.

III. DESCRIPTION OF THE PROBLEM

When they are 60 plus and retired, all their responsibilities are discharged, all ambitions are spent and there is nothing more to achieve. They dream that, they will be at home, surrounded by the loved ones and someone to give helping hand when they are sick. But the dreams can turn sour. Sometimes circumstances conspire to make these successful people helpless and at other times the children who they groomed all their life dump them. They always love to be in a joint family where there is security, love and care. But the growing materialistic outlook of the society and break down in understanding between the past and the present generations is making all this a dream for the old age people.

The most important common factors for preferring old age home are

A_1.Daughter in law,
A_2.No male Child,
A_3. No children,
A_4. Attitude Problem
A_5. Health Problem

To analyse the factors the following family status where analyzed

B_1.Poor family,

TABLE III: Linguistic values of the opinion of the Expert 1

B_2. Low middle family,
B_3. Middle family,
B_4. High middle family
B_5. Rich family

Three experts opinion was obtained in the three estimates(e_o,e_m,e_p) technique format

TABLE II: Opinion of the Expert 1.

	B₁	***B₂***	***B₃***	***B₄***	***B₅***
A₁	*VL*	*L*	*L*	*VL*	*VL*
	H	*M*	*H*	*L*	*L*
	VH	*H*	*H*	*H*	*VH*
A₂	*H*	*VL*	*L*	*VL*	*VL*
	L	*H*	*H*	*L*	*VL*
	H	*H*	*VH*	*M*	*L*
A₃	*M*	*L*	*VL*	*VL*	*VL*
	H	*M*	*L*	*L*	*VL*
	VH	*H*	*M*	*L*	*L*
A₄	*M*	*L*	*VL*	*VL*	*VL*
	H	*M*	*L*	*L*	*VL*
	VH	*H*	*M*	*L*	*L*
A₅	*H*	*M*	*M*	*L*	*VL*
	H	*H*	*H*	*M*	*L*
	VH	*VH*	*H*	*H*	*L*

	B₁	***B₂***	***B₃***	***B₄***	***B₅***
A₁	*(0.0,0.1,0.2,0.3,0.4)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*	*(0.0,0.1,0.2,0.3,0.4)*

	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.6,0.7,0.8,0.9,1)
A_2	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.6,0.7,0.8,0.9,1)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)
A_3	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.3,0.4,0.5,0.6,0.7)	(0.0,0.1,0.2,0.3,0.4)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)
	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
A_4	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.6,0.7,0.8,0.9,1)
	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
A_5	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)
	(0.6,0.7,0.8,0.9,1)	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)

TABLE IV: Linguistic values of the opinion of the Expert 2.

	B_1	**B_2**	**B_3**	**B_4**	**B_5**
A_1	(0.0,0.1,0.2,0.3,0.4)	(0.0,0.1,0.2,0.3,0.4)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)	(0.0,0.1,0.2,0.3,0.4)
	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)
	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)
A_2	(0.0,0.1,0.2,0.3,0.4)	(0.0,0.1,0.2,0.3,0.4)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)	(0.1,0.2,0.3,0.4,0.5)
	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)
A_3	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)
	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.3,0.4,0.5,0.6,0.7)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)
A_4	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.0,0.1,0.2,0.3,0.4)
	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.0,0.1,0.2,0.3,0.4)
	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.6,0.7,0.8,0.9,1)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
A_5	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)
	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)
	(0.6,0.7,0.8,0.9,1)	(0.6,0.7,0.8,0.9,1)	(0.5,0.6,0.7,0.8,0.9)	(0.3,0.4,0.5,0.6,0.7)	(0.1,0.2,0.3,0.4,0.5)

TABLE V: Linguistic values of the opinion of the Expert 3.

