Decision Support System Using Fuzzy Logic Method of Tahani Model for Student Selection

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Abstract. Tahani model of fuzzy database is one of the methods used for the making decision process. On this occasion, the researcher used the fuzzy database tahani model to build a DSS for the selection of new candidate students at the SMP Taman Siswa Kisaran. SMP is junior high school. This system was built to recommend to principals about new candidate students who are eligible to be accepted. Some of the main variables that form the basis of calculation, namely the average elementary school diploma, including Mathematic score, Indonesian Language score, and Pancasila Education score. The Other variables are Academic Test score and Religious Education Test score. The result of the system recommendations is based on the value of membership and fire strength from the calculation process in the system. To ensure the feasibility of the system, testing the result of the system calculations and comparing them with the results of calculations manually. If the result of the system calculation is the same as the result of the manual calculation, then the decision support system for the selection of new candidate students is feasible to be applied at the SMP Taman Siswa Kisaran

1. Introduction

SMP Taman Siswa Kisaran is one of junior high school which is one of the first level secondary schools in the Kisaran city. SMP Taman Siswa Kisaran is well known for its strong discipline and complete supporting facilities for the teaching and learning process, making this school one of the most desirable private school for prospective students.

Like the other schools, SMP Swasta Taman Siswa Kisaran accepts new prospective students every year. By the school, there are several criteria that form the basis of the assessment to determine the acceptance of new prospective students, namely the average value of a basic school which includes Mathematics, Indonesian Language, and Pancasila Education scores. Then other criteria are Academic Test score and Religious Education Test score.

The problem that often arises in the process of accepting new prospective students is that it is quite complicated and difficult to ascertain how high the value of each prospective new student is for
the final result of the assessment of some predetermined criteria so that decisions obtained sometimes result from inaccurate data processing. The problem arises because each criterion has a range of values grouped in sets or categories. For example, mathematical scores have 3 sets, namely low, medium, and high. The score of 0-55 is included in the low set, > 55-75 belong to the middle set, and > 75-100 belong to the high set. Then the system used to process prospective new student selection data is not able to accommodate the data process.

Based on the background of the problem the researcher tries to apply the fuzzy logic of the tahani model to the DSS for the selection of new student admissions. This study aims to implement the fuzzy logic of tahani model for the selection of new students into the system, then the system provides ranking information from the selection result of new students. The output achieved from the research results is a system that can help schools decide whether new prospective students are accepted or not.

Dewi and Purnomo explained that fuzzy logic is soft computing which is formed by one of the fuzzy logic components itself. The basis of fuzzy logic is fuzzy set theory which is the degree of membership plays a role in determining the location of the elements in a set. Membership value is the main characteristic of fuzzy logic reasoning[1].

Fuzzy logic is only has two values, namely 1 and 0 which are generalizations of crisp set or classical logic[2]. In fuzzy logic, a statement with the value of truth ranges from completely correct to completely false. Fuzzy Logic is related to the uncertainty that has become human nature, simulating the process of normal human consideration by allowing the computer to behave a little more carefully and a clear and incoming rather than conventional computer method is required. The idea behind this is that decision making is not just about white and black or false right, but it often involves gray areas, and it is possible[2], [3].

Information systems are daily transactions within an organization that can support managerial operations well. The transaction includes strategic activities that can provide reports for certain (external) parties.[4], [5].

Michael S. Scott Morton, defines a decision support system as a collection of model-based procedure for processing data and decision to assist manager in making decision[3].

Alter said that a decision support system is a system that is part of an interactive information system that provides services about information, system modeling and data manipulation using a system where the system is needed for decision making in both semi-structured and unstructured conditions.[6].

Admission of new students is the initial gate that must be passed by students and schools in the screening of educational objects. The event is important for a school, because this event is a starting point that determines the smooth running of a school's work. Errors in admission of new students can determine the success or failure of the education business in the school concerned[7].

