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# Decision Support System for Selecting the Best Graduates of Undergraduate Students Using the Analytical Hierarchy Process (AHP) Method

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**Abstract−**The selection of top graduates is a crucial process in higher education, aiming to reward students who demonstrate the best performance during their studies. However, in practice, this process often only considers academic grades such as the Grade Point Average (GPA), without considering other factors such as organizational activity, non-academic achievements, or student attitudes and ethics. This can lead to unfairness and subjectivity in decision-making. This study aims to develop a Decision Support System (DSS) to assist the selection process of top undergraduate graduates objectively and measurably using the Analytical Hierarchy Process (AHP) method. AHP is used to determine the weight of each criterion based on its relative importance through pairwise comparisons. The criteria used include GPA, academic and non-academic achievements, organizational activity, and student behavior. This system provides a final result in the form of a graduate ranking based on the highest score. Test results indicate that the system is able to improve accuracy and transparency in the selection process of top graduates. This research is expected to become an information technology solution that supports fair and data-based decision-making in higher education.

**Keywords:** Decision Support System; Best Graduate; AHP Method; Undergraduate Student

## 1. INTRODUCTION

Higher education is the final stage of formal academic education before entering the workforce or continuing on to a higher level. At the end of their studies, universities pay close attention to the selection of top graduates. Determining the top undergraduate graduates is a symbol of academic and non-academic achievement throughout the course of study. Top graduates often represent the quality of a study program, faculty, or even the institution as a whole, as they are considered an ideal reflection of the graduates produced by that institution[1].

However, the process of determining the best graduates is not as simple as comparing academic grades alone. While GPA (Grade Point Average) is often the primary indicator, in practice, many other factors influence a person's eligibility to be the best graduate. These factors can include academic achievement, active participation in student organizations, participation in social activities and committees, leadership, behavior, ethics, and awards or other accomplishments during the study period. Problems arise when this assessment process is carried out manually or based solely on subjective considerations by certain parties, which opens up the opportunity for unfairness and lack of objectivity in decision-making[2].

In many educational institutions, selecting top graduates remains a challenge due to the lack of decision-making tools capable of systematically and measurably addressing multiple criteria. When decisions are based solely on one or two key indicators, such as GPA or thesis grades, the contributions of other outstanding students in non-academic fields are not properly recognized in the assessment process. This results in inequities in achievement recognition, which can negatively impact overall student motivation.

To address this issue, an approach is needed that can consider multiple criteria simultaneously while maintaining the principles of objectivity and transparency. One appropriate approach to implement is the Analytical Hierarchy Process (AHP) method. AHP is a multi-criteria decision-making method developed by Thomas L. Saaty in the 1980s, which can be used to prioritize and make the best choice from a number of alternatives based on a number of specific criteria[3][4]. This method is very suitable for application in complex situations, where there are many factors that must be considered in the decision-making process[5].

Through the AHP approach, various criteria for determining the best graduates can be structured hierarchically, starting from the main objective, assessment criteria, sub-criteria (if any), and finally alternative student candidates for the best graduate. Furthermore, this method allows for pairwise comparisons between criteria to determine their weight or level of importance, which is carried out through assessments by experts or authorized parties. This process then produces a final score that reflects the deservingness of each alternative (student) to be named the best graduate.

Several previous studies have shown that the Analytical Hierarchy Process (AHP) method has been widely used in various multi-criteria decision-making contexts. Research conducted by Cepi Cahyadi et al. (2023) applied the AHP method to employee performance assessments at PT. Smart Solution. The results showed that attendance criteria had the highest weighting of 0.6169, followed by work results, speed, and tardiness. This demonstrates AHP's ability to systematically set priorities based on relevant criteria[6]. Meanwhile, research by Wahyu Handayani and Wulan Dari (2024) used AHP in a product selection decision support system at CV. Gambir Kuning. They found that this method produced an acceptable level of consistency (CR = 0.026) and successfully selected the best product with the highest weighting of 51%[7]. Another study by Lutfi Syafirullah et al. (2024) compared the AHP and ANP methods in the presidential election based on the preferences of the millennial generation at Cilacap State Polytechnic. AHP proved effective in converting subjective assessments into rational priority weights, with the candidate pair Ganjar Pranowo–Mahfud MD achieving the highest score of 0.39192[8]. In addition, Yuviani Kusumawardhani et al. (2024) developed a sustainable tourism decision support system using AHP to determine tourism village development strategies in Bogor Regency. The results showed that economic development was the top priority with a weighting of 0.677, followed by social and environmental aspects[9].

