

# Decision Making Technique Project “Scholarship Acceptance Using Simple Additive Weighting Method”

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## ABSTRACT

Scholarships are important financial aid programs for students from various sources, such as governments and universities, to support their education. Santo Thomas Catholic University offers various types of scholarships, but the selection process is often not on target and faces problems such as document falsification. To improve fairness and efficiency in the selection process, this study proposes the use of the Simple Additive Weighting (SAW) method, which can provide objective assessments based on the weight of the established criteria. The SAW method is known to be effective in managing data and producing transparent decisions. The results of the study show that the application of this method is able to produce a ranking of prospective scholarship recipients that can be used as a reference by the Scholarship Selection Team, thereby increasing the validity of the overall selection process.

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## INTRODUCTION

Scholarships are financial aid programs for students that come from governments, universities, organizations, or individuals. Scholarships are awarded based on certain criteria, such as academic or non-academic achievement, to support the education of qualified students. Scholarships can have a significant impact on recipients. In addition to helping financially, scholarships can also open up greater opportunities for students to develop themselves, gain new experiences, and build valuable professional networks. Therefore, scholarships are one of the effective ways to support students' educational and career development. Santo Thomas Catholic University offers several forms of scholarships, including the Regular KIP-K Scholarship for underprivileged and outstanding students, the Aspiration KIP-K Scholarship, Regional Scholarships, and Diocesan Scholarships. These scholarship programs aim to help students continue their education with adequate financial support.

However, the scholarship selection process at Saint Thomas Catholic University often faces problems, such as scholarship recipients who are not on target and the selection process is considered unfair. Many students who are financially able to receive scholarships, and there are cases of document falsification that make it difficult to determine worthy scholarship recipients. To overcome this problem, an efficient method is needed to determine scholarship recipients. Saint Thomas Catholic University needs to establish clear and measurable admission criteria, and improve the document verification system. This will help ensure that scholarships are awarded to students who are truly qualified.

The Simple Additive Weighting (SAW) method is one of the multi-criteria decision-making methods used to assess and select the best alternative based on several criteria. This method is known for its simplicity and ability to provide objective and transparent results. The Simple Additive Weighting (SAW) method is proposed as a solution to improve efficiency and fairness in the selection process. The Simple Additive Weighting (SAW) method works by assessing each candidate based on the weight of the predetermined criteria, so that it can provide objective and

transparent results. By implementing this method, it is hoped that Santo Thomas Catholic University can improve its scholarship acceptance system.

Veronika and Ginting, 2020 as quoted by Poningsih et al., 2020:63 "The SAW method is an abbreviation of Simple Additive Weighting which is used to determine a weighted value by finding the value of the weighted sum of all alternatives for all criteria and attributes. This method is able to analyze existing alternatives to produce a decision easily". The advantages of this previous research provide insight into the decision-making process using the Simple Additive Weighting (SAW) method, which is very important in various fields. This journal offers a detailed explanation of the SAW method, making it accessible to readers to understand and apply in research. This journal discusses the importance of technology and computer systems in improving the scholarship process, highlighting the relevance of modern tools in education and decision support systems. The weaknesses of Previous Research are the use of sharp and fuzzy numbers in calculations can pose challenges in data normalization and interpretation of results. Differences in the calculation of the normalization matrix based on attribute values (benefits and costs) can affect the accuracy and reliability of the decision-making process.

Asdin Wahyu Pamungkas, Didik Nugroho, Sri Siswanti "Determination of Criteria Weights In scholarship selection using the Fuzzy Multiple Attribute Decision Making (FMADM) model with the Simple Additive Weighting (SAW) method, criteria and weights are needed to carry out the calculations so that the best alternative can be obtained".

