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Abstract

In this paper, computational experiments using the fuzzy integral theory and the Z-number combination have been conducted using fuzzy theory. The article was considered for the selection of the best biological and technologically-based selection breeds of cotton in the case of poor decision-making, and the results of the computational work using these two methods were theoretically justified.

Keywords
(separated by '-')
Z-number - Fuzzy theory - Fuzzy integral - Fuzzy measure - Computational experiments - Decision-making

Accounting Experience Between Fuzzy Integral and Z-numbers

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Abstract. In this paper, computational experiments using the fuzzy integral theory and the Z-number combination have been conducted using fuzzy theory. The article was considered for the selection of the best biological and technologically-based selection breeds of cotton in the case of poor decision-making, and the results of the computational work using these two methods were theoretically justified.

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1 Introduction

Today, results are obtained using decision-making issues, but they are not always expected. For example, there are significant shortcomings in the decision-making process between the managers of the enterprise, the issues of staff training and placement, and the consideration of their strengths and weaknesses.

It is well known that the dimension has a fundamental characteristic of additiveness in classical mathematics: the number equal to the sum of several combined characteristics must be the sum of the number of corresponding characteristics. Clearly, the use of linguistic variables directly in mathematical models undermines the hypothesis that measurements are addictive, that is, there is a problem with the use and study of measurements that do not obey additivity requirements.

2 Calculation of Fuzzy Integral by the Fuzzy Measure

Let G $x_1,\ x_2,\ \ldots, x_n$ be a set of elements, $G = \{x_1,\ x_2,\ \ldots, x_n\}$. The structure of G depends on the specific problem. For example, $x_1,\ x_2,\ \ldots, x_n$ is the yield of cotton under different weather conditions G = {25, 30, 35}. In G, we construct all possible sets of components and define them by $\beta(G)$. For example, $\beta(G)$ the elements of a set are: A1 = {25}; A2

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= {30}; A3 = {35}; A4 = {25; 30}; A5 = {25; 35}; A6 = {30; 35}; A7 = G = {25; 30; 35}; [1, 2, 7].

The main feature of this is that it is closed to mergers, complements and intersections: $A_i \cup A_j \in \beta(G), \overline{A}_i \in \beta(G), A_i \cap A_j \in \beta(G)$.

For example, $A_1 \cup A_2 = A_4 = \{25;\ 30\} \in \beta(G)$ [1, 2, 8].

$\beta(G)$ Include a dimension in the set that is a function of the set.

An fuzzy measure is the function of set G, given in set $\beta(G)$ and satisfying the following conditions [1, 2, 8]:

1. Limited. $g\ (\emptyset) = 0$, $g\ (G) = 1; G = \{x_1,\ x_2,\ \ldots, x_n\}$
2. Monotony. If then A, B $\in \beta(\Gamma)$, A $\subseteq$ B, then g(A) $\leq g$(B);
3. Continuity. Let the sequence, if $\{A_i\} \in \beta(G)$, $1 \leq i \leq \infty$ if $A_i \supseteq A_z \supseteq \ldots\ldots A_n \supseteq \ldots$, do $g(\bigcap\limits_{i=1}^{\infty} A_i) = \lim\limits_{i \to \infty} g(A_i)$.

$(G, \beta(G), g)$ The triad is called a fuzzy measure space.

Sugeno $g(A \cup B)$ proposed the formation of an fuzzy measure of the association as follows [2, 9]:

$$g(A \cup B) = g(A) + g(B) + \lambda g(A)g(B).$$

Here, λ takes the values in range $-1 < \lambda < \infty$, where (3) $A \cap B = \emptyset$.

The expression given is rule λ, g_λ and the vague fuzzy is called the Sugeno measure λ.

Calculation of fuzzy integral consists of two parts: λ parameter estimation and integral self-computation on given illumination density.