	B_1	**B_2**	**B_3**	**B_4**	**B_5**
A_1	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)	(0.0,0.1,0.2,0.3,0.4)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)

	(0.3,0.4,0.5,0.6,0.7)	*(0.3,0.4,0.5,0.6,0.7)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.1,0.2,0.3,0.4,0.5)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.5,0.6,0.7,0.8,0.9)*	*(0.6,0.7,0.8,0.9,1)*	*(0.6,0.7,0.8,0.9,1)*	*(0.5,0.6,0.7,0.8,0.9)*
A_2	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.1,0.2,0.3,0.4,0.5)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.5,0.6,0.7,0.8,0.9)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*
A_3	*(0.3,0.4,0.5,0.6,0.7)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.3,0.4,0.5,0.6,0.7)*	*(0.0,0.1,0.2,0.3,0.4)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.1,0.2,0.3,0.4,0.5)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.6,0.7,0.8,0.9,1)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*
A_4	*(0.5,0.6,0.7,0.8,0.9)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.0,0.1,0.2,0.3,0.4)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.5,0.6,0.7,0.8,0.9)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.1,0.2,0.3,0.4,0.5)*
	(0.6,0.7,0.8,0.9,1)	*(0.5,0.6,0.7,0.8,0.9)*	*(0.6,0.7,0.8,0.9,1)*	*(0.0,0.1,0.2,0.3,0.4)*	*(0.1,0.2,0.3,0.4,0.5)*
A_5	*(0.5,0.6,0.7,0.8,0.9)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.1,0.2,0.3,0.4,0.5)*	*(0.0,0.1,0.2,0.3,0.4)*
	(0.5,0.6,0.7,0.8,0.9)	*(0.5,0.6,0.7,0.8,0.9)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.3,0.4,0.5,0.6,0.7)*	*(0.0,0.1,0.2,0.3,0.4)*
	(0.6,0.7,0.8,0.9,1)	*(0.6,0.7,0.8,0.9,1)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.5,0.6,0.7,0.8,0.9)*	*(0.1,0.2,0.3,0.4,0.5)*

TABLE VI: Expected opinion of the Expert 1.

	B_1	B_2	B_3	B_4	B_5
A_1	(0.43,0.53,0.63,0.73,0.83)	(0.30,0.40,0.50,0.60,0.70)	(0.43,0.53,0.63,0.73,0.83)	(0.15,0.25,0.35,0.50,0.60)	(0.20,0.27,0.40,0.47,0.57)
A_2	(0.43,0.53,0.63,0.73,0.83)	(0.42,0.52,0.62,0.72,0.82)	(0.450,0.55,0.65,0.75,0.85)	(0.12,0.22,0.317,0.42,0.52)	(0.02,0.12,0.22,0.32,0.42)
A_3	(0.48,0.58,0.68,0.78,0.88)	(0.30,0.40,0.50,0.60,0.70)	(0.12,0.22,0.32,0.42,0.52)	(0.08,0.18,0.283,0.40,0.50)	(0.02,0.12,0.22,0.32,0.42)
A_4	(0.48,0.58,0.68,0.78,0.88)	(0.30,0.40,0.50,0.60,0.70)	(0.33,0.43,0.53,0.63,0.73)	(0.13,0.23,0.333,0.40,0.54)	(0.10,0.18,0.28,0.38,0.48)
A_5	(0.52,0.62,0.72,0.82,0.92)	(0.48,0.58,0.68,0.78,0.88)	(0.47,0.57,0.67,0.77,0.87)	(0.30,0.40,0.50,0.60,0.70)	(0.10,0.18,0.23,0.38,0.48)

TABLE VII: Expected opinion of the Expert 2.

	B_1	B_2	B_3	B_4	B_5
A_1	(0.30,0.40,0.50,0.60,0.70)	(0.42,0.52,0.62,0.72,0.82)	(0.45,0.55,0.65,0.75,0.85)	(0.42,0.52,0.62,0.72,0.82)	(0.15,0.25,0.35,0.45,0.55)
A_2	(0.28,0.38,0.48,0.58,0.68)	(0.42,0.52,0.62,0.72,0.82)	(0.30,0.40,0.50,0.60,0.70)	(0.28,0.38,0.48,0.58,0.68)	(0.13,0.23,0.33,0.43,0.53)
A_3	(0.30,0.40,0.50,0.60,0.70)	(0.30,0.40,0.50,0.60,0.70)	(0.13,0.23,0.33,0.43,0.53)	(0.27,0.37,0.47,0.57,0.67)	(0.05,0.15,0.25,0.35,0.45)
A_4	(0.52,0.62,0.72,0.82,0.92)	(0.33,0.43,0.53,0.63,0.73)	(0.52,0.62,0.72,0.82,0.92)	(0.27,0.37,0.47,0.57,0.67)	(0.02,0.12,0.22,0.32,0.42)
A_5	(0.48,0.58,0.68,0.78,0.88)	(0.52,0.62,0.72,0.82,0.92)	(0.33,0.43,0.53,0.63,0.73)	(0.27,0.37,0.47,0.57,0.67)	(0.10,0.20,0.30,0.40,0.50)