2. Methodology

The database used in the tahani fuzzy model is still a standard database. Data is classified according to user desires. The correlation is still standard, but in this model, fuzzy set theory is used to obtain information from the query[9].

The fuzzy stages of the tahani model, which first describe membership functions for each criterion or fuzzy variable, are curves that show the mapping of data input points into membership values (degrees of membership) that have intervals between 0 to 1[2]. One method that can be used is the function approach. The membership function approach is triangular in shape. The second
fuzzification is the conversion of member values into fuzzy values. Where the calculation of the value of the degree of membership in each fuzzy set is a formulation of each fuzzy variable. Fuzzification step is a system management database query that is created and implemented for the basis of queries on fuzzy logic systems. This means forming queries with standard relations.\[3\]

Operators used for basic relations in the formation of queries on fuzzy set, i.e. intersections, these operators relate to intersection operations on sets. α-predicate as a result of operations with the AND operator is obtained by taking the smallest membership value between elements in the set concerned with the following equation:

\[ \mu_{A \cap B} = \min(\mu_{A(x)}, \mu_{B(y)}) \]  \hspace{1cm} (1)

Union operator, the predicate of α as a result of operations with the OR operator is obtained from the largest value of the membership value of all elements in the set related to this equation:

\[ \mu_{A \cup B} = \max(\mu_{A(x)}, \mu_{B(y)}) \]  \hspace{1cm} (2)

Complementary operators. The predicate α results of the operation with the NOT operator is obtained by subtracting the membership value of the elements in the set from 1, as follows:

\[ \mu A^c = 1 - \mu_{A(x)} \]  \hspace{1cm} (3)

After obtaining the result of the relation operation from the formation of the query, then the data resulting from the recommendation of either the AND or OR operation is the recommendation value > 0.

3. Result and Discussion

The following are the criteria (variables) that are used as a basis for selecting prospective new students by using the fuzzy tahani model, namely:

| Table 1. Assessment Criteria |
|-----------------------------|
| **Variable Name** | **Talk Universe** | **Fuzzy Set** |
| Mathematics Score | [0,100] | Low, Middle, High |
| Indonesian Language Score | [0,100] | Low, Middle, High |
| Pancasila Education Score | [0,100] | Low, Middle, High |
| Academic Test Score | [0,100] | Low, Middle, High |
| Religious Education Test Score | [0,100] | Low, Middle, High |

From the criteria table a membership function can be made of each of the existing variables, namely the mathematic score, the membership function for the mathematical score variable consists of 3 fuzzy sets, namely Low, Medium, and High.
The expression for the fuzzy membership function for the mathematic score variable is:

\[
\mu_{\text{Low}}[a] = \begin{cases} 
1; & a \leq 55 \\
\frac{65-a}{10}; & 55 \leq a \leq 65 \\
0; & a \geq 65 
\end{cases}
\]

\[
\mu_{\text{Middle}}[a] = \begin{cases} 
0; & a \leq 55 \text{ or } a \geq 85 \\
\frac{a-55}{10}; & 55 \leq a \leq 65 \\
\frac{85-a}{20}; & 65 \leq a \leq 85 
\end{cases}
\]

\[
\mu_{\text{High}}[a] = \begin{cases} 
0; & a \leq 65 \\
\frac{a-65}{20}; & 65 \leq a \leq 85 \\
1; & a \geq 85 
\end{cases}
\]

Table 2 shows a table of prospective new students based on their mathematic score with the degree of membership in each set.

| No | Prospective Students Name | Mathematic Score | Membership Degrees $[\alpha]$ |
|----|--------------------------|------------------|-------------------------------|
|    |                          |                  | Low  | Middle | High |
| 1  | Suci Amelia              | 85,00            | 0    | 0      | 1    |
| 2  | Randy Pranata           | 80,20            | 0    | 0,24   | 0,76 |
| 3  | Nurmala                  | 75,90            | 0    | 0,455  | 0,545|
| 4  | Rudianto                 | 50,45            | 1    | 0      | 0    |
| 5  | Yessi                    | 82,78            | 0    | 0,111  | 0,889|