1. The parameter λ applies by definition [1, 2], $(-1,\ \infty)$ to the field. Equation $\lambda = 0$, $\sum\limits_j g(d_j) = 1$ implies that the probability criterion is complied with $\sum\limits_j g(d_j) = 1$.
2. Calculation of integral by fuzzy density:

$$\int h(x) \circ g = \bigcup_{i=1}^{n} (h(x_i) \wedge g(E_i)), \quad E_i = \{x_i,\ x_{i+1}, \ldots, x_n\},\ E_1 \supset E_2 \supset \ldots.E_n,\ E_1 = U$$

3 Calculation on the Basis of the Combination of Z-numbers

For computational experiments on the basis of Z-numbers, we use the T-norm and the T-ratio over discrete Z numbers. $Z_1 = (A_1, B_1)$, $Z_2 = (A_2, B_2)$ considering discrete Z numbers $Z_{T-norm}(Z_1, Z_2)$ T-norm operation is defined as [3–5]:

$$\begin{aligned} &Z_{T-norm}(Z_1, Z_2) = T((A_1, B_1), (A_2, B_2)) = (T(A_1, A_2), T(B_1, B_2)) \\ &Z^{+}_{T-norm}(Z_1, Z_2) = (T(A_1, A_2), T(R_1, R_2)). \end{aligned} \tag{1}$$

There

$$T(A_1, A_2) = \bigcup_{\alpha \in (0,1]} T(A_1^{\alpha}, A_2^{\alpha}); T(A_1^{\alpha}, A_2^{\alpha}) = \{T(x, y) \big| x \in A_1^{\alpha}, y \in A_2^{\alpha}\},$$

$$T(R_1, R_2) = R_1 \wedge R_2.$$

$Z_1 = (A_1, B_1)$, $Z_2 = (A_2, B_2)$ considering discrete Z numbers $Z_{T-conorm}(Z_1, Z_2)$ The operation of the T-beam is defined as follows [3, 4]:

$$\begin{aligned} &Z_{T-conorm}(Z_1, Z_2) = S((A_1, B_1), (A_2, B_2)) = (S(A_1, A_2), S(B_1, B_2)) \\ &Z^{+}_{T-conorm}(Z_1, Z_2) = (S(A_1, A_2), S(R_1, R_2)), \end{aligned} \tag{2}$$

there

$$S(A_1, A_2) = \bigcup_{\alpha \in (0,1]} S(A_1^{\alpha}, A_2^{\alpha}); \; S(A_1^{\alpha}, A_2^{\alpha}) = \{S(x, y) \big| x \in A_1^{\alpha}, y \in A_2^{\alpha}\},$$

$$S(R_1, R_2) = R_1 \vee R_2.$$

Step 1. Substituting each (Z_{G_i}, Z_{H_i}) pair in Z-number Z_{GH_i} based on T-norm Z_{T-norm} according to (1) [3–7]:

$Z_{H_i G_i} = Z_{T-norm}(Z_{H_i}, Z_{G_i}) = T((A_{H_i}, B_{H_i}), (A_{G_i}, B_{G_i}))$.

Step 2. In accordance with (1) T-commerce $Z_{T-conorm}$ by virtue Z_{HG_i}, Z_{agg} of the merger action [4, 7]:

$$Z_{agg} = Z_{T-conorm}(Z_{g_1 h_1}, Z_{g_2 h_2}, ..., Z_{g_n h_n}) = S((A_{g_1 h_1}, B_{g_1 h_1}), (A_{g_2 h_2}, B_{g_2 h_2}), ..., (A_{g_n h_n}, B_{g_n h_n}))$$

We will consider the proposed approach for the selection of the best biologically and technologically-selective varieties of cotton in the form of poorly made decisions, given the ill-defined initial conditions: planting and cultivation conditions (amount and composition of fertilizers, irrigation, soil type, and so on). Boundary conditions for varieties).

The problem of poor decision making is formulated as follows.

Issued by:

- Collection of alternatives: selection of cotton varieties and fertilizers depending on the soil type $\Gamma = \{x_1, x_2, \ldots, x_n\}$;
- character set: biological and technological characteristics in which the selection of the optimal $H = \{h_1, h_2, ..., h_k\}$ variety is made.
- $x_i \in \Gamma$ the importance of each sign in the alternative,
- Initial conditions: soil types, irrigation and fertilizer application procedures, weather conditions (sun activity: open air, cloudiness).