#### Advantages of the Simple Additive Weighting (SAW) Method

1. The calculation of the SAW method only has 4 stages, namely determining the criteria, determining the suitability of the rating, making a decision matrix and ranking obtained from the addition of the normalized multiplication of R.
2. Determining the weight value for each attribute is then continued with the ranking process which will select the best alternative from a number of alternatives.
3. The assessment will be more accurate because it is based on the predetermined preference weight criteria values.
4. There is a normalization calculation of the matrix according to its attribute values (including benefits and costs)

#### Disadvantages of the Simple Additive Weighting (SAW) Method

1. The calculation is done using crisp and fuzzy numbers.
2. There are differences in the calculation of the normalization matrix according to attribute values (between benefit and cost values)

## METHOD

A series of systematic and organized procedures or steps used to achieve a goal or solve a problem. This method is applied in various fields, including science, technology, education, and business, to ensure that the process or research is carried out consistently, objectively, and can be replicated.

### Method Simple Additive Weighting (SAW)

According to (Fisburn & MacCrimmon, 2017), "The Simple Additive Weighting Product (SAW) method is known as the weighted sum method. The basic concept of the SAW method is to find the weighted sum of the performance ratings on each alternative on all attributes". SAW (Simple Additive Weighting) Method The SAW method is a weighted summation method. The basic concept of the SAW method is to find the weighted summation of the performance ratings on each alternative on all criteria. The SAW method requires a normalization process of the decision matrix (X) to a scale that can be compared with all existing alternative ratings. The SAW method recognizes 2 (two) attributes, namely the benefit criteria and the cost criteria. The fundamental difference between these two criteria is in the selection of criteria when making decisions. The steps for solving in using it are:

1. Determine the alternative, namely  $A_i$ .
2. Determining the criteria that will be used as a reference in decision making, namely  $C_j$ .

3. Provides a rating value for the suitability of each alternative for each criterion.
4. Determine the preference weight or level of importance (W) of each criterion.  $W = [W_1, W_2, W_3, \dots, W_j]$
5. Create a table of suitability ratings for each alternative on each criterion.
6. Create a decision matrix (X) formed from the suitability rating table of each alternative on each criterion. The X value of each alternative (Ai) on each criterion (Cj) that has been determined, where,  $i=1,2,\dots,m$  and  $j=1,2,\dots,n$ .
7. Perform the decision matrix (X) normalization step by calculating the normalized performance rating value (rij) of the alternative (Ai) on the criteria (Cj) using the formula:

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max } x_{ij}} & \text{jika j atribut keuntungan (benefit)} \\ \frac{\text{Min } x_{ij}}{x_{ij}} & \text{jika j atribut biaya (cost)} \end{cases}$$

Information:

$r_{ij}$  = normalized performance rating value.

$x_{ij}$  = attribute values owned by each criterion.

Max  $x_{ij}$  = the largest value of each criterion i.

Min  $x_{ij}$  = the smallest value of each criterion i.

Benefits = if the largest value is the best.

cost = if the smallest value is the best.

Where  $r_{ij}$  is the normalized performance rating of alternative Ai on attribute Cj :  $i = 1, 2, \dots, m$  and  $j = 1, 2, \dots, n$ .

8. The result of normalization ( $r_{ij}$ ) forms a normalized matrix (R).

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1j} \\ \vdots & \vdots & \dots & \vdots \\ r_{i1} & r_{i2} & \dots & r_{ij} \end{bmatrix}$$

9. The final result of the preference value ( $V_i$ ) is obtained from the sum of the multiplication of the row elements of the normalized matrix (R) with the preference weights (W) that correspond to the column elements of the matrix (W).

$$V_i = \sum_{j=1}^n W_j r_{ij} \quad V_i = \sum_{j=1}^n W_j r_{ij}$$

Information :

$V_i$  = Ranking for each alternative  $W_j$  = weight value of each criterion

## RESULTS AND DISCUSSION

Contains a discussion of the results of the research, namely in the process of making a Decision Support System for determining scholarships using the Simple Additive Weighting method. Starting from determining the criteria for determining scholarships, there are five (5) criteria including: Academic Test, Achievement, GPA, Active Semester and Parental Income. More complete information can be seen in Table 2. In the discussion of this research, it can be described in several ways as follows: In the discussion of this research, it can be described in several points as follows.

### Test Results:

Steps to determine the calculation for Scholarship Acceptance using the Simple Additive Weighting (SAW) Method, namely:

1. Alternative

Determining Alternatives ( $A_i$ ) or data on the names of students who register as scholarship recipients.