TABLE VIII: Expected opinion of the Expert 3.

	B_1	B_2	B_3	B_4	B_5
A_1	(0.30,0.40,0.50,0.60,0.70)	(0.30,0.40,0.50,0.60,0.70)	(0.43,0.53,0.63,0.73,0.83)	(0.45,0.55,0.65,0.75,0.85)	(0.17,0.27,0.37,0.47,0.57)
A_2	(0.43,0.53,0.63,0.73,0.83)	(0.28,0.38,0.48,0.58,0.68)	(0.30,0.40,0.50,0.60,0.70)	(0.13,0.23,0.33,0.43,0.53)	(0.12,0.22,0.32,0.42,0.52)
A_3	(0.29,0.36,0.42,0.49,0.56)	(0.19,0.26,0.32,0.39,0.46)	(0.20,0.27,0.33,0.40,0.47)	(0.09,0.16,0.22,0.29,0.36)	(0.08,0.14,0.21,0.28,0.34)
A_4	(0.19,0.24,0.28,0.33,0.37)	(0.13,0.17,0.21,0.26,0.30)	(0.13,0.18,0.22,0.27,0.31)	(0.06,0.1,0.15,0.19,0.24)	(0.05,0.1,0.14,0.19,0.23)
A_5	(0.13,0.16,0.19,0.22,0.25)	(0.08,0.11,0.14,0.17,0.20)	(0.09,0.12,0.15,0.18,0.21)	(0.04,0.07,0.1,0.13,0.16)	(0.03,0.06,0.09,0.12,0.15)

TABLE IX: Aggregated Expected opinion of the three expert, Decision Matrix

$$D = \left(\begin{array}{cccccc} & B_1 & B_2 & B_3 & B_4 & B_5 \\ A_1 & (0.34,0.44,0.54,0.64,0.74) & (0.34,0.44,0.54,0.64,0.74) & (0.44,0.54,0.64,0.74,0.84) & (0.34,0.44,0.54,0.64,0.74) & (0.16,0.26,0.36,0.46,0.56) \\ A_1 & (0.38,0.48,0.58,0.68,0.78) & (0.37,0.47,0.57,0.67,0.77) & (0.35,0.45,0.55,0.65,0.75) & (0.18,0.28,0.38,0.48,0.58) & (0.09,0.19,0.29,0.39,0.49) \\ A_1 & (0.39,0.48,0.57,0.67,0.76) & (0.28,0.38,0.47,0.57,0.66) & (0.12,0.21,0.31,0.4,0.49) & (0.15,0.24,0.34,0.43,0.53) & (0.03,0.12,0.22,0.31,0.41) \\ A_1 & (0.47,0.56,0.66,0.75,0.85) & (0.3,0.39,0.49,0.58,0.67) & (0.39,0.48,0.58,0.67,0.76) & (0.18,0.27,0.37,0.46,0.56) & (0.05,0.15,0.24,0.34,0.43) \\ A_1 & (0.48,0.57,0.66,0.76,0.85) & (0.47,0.56,0.66,0.75,0.85) & (0.39,0.48,0.58,0.67,0.77) & (0.27,0.36,0.46,0.55,0.65) & (0.09,0.18,0.27,0.37,0.46) \end{array} \right)$$