Required:

- Selection of the most suitable alternative: breeding for initial planting conditions (cultivation of fertilizers and agrotechnical order, irrigation, soil type and boundary conditions for the given varieties).

The experiment was conducted to determine the best $\Gamma = \{x_1, x_2, x_3, x_4\}$ four selective varieties of cotton S-4727, Tashkent 1, 159-F, 108-F with the following characteristics ($H = \{h_1, h_2, h_3, h_4\}$): yield, fiber length, strength of fiber, fat seed quality [3, 4, 7].

The importance of each sign is given and expressed by vague densities

$$g_1 = 0,66, \quad g_2 = 0,89, \; g_3 = 0,96, \quad g_4 = 0,93$$

$$h_1 = 0,19, \quad h_2 = 0,21, \; h_3 = 0,22, \quad h_4 = 0,24$$

$0 \le g_i \le 1$ in the case of non-linear densities, g_λ the scale shall be constructed in accordance with rule λ:

$$g_\lambda(\{x_1, \ldots., x_k\}) = \begin{cases} \frac{1}{\lambda}(\prod\limits_{i=1}^{k}(1+\lambda g_i) - 1), \; \lambda \ne 0) \\ \sum\limits_{i+1}^{k} g_i, \quad \lambda = 0 \end{cases}$$

$$g_\lambda(x_1, \, x_2, \, x_3, \, x_4) = 1.$$

Calculate the parameter $\frac{1}{\lambda}(\prod\limits_{i1}^{n}(1+\lambda g_i) - 1) = 1$ to λ of the normalization condition [2].

$$\begin{gathered} g_1g_2g_3g_4\lambda^3 + (g_1g_2g_3 + g_1g_2g_4 + g_1g_3g_4 + g_2g_3g_4)\lambda^2 \\ + (g_1g_2 + g_1g_3 + g_1g_4 + g_2g_3 + g_2g_4 + g_3g_4)\lambda + g_1 + g_2 + g_3 + g_4 = 1. \\ 0,524\lambda^3 + 2,49\lambda^2 + 4,409\lambda + 2,44 = 0. \\ \lambda^3 + 4,75\lambda^2 + 8,41\lambda + 4,66 = 0. \\ \lambda = -0,96 \end{gathered}$$

The problem of obtaining an integral estimation of the chosen strategy using an integral $\int h \circ g$ integral is raised.

$$h_1 = 0,19, \quad h_2 = 0,21, \; h_3 = 0,22, \quad h_4 = 0,24.$$

$$\int h \circ g = \bigcup_{i=1}^{4}(h(x_i) \wedge g(E_i)) = \max(0,19; \; 0,21; \; 0,22; \; 0,24) = 0,24$$

$$x_4 = 0,24$$

4 To Carry Out Computational Experiments on the Basis of Z-numbers

Computational experiments based on Z-numbers: $G = \{g_1, g_2, g_3, g_4\}$ computational experiments on selecting the best for the issue of four varieties of cotton, and $H = \{h_1, h_2, \ldots, h_4\}$ on the characteristics.

$$A_{h_1} = {}^{0.2}/_{0} + {}^{0.4}/_{1} + {}^{1}/_{2} + {}^{0.4}/_{3} + {}^{0.2}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{h_1} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{h_2} = {}^{0}/_{1} + {}^{0.3}/_{1} + {}^{0.4}/_{2} + {}^{0.7}/_{3} + {}^{1}/_{4} + {}^{0.8}/_{5} + {}^{0.6}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{h_2} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{h_3} = {}^{0}/_{0} + {}^{0}/_{1} + {}^{0.5}/_{2} + {}^{0.6}/_{3} + {}^{0.7}/_{4} + {}^{1}/_{5} + {}^{0.7}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{h_3} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{h_4} = {}^{0}/_{0} + {}^{0}/_{1} + {}^{0}/_{2} + {}^{0.5}/_{3} + {}^{0.6}/_{4} + {}^{0.7}/_{5} + {}^{0.8}/_{6} + {}^{1}/_{7} + {}^{0.8}/_{8} + {}^{0}/_{9},$$