**Table1.** Alternative

Alternative	Student Name
A1	Saveria
A2	Diana
A3	Rusdi
A4	Christian
A5	Samson
A6	Angie
A7	Rick
A8	Noble
A9	Reni
A10	Desi

2. Determination of Criteria

Determining the criteria which will be used as a reference in determining the eligibility of Scholarship recipients, namely  $C_j$  with 5 criteria, namely Academic Test, Achievement, GPA, Active Semester and Parental Income as in Table 2 below.

**Table2.** Determination of criteria

Criteria	Information
C1	Academic Test
C2	Performance
C3	GPA
C4	Active Semester
C5	Parent's Income

3. Giving Alternative Values for Each Criteria

Alternative values for each criterion for each student applying for the scholarship.

**Table3.** Alternative values for each criterion

Student Name	Academic test	Performance	GPA	Active Semester	Parent's Income
Saveria	92	5 Awards	3.9	6	2,000,000.00
Diana	85	1 Award	2.5	8	1,000,000.00
Rusdi	70	3 Awards	3.0	2	2,500,000.00
Christian	80	4 Awards	3.5	2	2,200,000.00
Samson	65	2 Awards	2.8	4	1,500,000.00
Angie	74	1 Award	3.8	6	1,800,000.00
Rick	78	2 Awards	2.0	8	3,000,000.00
Noble	80	4 Awards	4.0	8	2,800,000.00
Reni	68	5 Awards	3.8	6	1,100,000.00
Desi	62	3 Awards	2.4	4	3,500,000.00

4. Determining Attribute Values

Determine the Benefit and Cost Attributes of each criteria.

Benefit means the higher the value, the more it is prioritized, and Cost means the lower the value, the more it is prioritized.

**Table4.** Determining the value of benefit and cost attributes

Criteria	Information	Attribute
C1	Academic Test	Benefits
C2	Performance	Benefits
C3	GPA	Benefits
C4	Active Semester	Benefits
C5	Parent's Income	Cost

5. Determining Weight Value

Provide a weight value or level of importance ( $W$ ) for each criterion. The weight of the

criteria that will be used in determining the scholarship is as follows:

**Table 5.** Determination of weight

Criteria	Weight
Academic Test	20
Performance	20
GPA	25
Active Semester	15
Parent's Income	20

6. Determining the Weight of Each Criteria

a. Academic Test

With variables and values :

Very High = 1

Height = 0.75

Medium = 0.50

Low = 0.25

Very Low = 0

**Table 6.** Weighting of academic test criteria

Range	Variables	Mark
86-100	Very high	1
76-85	Tall	0.75
66-75	Currently	0.50
61-65	Low	0.25
<=60	Very Low	0

b. Performance

With variables and values :

Very High = 1

Height = 0.75

Medium = 0.50

Low = 0.25

Very Low = 0

**Table 7.** Criteria weight

Range	Variables	Mark
>5	Very high	1
4	Tall	0.75
3	Currently	0.50
1-2	Low	0.25
0	Very Low	0

c. GPA

With variables and values :

Very High = 1

Height = 0.75

Medium = 0.50

Low = 0.25

Very Low = 0

**Table 8.** B gp criteria robot

Range	Variables	Mark
3.8 - 4.0	Very high	1
3.5 - 3.79	Tall	0.75
3.0 - 3.49	Currently	0.50
2.0 - 2.95	Low	0.25
<=1	Very Low	0

d. Active Semester

With variables and values :

Very High = 1  
 Height = 0.75  
 Medium = 0.50  
 Low = 0.25  
 Very Low = 0

**Table 9.**Active semester criteria weight

Range	Variables	Mark
7/8	Very high	1
5/6	Tall	0.75
3/4	Currently	0.50
1/2	Low	0.25
Not active	Very Low	0

e. Parent's Income

With variables and values :

Very High = 1  
 Height = 0.75  
 Medium = 0.50  
 Low = 0.25  
 Very Low = 0

**Table 10.**Weighting of parental income criteria

Range	Variables	Mark
1,000,000-1,400,000	Very high	1
1,500,000-1,900,000	Tall	0.75
2,000,000-2,500,000	Currently	0.50
2,600,000-3,500,000	Low	0.25
<=4,000,000	Very Low	0

## 7. Suitability Rating of Each Alternative and Criteria

Convert the values into weighted values as in the table above for each criterion, as in table 6 below.