The membership function for the Indonesian language score variable consists of 3 fuzzy sets, namely Low, Middle, and High.

\[
\mu_{\text{Low}}[b] = \begin{cases} 
1; & a \leq 55 \\
\frac{65-a}{10}; & 55 \leq a \leq 65 \\
0; & a \geq 65 
\end{cases}
\]

\[
\mu_{\text{Middle}}[b] = \begin{cases} 
0; & a \leq 65 \text{ or } a \geq 85 \\
\frac{a-55}{10}; & 55 \leq a \leq 65 \\
\frac{85-a}{20}; & 65 \leq a \leq 85 
\end{cases}
\]

\[
\mu_{\text{High}}[b] = \begin{cases} 
0; & a \leq 65 \\
\frac{a-65}{20}; & 65 \leq a \leq 85 \\
1; & a \geq 85 
\end{cases}
\]

Table 2. Prospective Students Are Based on Mathematic Score

**Figure 1.** Graph of Membership Function in Mathematic Score

**Figure 2.** Graph of Membership Function in Indonesian Language Score

The expression for the fuzzy membership function for the Indonesian language score variable is:
Table 3 shows a table of prospective new students based on their Indonesian language score with the degree of membership in each set.

### Table 3. Prospective Students Are Based on Indonesian Language Score

| No | Prospective Students Name | Indonesian Language Score | Membership Degrees [α] |
|----|---------------------------|---------------------------|------------------------|
|    |                           | Low | Middle | High |
| 1  | Suci Amelia               | 79,30 | 0     | 0,285 | 0,715 |
| 2  | Randy Pranata            | 85,50 | 0     | 0     | 1     |
| 3  | Nurmala                   | 60,67 | 0,433 | 0,567 | 0     |
| 4  | Rudianto                  | 85,00 | 0     | 0     | 1     |
| 5  | Yessi                     | 70,02 | 0     | 0,749 | 0,251 |

From the result of the above calculations determined the mathematic score variable with a high fuzzy set priority, Indonesian language score with a high fuzzy set priority, Pancasila educational score with a high fuzzy set priority, academic test score with a high fuzzy set priority, and religious education test score with fuzzy set priorities. The height is executed using the Structure Query Language (SQL). SQL that is formed is as follows:

```
Select pros_student_name, s_mtk, s_il, s_pe, s_at, s_ret, (s_mtk + s_il + s_pe + s_at + s_ret)/5 as rekomendasi From tbl_pros_student_name Where s_mtk="High" and s_il="High" and s_pe="High" and s_at="High" and s_ret="High".
```

### Table 4. Query Results

| No | Prospective Students Name | Mathematic Score | Indonesian Language Score | Pancasila Education Score | Academic Tes Score | Religious Education Tes | Recom mendation |
|----|---------------------------|------------------|---------------------------|---------------------------|-------------------|------------------------|-----------------|
| 1  | Suci Amelia               | 1                | 0,715                     | 0,578                     | 0,5               | 0,3                    | 0,61            |
| 2  | Randy Pranata            | 0,76             | 1                         | 0                         | 0,5               | 0,5                    | 0,452           |
| 3  | Nurmala                   | 0,545            | 0                         | 1                         | 1                 | 0,1                    | 0,529           |
| 4  | Rudianto                  | 0                | 0,9                       | 0                         | 1                 | 0,58                   | 0,58            |
| 5  | Yessi                     | 0,889            | 0,251                     | 0                         | 0                 | 1                      | 0,428           |

### Conclusion

From the result of the research conducted it can be concluded that the fuzzy logic of the Tahani model can be applied to the selection of prospective new students by using the value of the assessment criteria as fuzzy input data. With fuzzy logic Tahani the selection process of prospective new students...
can produce accurate information that can be used by school management as an auxiliary tool to make admissions decisions

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