$$B_{h_4} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{g_1} = {}^{0}/_{0} + {}^{0.6}/_{1} + {}^{0.8}/_{2} + {}^{1}/_{3} + {}^{0.7}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{g_1} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{g_2} = {}^{0}/_{0} + {}^{0}/_{1} + {}^{0.4}/_{2} + {}^{0.6}/_{3} + {}^{1}/_{4} + {}^{0.8}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{g_2} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{g_3} = {}^{0}/_{0} + {}^{0}/_{1} + {}^{0}/_{2} + {}^{0.4}/_{3} + {}^{0.6}/_{4} + {}^{1}/_{5} + {}^{0.8}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{g_3} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{g_4} = {}^{0.2}/_{0} + {}^{0.4}/_{1} + {}^{1}/_{2} + {}^{0.4}/_{3} + {}^{0.2}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$B_{g_4} = {}^{0}/_{0} + {}^{0}/_{0.1} + {}^{0}/_{0.2} + {}^{0}/_{0.3} + {}^{0}/_{0.4} + {}^{0.1}/_{0.5} + {}^{0.3}/_{0.6} + {}^{1}/_{0.7} + {}^{0.7}/_{0.8} + {}^{0.6}/_{0.9};$$

$$A_{h_1} = {}^{0.2}/_{0} + {}^{0.4}/_{1} + {}^{1}/_{2} + {}^{0.4}/_{3} + {}^{0.2}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$A_{g_1} = {}^{0}/_{0} + {}^{0.6}/_{1} + {}^{0.8}/_{2} + {}^{1}/_{3} + {}^{0.7}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

The approximate value of the cotton grade is determined by the T-norm method described in formula $p = \int_R \mu_A(u)p_x(u)du$. Consider calculating the approximate price for each grade. The minimum of the function $T(Z_H, Z_G) = \min(Z_H, Z_G)$ is used as the T-norm.

The minimum and maximum number of illuminated discrete numbers is determined by the formula $p = \int_R \mu_A(u)p_x(u)du$.

$$A_{h_1 g_1} = {}^{0.2}/_{0} + {}^{0.6}/_{1} + {}^{1}/_{2} + {}^{0.4}/_{3} + {}^{0.2}/_{4} + {}^{0}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9}.$$

For each of these varieties, computations were performed, as shown below, for the second grade.

$$p_{h_2} = {}^{0}/_{0} + {}^{0.77}/_{1} + {}^{0}/_{2} + {}^{0}/_{3} + {}^{0}/_{4} + {}^{0.23}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9},$$

$$p_{g_2} = {}^{0}/_{0} + {}^{0.62}/_{1} + {}^{0}/_{2} + {}^{0}/_{3} + {}^{0}/_{4} + {}^{0.3}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0.14}/_{9},$$

$$p_{hg_2} = {}^{0}/_{0} + {}^{0.897}/_{1} + {}^{0}/_{2} + {}^{0}/_{3} + {}^{0}/_{4} + {}^{0.101}/_{5} + {}^{0}/_{6} + {}^{0}/_{7} + {}^{0}/_{8} + {}^{0}/_{9}.$$

$$\sum_{k=0}^{9} \mu_{A_{h_2}}(x_{h_2,k}) \cdot p_{A_{h_2}}(x_{h_3,k}) = 0 \cdot 0 + 0.3 \cdot 0.77 + 0.4 \cdot 0 + 0.7 \cdot 0$$
$$+ 1 \cdot 0 + 0.8 \cdot 0.23 + 0.6 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 = 0.231 \cdot 0.184 = 0.415,$$

$$\sum_{k=0}^{9} \mu_{A_{g_2}}(x_{g_2,k}) \cdot p_{A_{g_2}}(x_{g_2,k}) = 0 \cdot 0 + 0 \cdot 0.56 + 0.4 \cdot 0 + 0.6 \cdot 0 + 1 \cdot 0$$
$$+ 0.8 \cdot 0.3 + 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0.14 = 0.24.$$