**Table 11.**Compatibility branch

Student Name	Academic Test	Performance	GPA	Active Semester	Parent's Income
Saveria	92 = 1	4 Awards = 0.75	3.5 = 0.75	5 = 0.75	2,000,000.00 = 0.50
Diana	85 = 1	5 Awards = 1	2.5 = 0.25	7 = 1	1,000,000.00 = 1
Rusdi	70 = 0.50	3 Awards = 0.50	3.0 = 0.50	1 = 0.25	2,500,000.00 = 0.50
Christian	80 = 0.75	2 Awards = 0.25	3.5 = 0.75	1 = 0.25	2,200,000.00 = 0.50
Samson	65 = 0.25	2 Awards = 0.25	2.8 = .25	3 = 0.50	1,500,000.00 = 0.75
Angie	74 = 0.50	5 Awards = 1	3.8 = 1	5 = 0.75	1,800,000.00 = 0.75
Rick	88 = 1	2 Awards = 0.25	2.0 = 0.25	7 = 1	3,000,000.00 = 0.25
Noble	80 = 0.75	4 Awards = 0.75	4.0 = 1	7 = 1	2,800,000.00 = 0.25
Reni	68 = 0.50	5 Awards = 1	3.8 = 1	5 = 0.75	1,100,000.00 = 1
Desi	61 = 0.25	3 Awards = 0.50	2.4 = 0.25	3 = 0.50	1,300,000.00 = 1

Create a decision matrix (X) formed from the suitability rating table of each alternative on each criterion. The X value of each alternative (Ai) on each criterion (Cj) that has been determined, where,  $i=1,2,\dots,m$  and  $j=1,2,\dots,n$ . From the suitability rating table, the Decision Matrix X is produced as explained below.

	1	0.75	0.75	0.75	0.50
	1	1	0.25	1	1
	0.50	0.50	0.50	0.25	0.50
	0.75	0.25	0.75	0.25	0.50
X =	0.25	0.25	0.25	0.50	0.75
	0.50	1	1	0.75	0.75
	1	0.25	0.25	1	0.25
	0.75	0.75	1	1	0.25
	0.50	1	1	0.75	1
	0.25	0.50	0.25	0.50	1

8. Normalizing Matrix X to Matrix R

Normalization is the core of the SAW method implementation, so the formula used in the SAW method normalization is as follows.

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max}_i x_{ij}} & \text{jika j atribut keuntungan (benefit)} \\ \frac{\text{Min}_i x_{ij}}{x_{ij}} & \text{jika j atribut biaya (cost)} \end{cases}$$

This calculation is done separately.

**Academic Test**

The Academic Test Criteria are included in the benefit criteria, meaning that the higher the score, the more priority it will be.

$$R11 = \frac{1}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{1}{1} = 1$$

$$R21 = \frac{1}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{1}{1} = 1$$

$$R31 = \frac{0,50}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,50}{1} = 0,5$$

$$R41 = \frac{0,75}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,75}{1} = 0,75$$

$$R51 = \frac{0,25}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,25}{1} = 0,25$$

$$R61 = \frac{1}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,50}{1} = 0,5$$

$$R71 = \frac{1}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{1}{1} = 1$$

$$R81 = \frac{0,50}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,75}{1} = 0,75$$

$$R91 = \frac{0,75}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,50}{1} = 0,5$$

$$R101 = \frac{0,25}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,25}{1} = 0,25$$

**Performance**

Achievement criteria are included in the benefit criteria, meaning the higher the value, the more priority it will be.