TABLE X: Attributes Weightage by three experts

	B_1	B_2	B_3	B_4	B_5
A_1	VH	M	M	H	VH
A_2	H	L	L	H	H
A_3	VH	M	M	VH	VH

TABLE XI: Linguistic values of the weights of the attributes by three experts

	B_1	B_2	B_3	B_{41}	B_5
E_1	(0.6,0.7,0.8,0.91)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.5,0.6,0.7,0.8,0.9)	(0.6,0.7,0.8,0.91)
E_2	(0.5,0.6,0.7,0.8,0.9)	(0.1,0.2,0.3,0.4,0.5)	(0.1,0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8,0.9)	(0.5,0.6,0.7,0.8,0.9)
E_3	(0.6,0.7,0.8,0.91)	(0.3,0.4,0.5,0.6,0.7)	(0.3,0.4,0.5,0.6,0.7)	(0.6,0.7,0.8,0.91)	(0.6,0.7,0.8,0.91)

TABLE XII: Aggregated weights of the attributes by three experts

B_1	B_2	B_3	B_4	B_5
(0.57,0.67,0.77,0.87,0.97)	(0.23,0.33,0.43,0.53,0.63)	(0.23,0.33,0.43,0.53,0.63)	(0.53,0.63,0.73,0.83,0.93)	(0.57,0.67,0.77,0.87,0.97)

TABLE XIII: Weighted Normalized decision matrix:

	B_1	B_2	B_3	B_4	B_5
A_1	(0.23,0.35,0.50,0.66,0.85)	(0.09,0.17,0.28,0.40,0.56)	(0.12,0.21,0.33,0.47,0.63)	(0.21,0.33,0.47,0.63,0.82)	(0.11,0.21,0.33,0.48,0.65)
A_2	(0.28,0.41,0.57,0.76,0.97)	(0.11,0.20,0.31,0.46,0.62)	(0.10,0.19,0.30,0.44,0.61)	(0.12,0.23,0.36,0.51,0.69)	(0.07,0.16,0.29,0.44,0.61)
A_3	(0.29,0.42,0.58,0.77,0.97)	(0.08,0.17,0.27,0.40,0.55)	(0.04,0.09,0.18,0.28,0.41)	(0.10,0.22,0.36,0.50,0.69)	(0.02,0.11,0.22,0.35,0.52)
A_4	(0.32,0.44,0.60,0.77,0.97)	(0.08,0.15,0.25,0.36,0.50)	(0.11,0.19,0.29,0.42,0.56)	(0.11,0.20,0.32,0.45,0.61)	(0.03,0.12,0.22,0.35,0.49)
A_5	(0.32,0.45,0.60,0.78,0.97)	(0.13,0.22,0.33,0.47,0.63)	(0.11,0.19,0.29,0.42,0.57)	(0.17,0.27,0.40,0.54,0.71)	(0.06,0.14,0.24,0.38,0.52)

TABLE XIV: Fuzzy Positive Ideal Solution(FPIS) S^+ , Fuzzy Negative Ideal Solution(FNIS)S^-

	B_1	B_1	B_1	B_1	B_1
S^+	(0.32,0.45,0.60,0.78,0.97)	(0.13,0.22,0.33,0.47,0.63)	(0.12,0.21,0.33,0.47,0.63)	(0.21,0.33,0.47,0.63,0.82)	(0.11,0.21,0.33,0.48,0.65)
S^-	(0.23,0.35,0.50,0.66,0.85)	(0.08,0.15,0.25,0.36,0.50)	(0.04,0.09,0.18,0.28,0.41)	(0.10,0.22,0.36,0.50,0.69)	(0.02,0.11,0.22,0.35,0.52)

TABLE XV: Fuzzy Positive Distance(FPD),Fuzzy Negative Distance(FND) ,Closeness Co-efficient and Rank

.

Alternatives	FPD	FND	CCi	Rank
A_1	0.162	0.413	0.718	1
A_2	0.223	0.356	0.615	3
A_3	0.475	0.112	0.19	5
A_4	0.416	0.255	0.38	4
A_5	0.208	0.375	0.643	2

IV. CONCLUSION

From the calculation we found that A_1- Daughter-In-Law is ranked No.1. A_5 – Health Problem and A_2 – No male child are ranked next to A_1. So the major reason for preferring old age home is Daughter-In-Law. To avoid this scenario in future, Daughter-In-Law must play the role of daughter in her In – Law's home for happy family life.

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