Thereby,

$$b_{A_{h_2 g_2}} = P(A_{h_2 g_2}) = \sum_{k=0}^{9} \mu_{A_{h_2 g_2}}(y_{y_i}) \cdot p_{A_{h_2 g_2}}(y_i) = 0 \cdot 0 + 0.3 \cdot 0.897 + 0.4 \cdot 0 + 0.7 \cdot 0 + 1 \cdot 0$$
$$+ 0.8 \cdot 0.101 + 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 = 0.24 \cdot 0.080 = 0.320,$$

Calculation results for the third grade:

$$b_{A_{h_3 g_3}} = P(A_{h_3 g_3}) = \sum_{k=0}^{9} \mu_{A_{h_3 g_3}}(y_{y_i}) \cdot p_{A_{h_3 g_3}}(y_i) = 0 \cdot 0 + 0 \cdot 0.85 + 0.5 \cdot 0 + 0.6 \cdot 0 + 0.7 \cdot 0 + 0.8 \cdot 0$$
$$+ 0.7 \cdot 0.06 + 0 \cdot 0 + 0 \cdot 0 = 0.042,$$

Thereby,

$$b_{A_{h_3 g_3}} = P(A_{h_3 g_3}) = \sum_{k=0}^{9} \mu_{A_{h_3 g_3}}(y_{y_i}) \cdot p_{A_{h_3 g_3}}(y_i) = 0 \cdot 0 + 0 \cdot 0.85 + 0.5 \cdot 0 + 0.6 \cdot 0 + 0.7 \cdot 0 + 0.8 \cdot 0.2$$
$$+ 0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 = 0.16.$$
$$b_{A_{h_3 g_3}} = P(A_{h_3 g_3}) = \sum_{k=0}^{9} \mu_{A_{h_3 g_3}}(y_{y_i}) \cdot p_{A_{h_3 g_3}}(y_i) = 0 \cdot 0 + 0 \cdot 0.77 + 0.2 \cdot 0 + 0.6 \cdot 0 + 0.7 \cdot 0 + 0.8 \cdot 0$$
$$+ 0.7 \cdot 0.115 + 0 \cdot 0 + 0 \cdot 0 = 0.08,$$

The result is the T-dimension $Z_{T-conorm}(Z_{12}, Z_{HG_3}) = S(Z_{12}, Z_{HG_3}) = (A, B)$ to obtain the final grade:

$$A = {}^{0}/_{0} + {}^{0}/_{1} + {}^{0.5}/_{2} + {}^{0.6}/_{3} + {}^{0.7}/_{4} + {}^{1}/_{5} + {}^{0.7}/_{6} + {}^{0}/_{0} + {}^{0}/_{0} + {}^{0}/_{0},$$

$$B = {}^{0}/_{0.61} + {}^{0}/_{0.64} + {}^{0}/_{0.67} + {}^{0}/_{0.70} + {}^{0}/_{0.73} + {}^{0.01}/_{0.76} + {}^{0.14}/_{0.78}$$
$$+ {}^{0.61}/_{0.82} + {}^{1}/_{0.85} + {}^{0.6}/_{0.91}.$$

$Z_{agg} = (A, B)$ end result recommends planting 108-F cotton with a probability of 0.85.

5 Conclusion

Comparative results of computational experiments based on illuminating integral, Z-numbering and logical model based on Z-numbers are presented. The experiment was conducted to determine the best selection of cotton $X = \{x_1, x_2, x_3, x_4\}$ from four selective varieties S-4727, Tashkent 1, 159-F, 108-F with the following characteristics: yield, fiber length, fiber strength, cottonseed fat.

The results obtained from the uneven integral results show that 108-F is the best of the proposed selection varieties of cotton, with the highest value of this variety being the ill-fated set (0.24).

For the computational experiment on the basis of the Z-number association, the T-norm and T-normal methods were applied on discrete Z-numbers.

$Z_{agg} = (A, B)$ end result recommends planting 108-F cotton with a probability of 0.85.