These four studies confirm that AHP is a flexible and accurate method for assisting decision-making processes based on various criteria, and is relevant for application in the context of selecting top undergraduate graduates. However, there is limited research specifically developing a decision support system for selecting top undergraduate graduates using a comprehensive AHP approach.

Based on this background, this study aims to develop a decision support system that can assist universities in selecting the best undergraduate graduates objectively, fairly, and transparently. By utilizing the Analytical Hierarchy Process (AHP) method, this system is expected to accommodate various important criteria in student assessment and provide accountable recommendations. Furthermore, this research is also expected to contribute to the development of information technology in education, particularly in supporting the evaluation and assessment of student achievement.

Through the development of this system, it is hoped that the selection process for top graduates will no longer rely solely on intuition or subjective assessments, but rather through a structured, measurable, and data-driven process. This way, selected students will truly be individuals who not only excel academically but also demonstrate tangible contributions in other fields during their studies. This will ultimately foster a competitive, fair, and high-quality academic environment.

## 2. RESEARCH METHODOLOGY

### 2.1 Research Stages

In conducting research at Budi Darma University, the author followed several stages. One of these was the data collection method used to obtain the data needed for this study.

a. Field Research
   At this stage, the author conducted several observations and interviews with lecturers at Budi Darma University regarding data on final-year students who had completed their thesis defense.
b. Library Research
   At this stage, the author reviewed various similar studies related to determining the best graduates from various universities in Indonesia. The researcher also read and analyzed the research using the same method.
c. Analysis and Testing Stage
   At this stage, the author analyzed the research conducted. Furthermore, the researcher tested the validity of the research content. This ensured that the research was worthy of publication.
d. Results Determination and Summary Stage
   At this stage, the researcher determined the results and summarized the research. Consequently, the decision was made that five students would receive the title of best graduates.

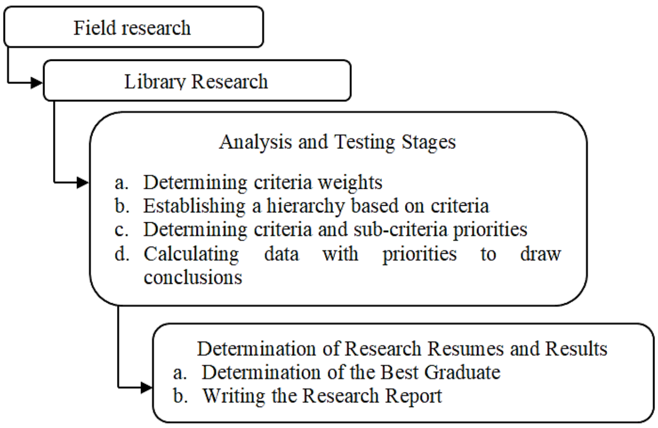


**Figure 1.** Research Stages

### 2.2 Decision Support System

A decision support system is an information system that helps in decision making by combining human intellectual abilities with modern technology, in which there are 3 components, namely language, knowledge and processing[10]. This method helps solve complex and unstructured problems, resulting in several alternatives that

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are used to determine concrete decisions based on existing data and criteria[11][12]. DSS is generally used to help managers in making decisions in a company/organization[13]. Decision support systems use a mathematical approach using data and models to process unstructured data to produce an alternative to reach the final decision required by the user[14][15].

### 2.3 Best Student

According to KBBI (Big Indonesian Dictionary), a student is someone who studies at a university. In the educational structure in Indonesia, students hold the highest educational status among others. A student is someone who is officially registered at a state or private university to take part in learning[16]. Students will have a big impact on the development of a country, because students with the fields they study will be able to create very good changes and developments for society[17]. Therefore, students must be competent, competitive and have a critical attitude towards various problems they face.