$$R12 = \frac{0,75}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,75}{1} = 0,75$$

$$R22 = \frac{1}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{1}{1} = 1$$

$$R32 = \frac{0,50}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,50}{1} = 0,5$$

$$R42 = \frac{0,25}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,25}{1} = 0,25$$

$$R52 = \frac{0,25}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,25}{1} = 0,25$$

$$R62 = \frac{1}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{1}{1} = 1$$

$$R72 = \frac{0,25}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,25}{1} = 0,25$$

$$R82 = \frac{0,70}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,75}{1} = 0,75$$

$$R92 = \frac{1}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{1}{1} = 1$$

$$R102 = \frac{0,50}{\text{Max}\{0,75;1;0,50;0,25;0,25;1;0,25;0,75;1;50\}} = \frac{0,50}{1} = 0,5$$

**GPA**

The GPA criteria are included in the benefit criteria, meaning that the higher the score,

the more priority it will be.

$$R13 = \frac{0,75}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,75}{1} = 0,75$$

$$R23 = \frac{0,25}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,25}{1} = 0,25$$

$$R33 = \frac{0,50}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,50}{1} = 0,5$$

$$R43 = \frac{0,75}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,75}{1} = 0,75$$

$$R53 = \frac{0,25}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,25}{1} = 0,25$$

$$R63 = \frac{1}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{1}{1} = 1$$

$$R73 = \frac{0,25}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,25}{1} = 0,25$$

$$R83 = \frac{1}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{1}{1} = 1$$

$$R93 = \frac{1}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{1}{1} = 1$$

$$R103 = \frac{0,25}{\text{Max}\{0,75;0,25;0,50;0,75;0,25;1;0,25;1;1;0,25\}} = \frac{0,25}{1} = 0,25$$

### Active Semester

The Active Semester criteria are included in the benefit criteria, meaning that the higher the value, the more priority it will be.

$$R14 = \frac{0,75}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,75}{1} = 0,75$$

$$R24 = \frac{1}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{1}{1} = 1$$

$$R34 = \frac{0,25}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,25}{1} = 0,25$$

$$R44 = \frac{0,25}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,25}{1} = 0,25$$

$$R54 = \frac{0,50}{\text{Max}\{1;1;0,50;0,75;0,25;0,50;1;0,75;0,50;0,25\}} = \frac{0,50}{1} = 0,5$$

$$R64 = \frac{0,75}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,75}{1} = 0,75$$

$$R74 = \frac{1}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{1}{1} = 1$$

$$R84 = \frac{1}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{1}{1} = 1$$

$$R94 = \frac{0,75}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,75}{1} = 0,75$$

$$R104 = \frac{0,50}{\text{Max}\{0,75;1;0,25;0,25;0,50;0,75;1;1;0,75;0,50\}} = \frac{0,50}{1} = 0,5$$

### Parent's Income

The Parental Income Criteria is included in the cost criteria, meaning the lower the value, the more priority it is given.

$$R15 = \frac{0,50}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,50}{0,25} = 2$$

$$R25 = \frac{1}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{1}{0,25} = 4$$

$$R35 = \frac{0,50}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,50}{0,25} = 2$$

$$R45 = \frac{0,50}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,50}{0,25} = 2$$

$$R55 = \frac{0,75}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,75}{0,25} = 3$$

$$R65 = \frac{0,75}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,75}{0,25} = 3$$

$$R75 = \frac{0,25}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,25}{0,25} = 1$$

$$R85 = \frac{0,25}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{0,25}{0,25} = 1$$

$$R95 = \frac{1}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{1}{0,25} = 4$$

$$R105 = \frac{1}{\text{Min}\{0,50;1;0,50;0,50;0,75;0,75;0,25;0,25;1;1\}} = \frac{1}{0,25} = 4$$

### Matrix X becomes Matrix R

The result of normalization (rij) forms a normalized matrix (R).

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1j} \\ \vdots & \vdots & & \vdots \\ r_{i1} & r_{i2} & \dots & r_{ij} \end{bmatrix}$$

Based on the results of the normalization calculations above, it can be formed into a matrix as follows:

	1	0,75	0,75	0,75	2
	1	1	0,25	1	4
	0,5	0,5	0,5	0,25	2
	0,75	0,25	0,75	0,25	2
R =	0,25	0,25	0,25	0,5	3
	0,5	1	1	0,75	3
	1	0,25	0,25	1	1



0.75	0.75	1	1	1
0.5	1	1	0.75	4
0.25	0.5	0.25	0.5	4

### Performing the Ranking Process

After normalizing the X Matrix into the R Matrix, the ranking and multiplication process of the W\*R Matrix for each Alternative is carried out.

