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Decision Making Problem under Generalized Fuzzy Soft Sets

V. Renuka

Research Scholar, Department of Mathematics, Vels Institute of Science, Technology and Advanced Studies, Chennai, Tamilnadu, India

S. Sandhiya*

Assistant Professor, Department of Mathematics, Vels Institute of Science, Technology and Advanced Studies, Chennai, Tamilnadu, India

***Abstract* -** The concept of a generalized fuzzy soft set was first proposed by Majumder and Samanta, and its use in solving selection problems has gained popularity in recent years. The generalized fuzzy soft set theory is an effective decision-making tool. In this paper, we try to apply the idea of a generalized fuzzy soft set to the student ranking process. Student's ranking provides easy to understand for students, parents, teachers and other concerned persons. It makes a well competition among the students. This study introduces a new technique for student ranking based on generalized fuzzy soft set theory.

Keywords - Generalized fuzzy soft set, Fuzzy set, Fuzzy soft set, Student's ranking, Soft set.

INTRODUCTION

To deal with uncertainty in real-life circumstances, many theories have been established. To deal with difficulties of ambiguity, Zadeh [11] proposed fuzzy sets. Molodtsov [9] drew attention to the shortcomings of fuzzy set theory and proposed soft set theory as a solution. Maji [9] combined soft and fuzzy sets to create fuzzy soft set theory. Generalized fuzzy soft set theory was introduced by Pinaki Majumdar [10].

Students ranking is a measure of how an individual student's performance compares to other students in his or her class. It is relatively normal to assign grades to students in order to assess how much they have learnt. Rank of the students is calculated by taking grade point averages. Students are assigned multiple letter grades based on how their continuous assessment scores are split up, and their total performance or class rank is derived using the grade point averages of these grades. However, neither strategy is completely correct. Majumdar developed a new ranking method which was based on generalized fuzzy soft set theory [10].

Several authors have studied educational measuring issues in recent years, particularly student assessments and rankings. However, statistical approaches are used in the majority of the new methods. A generic soft set based technique for determining student grades has been presented in this research. This technique has been tested on an actual data set, and a comparison with a traditional ranking system has been made. The following is how the rest of the paper is laid out: The second section contains some basic definitions. The method's algorithm is explained in section 3. Section 4 provides a numerical example, and section 5 brings the paper to a conclusion.

SOME BASIC DEFINITIONS

Generalized Fuzzy Soft Set [10]

Let U be a universal set, C be the set of parameters, F be a mapping C to I^u, where I^u is the collection of all fuzzy subsets of U and λ be a fuzzy subset of C, i.e. $\lambda: C \to I = [0,1]$. let $F_\lambda: C \to I^u \times I$ be a function, such that $F_\lambda(c) = \left(F(c),\ \lambda(c)\right), F(c) \in I^u$. Then F_λ is said to a generalized fuzzy soft set over (U, C).

Generalized Fuzzy Soft Matrix [10]

Let U be the universal set, C be the set of parameters and $A \subseteq C$. suppose that (F_λ, C) be a generalized fuzzy soft set over (U, C). A uniquely defined subset of $U \times C, R_A = \{(u, c), c \in C, u \in F_\lambda\ (c)\}$ is a relation form of (F_λ, C). The membership function μ_{R_A} and the function λ_{R_A} are written as $\mu_{R_A}: U \times C \to [0,1]$ and $\lambda_{R_A}: U \times C \to [0,1]$, where $R_A: (u, c) \epsilon\ [0,1]$, $\forall\ u \in U, c \in C$ and $\lambda_{R_A}: (u, c)\ \in\ [0,1]$,

If $\left[\mu_{ij}, \lambda_j\right]_{m\times n} = \left(\mu_{R_A}\left(u_{i,}c_j\right), \lambda\left(u_{i,}c_j\right)\right)$ then we can define a matrix as

$$[\mu_{ij},\lambda_j]_{m\times n} = \begin{bmatrix} (\mu_{11},\lambda_1) & (\mu_{12},\lambda_2) & \dots & (\mu_{1n},\lambda_n) \\ (\mu_{21},\lambda_1) & (\mu_{22},\lambda_2) & \dots & (\mu_{2n},\lambda_{1n}) \\ \vdots & \vdots & \vdots & \vdots \\ (\mu_{m1},\lambda_1) & (\mu_{m2},\lambda_2) & \dots & (\mu_{mn},\lambda_{1n}) \end{bmatrix}$$

Which is an $m \times n$ generalized fuzzy soft matrix of GFSS over (U, E).