### 2.4 Analytical Hierarchy Process (AHP) Method

The Analytical Hierarchy Process (AHP) is a decision-making method first developed by Thomas L. Saaty (1970). This method is used to determine decisions based on complex data and criteria, although the primary input is human input[18]. This method refers to grouping problems with complex data into a hierarchy, meaning each problem is grouped into different levels according to priority, making the complex data systematic and easier to process[19]. The main steps in the AHP method are[20]:

a. Establishing a hierarchy
b. Determining priorities
c. Testing logical consistency

The Analytical Hierarchy Process (AHP) process includes the following:

a. Determining each type of criteria to be used
b. Arranging each criterion in a paired matrix

$$a_{ij} = \frac{w_i}{w_j}, i, = 1,2,3 \dots n \quad (1)$$

This matrix is structured numerically to compare elements and assess their relative importance. This will ultimately be related to prioritization. The AHP provides the following provisions for comparing two elements:

**Table 1.** Provisions for Comparative Values

| Comparator | Mark |
|---|---|
| Both Elements Are Equally Important | 1 |
| One element is slightly more important than the other | 3 |
| One element is significantly more important than the other | 5 |
| One element is significantly more important than the other | 7 |
| One element is absolutely more important than the other. | 9 |
| The values between the two are close together | 2,4,6,8 |

c. Perform normalization on each column

$$a_{ij} = \frac{a_{ij}}{\sum a_{ij}} \quad (2)$$

d. Determining priority weight

$$a_{ij} = \frac{\sum a}{n} \quad (3)$$

e. Determining WSF (Weight Single Factor)

$$a_{ij} = \sum_i^n = 1 \ a_{ij} * \ w_i \quad (4)$$

f. Determining the CF (Consistency Factor) value

$$CF = \frac{WFS}{Bobot} \quad (5)$$

g. Calculate the maximum lambda value or average CF

$$\lambda \max = \frac{\sum CF}{n} \quad (6)$$

h. Calculating the Consistency Index (CI)

$$CI = \frac{\lambda \max - n}{n-1} \quad (7)$$

i. Measuring the overall consistency of the research

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$$CR = \frac{CI}{RI} \quad (8)$$

The IR value can be seen in the Random Consistency Index table, namely:

**Table 2.** RI Data

| Matrix Size | RI |
|---|---|
| 1 | 0,00 |
| 2 | 0,00 |
| 3 | 0,58 |
| 4 | 0,90 |
| 5 | 1,12 |
| 6 | 1,24 |
| 7 | 1,32 |
| 8 | 1,41 |
| 9 | 1,45 |
| 10 | 1,49 |

Consistency values are needed to indicate how stable a value remains under certain conditions. The higher the consistency value, the better the research.

j. Revision
Revisions are made if the CR value is > 0.10.

## 3. RESULTS AND DISCUSSION

In this study, researchers required data to be processed to produce a decision regarding the best graduates at Budi Darma University. This process required several pieces of data, including criteria and sub-criteria, weights, and alternative data.

**Table 3.** Criteria Data

| Criteria | Information |
|---|---|
| C1 | GPA |
| C2 | Study Period |
| C3 | Organization |
| C4 | Class Type |
| C5 | SP/Remedial |

**Table 4.** GPA Subcriteria

| GPA | Information |
|---|---|
| 3,51 – 4,00 | With compliments |
| 2,76 – 3,50 | Very satisfactory |
| 2,00 – 2,75 | Satisfying |

**Table 5.** Study Period Subcriteria

| Study Period | Information |
|---|---|
| <= 4 years | With compliments |
| >4 years – 5 years | Satisfying |
| >5 years – 7 years | Enough |

**Table 6.** Organizational Subcriteria

| Organization | Information |
|---|---|
| Active | Very Good |
| Inactive | Poor |

**Table 7.** Class Type Subcriteria

| Class Type | Information |
|---|---|
| Regular | Very Good |
| Employee | Good |

**Table 8.** SP/Remedial Subcriteria

| SP/Remedial | Information |
|---|---|
| Never | Very Good |

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| SP/Remedial | Information |
|---|---|
| Ever | Poor |