Using the above models, it is possible to predict not only actual productivity but also potential productivity in the field.

The development of an algorithm to use discrete Z-numbers arithmetic in illuminating conclusion systems for the full implementation of Z-information can be considered as a guide for future work in the conclusion mechanism that results in the least loss of Z-information.

References

1. Sugeno, M.: Fuzzy Measures and Fuzzy Integrals: A Survey. Fuzzy Automata and Decision Processes. pp.89–102, North-Holland Publishing Company (1997)
2. Primova, H.A., Sotvoldiyev, D.M., Raximov, R.T., Bobabekova, X.: Computing fuzzy integral of the basis of fuzzy mesure. J. Phys. Conf. Ser. **1441**(1), 012161, 1–7 (2020). https://doi.org/10.1088/1742-6596/1441/1/012161
3. Zadeh, L.A.: A note on a Z-number. Inf. Sci. (USA) **181**, 2923–2932 (2011)
4. Primova, H.A., Niyozmatova, N.A.: Methodology of using Z-numbers in systems of fuzzy inference. Am. J. Math. Comput. Sci. **2**, 67–73 (2016)
5. Zadeh, L.A.: Inf. Control. 338–353 (1965)
6. Aliev, R.A., Jabbarova, K.I., Huseynov, O.H.: Eighth WORLD Conference on Intelligent Systems for Industrial Automation, Tashkent, pp.159–167 (2014)
7. Primova, H., Sotvoldiev, D., Safarova, L.: 12th International Scientific and Technical Conference “Dynamics of Systems, Mechanisms and Machines”, Dynamics (2018)
8. Takagi, T., Sugeno, M.: IEEE Trans. Syst. Man Cybern. **15**(1), 116–132 (1985)
9. Mukhamedieva, D.T, Primova, Kh.A.: Approach to problem solving multicriterial optimization with fuzzy aim. Int. J. Math. Comput. Appl. Res. (IJMCAR). **4,** 55–68 (2014)

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Chapter 6

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AQ1	Kindly note that the "Eq. (3)" is provided but the corresponding equation is missing. Please check and amend if necessary.	

MARKED PROOF

Please correct and return this set

Please use the proof correction marks shown below for all alterations and corrections. If you wish to return your proof by fax you should ensure that all amendments are written clearly in dark ink and are made well within the page margins.

Instruction to printer	*Textual mark*	*Marginal mark*
Leave unchanged	• • • under matter to remain	Ⓥ
Insert in text the matter indicated in the margin	‸	New matter followed by ‸ or ‸ⓧ
Delete	/ through single character, rule or underline or ⊢—⊣ through all characters to be deleted	ꝺ or ꝺⓧ
Substitute character or substitute part of one or more word(s)	/ through letter or ⊢—⊣ through characters	new character / or new characters /
Change to italics	— under matter to be changed	⎵
Change to capitals	≡ under matter to be changed	≡
Change to small capitals	= under matter to be changed	=
Change to bold type	∼ under matter to be changed	∼
Change to bold italic	≂ under matter to be changed	≂
Change to lower case	Encircle matter to be changed	⧻
Change italic to upright type	(As above)	⊹
Change bold to non-bold type	(As above)	⊹∼
Insert 'superior' character	/ through character or ‸ where required	Y or ⅄ under character e.g. ²Y or ²⅄
Insert 'inferior' character	(As above)	‸ over character e.g. ‸₂
Insert full stop	(As above)	⊙
Insert comma	(As above)	,
Insert single quotation marks	(As above)	‘Y or ‘⅄ and/or ’Y or ’⅄
Insert double quotation marks	(As above)	“Y or “⅄ and/or ”Y or ”⅄
Insert hyphen	(As above)	⊢-⊣
Start new paragraph	⌐	⌐
No new paragraph	↩	↩
Transpose	⊔⊓	⊔⊓
Close up	linking ⁀ characters	⁀
Insert or substitute space between characters or words	/ through character or ‸ where required	Y
Reduce space between characters or words	| between characters or words affected	⊤