Generalized Resultant Matrix

Generalized resultant matrix is represented by r_{ij} and is defined as

$$[r_{ij}]_{m\times n} = [a_{ij},\lambda_j]_{m\times n} \;\forall\, i,j.$$

Generalized Choice Value Matrix

Generalized choice value matrix is denoted by C_j and is defined as

$$[C_i] = \sum_{i=1}^{m}\sum_{j=1}^{n} r_{ij} \;,\forall\, i,j$$

ALGORITHM

Step 1: Input the marks obtained by the students.

Step 2: Input the fuzzy sets A, A, S, A and T.

Step 3: Convert marks into grades.

Step 4: Calculate generalized resultant matrix.

Step 5: Compute choice value matrix.

Step 6: Find the ranks.

NUMERICAL EXAMPLE

Consider the following scenario: A class of ten pupils $S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}$ faces the following challenge. They are evaluated based on five criteria: faculty assessment, attendance, seminar, aptitude, and test performance. Each criterion is worth a total of 20 points. The following are their individual scores and overall marks:

TABLE 1

MARKS OBTAINED BY STUDENTS

Criteria / Students	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
Assessment by Faculty	12	09	12	17	10	19	14	07	11	18
Attendance	19	08	06	11	17	18	15	09	13	12
Seminar	15	10	08	12	13	19	12	09	16	19
Aptitude	07	12	13	17	11	18	16	10	18	19
Test Performance	13	16	09	07	19	17	10	06	19	14
Total Marks	66	55	48	64	70	91	67	41	77	82

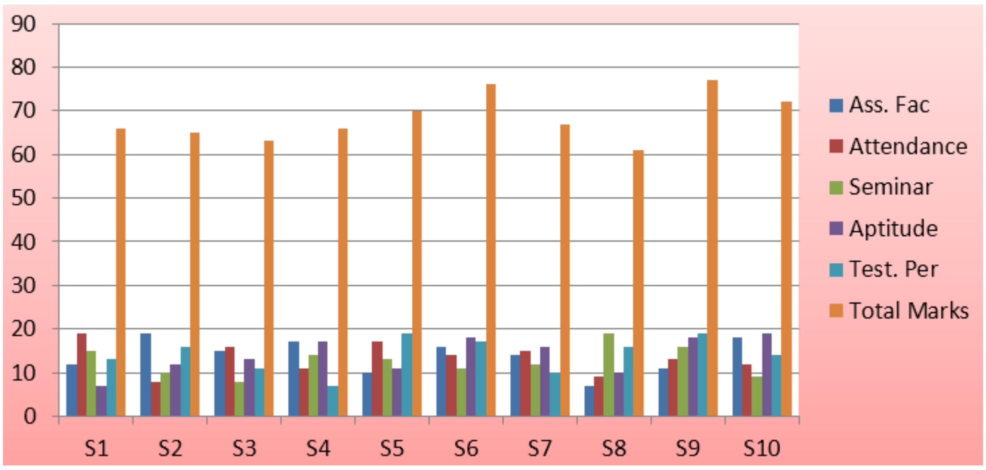

FIGURE 1 : MARKS OBTAINED BY THE STUDENTS

Let $U = \{A, A, S, A, T\}$ be our universal set and $S = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8, S_9, S_{10}\}$ be the set of students, where A, A, S, A and T denotes Assessment by Faculty, Attendance, Seminar, Aptitude and Test Performance respectively.