**Table 9.** Student Data

| Alternative | GPA | Study Period | Organization | Class Type | SP/Remedial |
|---|---|---|---|---|---|
| Student A | 3,59 | 4 | Active | Regular | Never |
| Student B | 3,85 | 4 | Inactive | Regular | Never |
| Student C | 3,50 | 4 | Active | Regular | Ever |
| Student D | 3,83 | 4 | Inactive | Regular | Never |

After the criteria and sub-criteria have been determined, the criteria are arranged into a hierarchy according to the steps of the AHP method above:

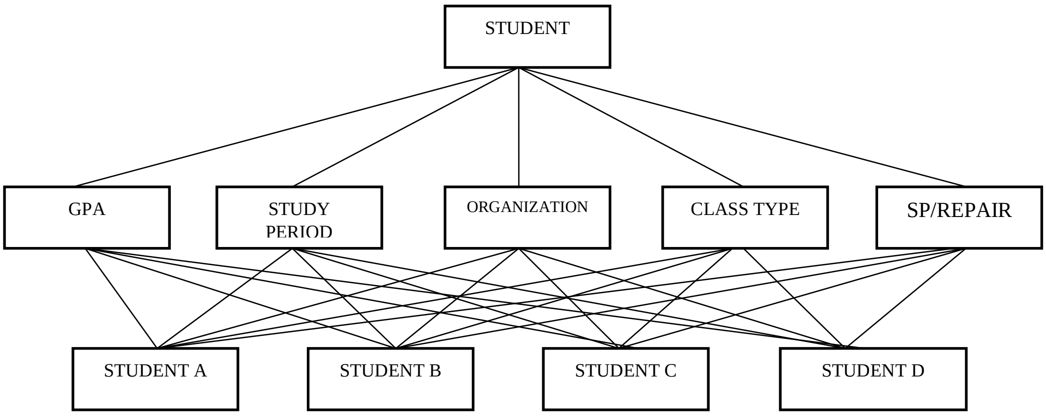


**Figure 2.** Criteria Hierarchy

The following are the stages of the AHP method in producing decisions:

a. Compiling a Pairwise Comparison Matrix
After determining the criteria, then continue by determining the comparison of paired matrix values as follows:

**Table 10.** Pairwise Comparison Matrix

| Criteria | GPA | Study Period | Organization | Class Type | SP/Remedial |
|---|---|---|---|---|---|
| GPA | 1 | 2 | 3 | 4 | 5 |
| Study Period | 0,5 | 1 | 5 | 3 | 3 |
| Organization | 0,333 | 0,2 | 1 | 3 | 3 |
| Class Type | 0,25 | 0,333 | 0,333 | 1 | 5 |
| SP/Remedial | 0,2 | 0,333 | 0,333 | 0,2 | 1 |
| Amount | 2,283 | 3,866 | 9,666 | 11,2 | 17 |

The values in the paired matrix indicate the level of importance between criteria. The calculation is as follows: if the study period column and the GPA row have a value of 2, then the GPA column and the study period row have a value of 1/2 = 0.5, and so on.

b. Compiling a Criteria Value Matrix
After determining the value of the pairwise comparison matrix, we will then normalize the columns by calculating the criteria value matrix and determining the priorities according to equations 2 and 3, which can be seen in Table 11.

**Table 11.** Column Normalization (Criteria Value Matrix)

| | GPA | Study Period | Organization | Class Type | SP/Remedial | Jumlah | Prioritas |
|---|---|---|---|---|---|---|---|
| GPA | 0,438 | 0,517 | 0,310 | 0,357 | 0,294 | 1,917 | 0,383 |
| Study Period | 0,219 | 0,259 | 0,517 | 0,268 | 0,176 | 1,439 | 0,288 |
| Organization | 0,146 | 0,052 | 0,103 | 0,268 | 0,176 | 0,745 | 0,149 |
| Class Type | 0,110 | 0,086 | 0,034 | 0,089 | 0,294 | 0,613 | 0,123 |
| SP/Remedial | 0,088 | 0,086 | 0,034 | 0,018 | 0,059 | 0,285 | 0,057 |