a. Weight Repair

**Table 12.**Weight correction

Criteria	Weight	W
Academic Test	20/100	0.2
Performance	20/100	0.2
GPA	25/100	0.25
Active Semester	15/100	0.15
Parent's Income	20/100	0.2

Predetermined weight (Wj) :

$$C1 = 0.2$$

$$C2 = 0.2$$

$$C3 = 0.25$$

$$C4 = 0.15$$

$$C5 = 0.2$$

b. Ranking Determination

The final result of the preference value (Vi) is obtained from the sum of the multiplication of the row elements of the normalized matrix (R) with the preference weights (W) that correspond to the column elements of the matrix (W).

$$V_i = \sum_{j=1}^n W_j r_{ij} \quad V_i$$

$$= \sum_{j=1}^n W_j r_{ij}$$

Then look for the result (Vi) from the normalization calculation above, in looking for the calculation (Vi) you will use the following calculation:

$$V1 = (0.2*1) + (0.2*0.75) + (0.25*0.75) + (0.15*0.75) + (0.2*2) = 1.05$$

$$V2 = (0.2*1) + (0.2*1) + (0.25*0.25) + (0.15*1) + (0.2*4) = 1.4125$$

$$V3 = (0.2*0.5) + (0.2*0.5) + (0.25*0.5) + (0.15*0.25) + (0.2*2) = 4.475$$

$$V4 = (0.2*0.75) + (0.2*0.25) + (0.25*0.75) + (0.15*0.25) + (0.2*2) = 0.825$$

$$V5 = (0.2*0.25) + (0.2*0.25) + (0.25*0.25) + (0.15*0.5) + (0.2*3) = 0.8375$$

$$V6 = (0.2*0.5) + (0.2*1) + (0.25*1) + (0.15*0.75) + (0.2*3) = 1.2625$$

$$V7 = (0.2*1) + (0.2*0.25) + (0.25*0.25) + (0.15*1) + (0.2*1) = 0.6625$$

$$V8 = (0.2*0.75) + (0.2*0.75) + (0.25*1) + (0.15*1) + (0.2*1) = 0.9$$

$$V9 = (0.2*0.5) + (0.2*1) + (0.25*1) + (0.15*0.75) + (0.2*4) = 1.4625$$

$$V10 = (0.2*0.25) + (0.2*0.5) + (0.25*0.25) + (0.15*0.5) + (0.2*4) = 1.0875$$

c. Ranking Results

Based on the results of the weighting calculations above, the selection results obtained can be ranked according to Table 8 as follows.

**Table 13.**Ranking Results

Alternative	Vi Value	Ranking
Rusdi	4.475	1
Reni	1.4625	2
Diana	1.4125	3
Angie	1.2625	4
Samson	1.0875	5
Saveria	1.05	6

Alternative	Vi Value	Ranking
Noble	0.9	7
Desi	0.8375	8
Christian	0.825	9
Rick	0.6625	10

From the calculation above, it can be seen that the largest value of the 10 data is at:

- V3 with a value of 4.475, so the alternative chosen as the first best alternative is V3.
- V9 with a value of 1.4625, so the alternative chosen as the second best alternative is V9.
- V2 with a value of 1.4625, so that the alternative chosen as the third best alternative is V2.

In other words, V3, V9 and V2 (Rusdita, Reni and Dian) will be selected as scholarship recipients at Santo Thomas Catholic University Medan.

### CONCLUSION

From the discussion and testing that has been done, it can be concluded that the decision support system (DSS) for scholarship acceptance using the Simple Additive Weighting (SAW) method has been successfully created and runs well. The test results show that the system is able to produce output as expected, with the ability to provide ranking of prospective scholarship recipients as the best reference for the Scholarship Selection Team. The main advantage of the SAW method is its ability to manage data quickly and provide objective decisions. Thus, the use of SAW-based DSS can be a good recommendation for universities in determining the selection of prospective scholarship recipients according to the quota that has been set, as well as increasing validity in the process of determining scholarship recipients as a whole.

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