Let $\lambda: S \to I = [0,1]$ be a fuzzy subset of S, defined as

S_1 S_2 S_3 S_4 S_5 S_6 S_7 S_8 S_9 S_{10}

$\lambda = [0.9 \quad 0.1 \quad 0.8 \quad 0.2 \quad 0.7 \quad 0.3 \quad 0.6 \quad 0.4 \quad 0.5 \quad 0.3]$

Here λ determines the grade difficulties associated to each student due to different criteria. To convert the marks obtained in different criteria into grades, we define five fuzzy sets

$$A: [0, 20] \to [0, 1]$$
$$A: [0, 20] \to [0, 1]$$
$$S: [0, 20] \to [0, 1]$$
$$A: [0, 20] \to [0, 1]$$
$$T: [0, 20] \to [0, 1]$$

as follows:

$$\mathrm{A}(x) = {}^{x}/_{20}, \ 0 \le x \le 20$$
$$\mathrm{A}(x) = \left({}^{x}/_{20}\right)^2, 0 \le x \le 20$$
$$\mathrm{S}(x) = \left({}^{x}/_{20}\right)^3, 0 \le x \le 20$$
$$\mathrm{A}(x) = \left({}^{x}/_{20}\right)^4, 0 \le x \le 20$$
$$\mathrm{T}(x) = \left({}^{x}/_{20}\right)^5, 0 \le x \le 20$$

The marks obtained by the students are converted into grades which are given below.

TABLE 2

GRADES OF THE STUDENTS

Criteria / Students	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
Assessment by Faculty	0.6	0.95	0.75	0.85	0.5	0.8	0.7	0.35	0.55	0.9
Attendance	0.9	0.16	0.64	0.3	0.72	0.49	0.56	0.2	0.42	0.36
Seminar	0.42	0.12	0.06	0.34	0.27	0.16	0.21	0.85	0.51	0.09
Aptitude	0.01	0.12	0.17	0.52	0.09	0.65	0.41	0.06	0.65	0.81
Test Performance	0.11	0.32	0.05	0.005	0.77	0.44	0.03	0.32	0.77	0.16
$\boldsymbol{\lambda}$	0.9	0.1	0.8	0.2	0.7	0.3	0.6	0.4	0.5	0.3

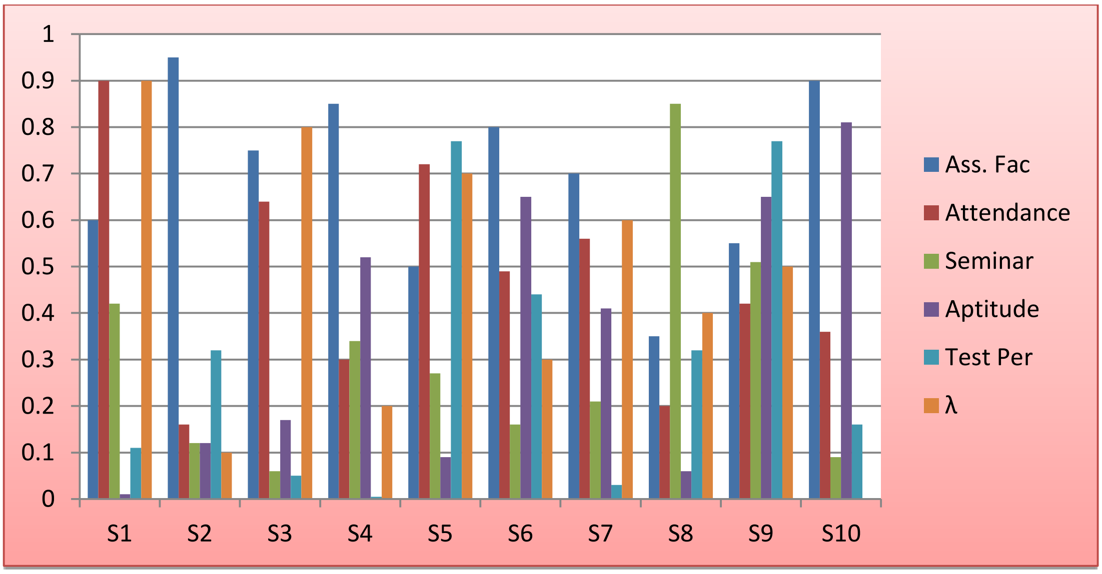

FIGURE 2 : STUDENT'S GRADE

The matrix form of the result is as follows:

$$[a_{ij},\lambda_j] = \begin{bmatrix} (0.6,0.9) & (0.95,0.1) & (0.75,0.8) & (0.85,0.2) & (0.5,0.7) & (0.8,0.3) & (0.7,0.6) & (0.35,0.4) & (0.55,0.5) & (0.9,0.3) \\ (0.9,0.9) & (0.16,0.1) & (0.64,0.8) & (0.3,0.2) & (0.72,0.7) & (0.49,0.3) & (0.56,0.6) & (0.2,0.4) & (0.42,0.5) & (0.36,0.3) \\ (0.42,0.9) & (0.12,0.1) & (0.06,0.8) & (0.34,0.2) & (0.27,0.7) & (0.16,0.3) & (0.21,0.6) & (0.85,0.4) & (0.51,0.5) & (0.09,0.3) \\ (0.01,0.9) & (0.12,0.1) & (0.17,0.8) & (0.52,0.2) & (0.09,0.7) & (0.65,0.3) & (0.41,0.6) & (0.06,0.4) & (0.65,0.5) & (0.81,0.3) \\ (0.11,0.9) & (0.32,0.1) & (0.05,0.8) & (0.005,0.2) & (0.77,0.7) & (0.44,0.3) & (0.03,0.6) & (0.32,0.4) & (0.77,0.5) & (0.16,0.3) \end{bmatrix}$$

The generalized resultant matrix and generalized choice value matrix are as follows:

$$[r_{ij}] = \begin{bmatrix} 0.54 & 0.81 & 0.38 & 0.009 & 0.099 \\ 0.095 & 0.016 & 0.012 & 0.012 & 0.032 \\ 0.6 & 0.512 & 0.048 & 0.136 & 0.04 \\ 0.17 & 0.06 & 0.068 & 0.104 & 0.001 \\ 0.35 & 0.504 & 0.189 & 0.063 & 0.539 \\ 0.24 & 0.147 & 0.048 & 0.195 & 0.132 \\ 0.42 & 0.336 & 0.126 & 0.246 & 0.018 \\ 0.14 & 0.08 & 0.34 & 0.024 & 0.128 \\ 0.275 & 0.21 & 0.255 & 0.325 & 0.385 \\ 0.27 & 0.108 & 0.027 & 0.243 & 0.048 \end{bmatrix}$$

And

$$C_i = \begin{bmatrix} 1.838 \\ 0.167 \\ 1.336 \\ 0.403 \\ 1.645 \\ 0.762 \\ 1.146 \\ 0.712 \\ 1.450 \\ 0.696 \end{bmatrix}$$

The maximum value is 1.838, so the student S_1 has got the first rank, S_5 has got second rank and the minimum value of the matrix is 0.167 and the student S_2 has got the last rank and the ranks of the students are listed in the below table:

S. NO	**STUDENTS**	**MARKS**	**RANK**
1	S_1	1.838	1
2	S_2	0.167	10
3	S_3	1.336	4
4	S_4	0.403	9
5	S_5	1.645	2
6	S_6	0.762	6
7	S_7	1.146	5
8	S_8	0.712	7
9	S_9	1.450	3
10	S_{10}	0.696	8

CONCLUSION

We present a novel student rating system based on generalized fuzzy soft set theory in this work. We looked at some real-world examples which are demonstrated, how this method may be used to generate class ranks. The proposed method aids in the more efficient and realistic assignment of student grades.

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