Table 11 shows the matrix normalization value obtained by calculating the paired matrix divided by the sum of the values in the criteria column. For example, if the GPA value is 1 and the sum of the GPA column values is 2.283, then the normalization of the GPA column and GPA row is 1/2.283 = 0.438. Meanwhile, the total column is obtained by adding the row criteria values. For the priority column, it is obtained by dividing the total column value of 1.9 by the number of criteria columns, namely 3 = 0.633.

c. Compiling a Row Addition Result Matrix

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**Table 12.** Row Sum Matrix

| | GPA | Study Period | Organization | Class Type | SP/Remedial | Jumlah |
|---|---|---|---|---|---|---|
| GPA | 0,168 | 0,149 | 0,046 | 0,044 | 0,017 | 0,424 |
| Study Period | 0,084 | 0,074 | 0,077 | 0,033 | 0,010 | 0,278 |
| Organization | 0,056 | 0,015 | 0,015 | 0,033 | 0,010 | 0,129 |
| Class Type | 0,042 | 0,025 | 0,005 | 0,011 | 0,017 | 0,100 |
| SP/Remedial | 0,034 | 0,025 | 0,005 | 0,002 | 0,003 | 0,069 |

Table 12 shows the row matrix values obtained by multiplying each column's value by the priority row. For example, in the GPA column, the GPA row in Table 9 is 0.438 x 0.383, while in the priority row in Table 10, the result is 0.168. For all GPA columns, multiply by the priority value in the GPA row.

d. Performing CR (Consistency Ratio) Calculations
CR calculation with the condition that CR <= 0.1. If it does not meet the conditions, corrections are made.

**Table 13.** Consistency Ratio (CR)

| | Number of Rows | Priority | Results |
|---|---|---|---|
| GPA | 0,424 | 0,383 | 0,807 |
| Study Period | 0,278 | 0,288 | 0,566 |
| Organization | 0,129 | 0,149 | 0,278 |
| Class Type | 0,1 | 0,123 | 0,223 |
| SP/Remedial | 0,069 | 0,057 | 0,126 |
| Amount | | | 2 |

After getting the $\sum$CF yaitu 2, value of 2, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.
Settlement:

$$\lambda\, max = \frac{\sum CF}{n} = \frac{2}{5} = 0{,}4$$

$$CI = \frac{\lambda \max - n}{n-1} = \frac{0{,}4-5}{5-1} = \frac{-4{,}6}{4} = -1{,}15$$

The IR value is seen in the random consistency index table, with a value of n = 3 = 0.58.

$$CR = \frac{CI}{RI} = \frac{-0{,}825}{0{,}58} = -1{,}422$$

e. Subcriteria Operations
At this stage, all sub-criteria scores will be prioritized, as described above. There are five sub-criteria: GPA, Study Period, Scientific Papers, TOEFL Scores, and Achievements.
1) GPA sub-criteria
a) Compiling a Pairwise Comparison Matrix

**Table 14.** Pairwise Comparison Matrix of GPA Subcriteria

| | With Compliments | Very Satisfactory | Satisfying |
|---|---|---|---|
| With Compliments | 1 | 2 | 3 |
| Very Satisfactory | 0,5 | 1 | 2 |
| Satisfying | 0,333 | 0,5 | 1 |
| Amount | 1,833 | 3,5 | 6 |

b) Compiling the Normalization Matrix (Criteria Value Matrix)

**Table 15.** Normalization of Matrix (Criteria Value Matrix) GPA

| | With Compliments | Very Satisfactory | Satisfying | Amount | Priority | Subcriteria Priority |
|---|---|---|---|---|---|---|
| With Compliments | 0,546 | 0,571 | 0,500 | 1,617 | 0,539 | 1 |
| Very Satisfactory | 0,273 | 0,286 | 0,333 | 0,892 | 0,297 | 0,552 |
| Satisfying | 0,182 | 0,143 | 0,167 | 0,491 | 0,164 | 0,304 |

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The priority value for a sub-criterion is obtained by dividing each priority value by the highest priority. For example, a criterion with a priority of 0.539, praising, divided by the highest priority, is 0.539, which equals 1.

c) Compiling a Row Addition Result Matrix

**Table 16.** Matrix of GPA Row Sum Results

| | With Compliments | Very Satisfactory | Satisfying | Amount |
|---|---|---|---|---|
| With Compliments | 0,539 | 0,594 | 0,492 | 1,625 |
| Very Satisfactory | 0,270 | 0,297 | 0,328 | 0,895 |
| Satisfying | 0,179 | 0,149 | 0,164 | 0,492 |

d) Perform CR (Consistency Ratio) Calculations

**Table 17.** CR IPK Calculation Matrix

| | Number of Rows | Priority | Results |
|---|---|---|---|
| With Compliments | 1,625 | 0,539 | 2,164 |
| Very Satisfactory | 0,895 | 0,297 | 1,192 |
| Satisfying | 0,492 | 0,164 | 0,656 |
| Amount | | | 4,011 |

After getting the $\sum$CF yaitu 4,008, value of 4.008, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.
Settlement:

$$\lambda \text{ max} = \frac{\sum CF}{n} = \frac{4{,}011}{3} = 1{,}337$$

$$\text{CI} = \frac{\lambda \text{ max} - n}{n-1} = \frac{1{,}337-3}{3-1} = \frac{-1{,}663}{2} = -0{,}8315$$

The IR value is seen in the random consistency index table, with a value of n = 3 = 0.58.

$$\text{CR} = \frac{CI}{RI} = \frac{-0{,}8315}{0{,}58} = -1{,}434$$

$$\text{CR} < 0{,}1$$

2) Study Period Sub-Criteria

a) Compiling a Pairwise Comparison Matrix

**Table 18.** Pairwise Comparison Matrix of Study Period Subcriteria

| | With Compliments | Satisfying | Enough |
|---|---|---|---|
| With Compliments | 1 | 3 | 5 |
| Satisfying | 0,333 | 1 | 3 |
| Enough | 0,2 | 0,333 | 1 |
| Amount | 1.533 | 4,333 | 9 |

b) Compiling a Criteria Value Matrix

**Tabel 19.** Normalisasi Matriks (Matriks Nilai Kriteria) Masa Studi

| | With Compliments | Satisfying | Enough | Amount | Priority | Subcriteria Priority |
|---|---|---|---|---|---|---|
| With Compliments | 0,652 | 0,692 | 0,56 | 1,904 | 0,634 | 1 |
| Satisfying | 0,217 | 0,231 | 0,333 | 0,781 | 0,26 | 0,41 |
| Enough | 0,13 | 0,077 | 0,111 | 0,318 | 0,106 | 0,167 |

c) Compiling a Row Addition Result Matrix

**Table 20.** Row Sum Result Matrix

| | With Compliments | Satisfying | Enough | Amount |
|---|---|---|---|---|
| With Compliments | 0,634 | 0,78 | 0,53 | 1,944 |
| Satisfying | 0.211 | 0,26 | 0,318 | 0,789 |
| Enough | 0,126 | 0,086 | 0,106 | 0.318 |

d) Perform CR (Consistency Ratio) Calculations

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**Table 21.** CR Calculation Matrix

| | Number of Rows | Priority | Results |
|---|---|---|---|
| With Compliments | 1,944 | 0,634 | 2,578 |
| Satisfying | 0,789 | 0,26 | 1,049 |
| Enough | 0.318 | 0,106 | 0,424 |
| Amount | | | 4,051 |

After getting the $\sum$ CF yaitu 4,051, value of 4.051, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.

Settlement:

$\lambda \text{ max } = \frac{\sum CF}{n} = \frac{4,051}{3} = 1,35$

$\text{CI } = \frac{\lambda \text{ max} - n}{n-1} = \frac{1,35-3}{3-1} = \frac{-1,65}{2} = -0,825$

The IR value is seen in the random consistency index table, with a value of n = 3 = 0.58.

$\text{CR } = \frac{CI}{RI} = \frac{-0,825}{0,58} = -1,422$

$\text{CR } < 0,1$

3) Organizational Subcriteria
   a) Compiling a Pairwise Comparison Matrix

**Table 22.** Pairwise Comparison Matrix of Organizational Subcriteria

| | Very Good | Poor |
|---|---|---|
| Very Good | 1 | 5 |
| Poor | 0,2 | 1 |
| Amount | 1,2 | 6 |

   b) Compiling a Criteria Value Matrix

**Table 23.** Normalization Matrix (Criteria Value Matrix) of Organization

| | Very Good | Poor | Jumlah | Prioritas | Prioritas Subkriteria |
|---|---|---|---|---|---|
| Very Good | 0,83 | 0,83 | 1,67 | 0,83 | 1 |
| Poor | 0,17 | 0,17 | 0,33 | 0,17 | 0,20 |

   c) Compiling a Row Addition Result Matrix

**Table 24.** Organizational Row Sum Result Matrix

| | Very Good | Poor | Jumlah |
|---|---|---|---|
| Very Good | 0,692 | 0,142 | 0,833 |
| Poor | 0,138 | 0,028 | 0,167 |

   d) Perform CR (Consistency Ratio) Calculations

**Table 25**. Organizational Calculation Matrix

| | Number of Rows | Priority | Results |
|---|---|---|---|
| Very Good | 0,833 | 0,835 | 1,668 |
| Poor | 0,1666 | 0,167 | 0,3336 |
| Amount | | | 2,0016 |

After getting the $\sum$ CF yaitu 2,2, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.
Penyelesaian:

$\lambda \text{ max } = \frac{\sum CF}{n} = \frac{2,0016}{2} = 1,0008$

$\text{CI } = \frac{\lambda \text{ max} - n}{n-1} = \frac{1,0008-2}{2-1} = \frac{-0,9992}{1} = -0,9992$

The IR value is seen in the random consistency index table, with the value n = 2 = 0.

$\text{CR } = \frac{CI}{RI} = \frac{-0,9992}{0} = 0$

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$CR < 0,1$

4) Class Type Subcriteria
   a) Compiling a Pairwise Comparison Matrix

**Table 26.** Pairwise Comparison Matrix of Class Type Subcriteria

| | Very good | Poor |
|---|---|---|
| Very Good | 1 | 4 |
| Poor | 0,25 | 1 |
| Amount | 1,25 | 5 |

   b) Compiling a Criteria Value Matrix

**Table 27.** Normalization of Matrix (Criteria Value Matrix) Class Type

| | Very good | Poor | Amount | Priority | Subcriteria Priority |
|---|---|---|---|---|---|
| Very Good | 0,8 | 0,8 | 1,6 | 0,8 | 1 |
| Poor | 0,2 | 0,2 | 0,4 | 0,2 | 0,25 |

   c) Compiling a Row Addition Result Matrix

**Table 28.** Matrix of Class Type Row Sum Results

| | Very good | Poor | Amount |
|---|---|---|---|
| Very Good | 0,8 | 0,8 | 1,6 |
| Poor | 0,2 | 0,2 | 0,4 |

   d) Perform CR (Consistency Ratio) Calculations

**Table 29.** Class Type Calculation Matrix

| | Number of Rows | Priority | Results |
|---|---|---|---|
| Very Good | 1,6 | 0,8 | 2,4 |
| Poor | 0,4 | 0,2 | 0,6 |
| Amount | | | 3 |

After getting the $\sum$CF yaitu 2,2, value of 2.2, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.
Settlement:

$$\lambda \max = \frac{\sum CF}{n} = \frac{3}{2} = 1,5$$

$$CI = \frac{\lambda \max - n}{n-1} = \frac{1,5-2}{2-1} = \frac{-0,5}{1} = -0,5$$

The IR value is seen in the random consistency index table, with the value n = 2 = 0.

$$CR = \frac{CI}{RI} = \frac{-0,5}{0} = 0$$

$CR < 0,1$

5) SP/Improvement Subcriteria
   a) Compiling a Pairwise Comparison Matrix

**Table 30**. Pairwise Comparison Matrix of SP/Improvement Subcriteria

| | Very Good | Poor |
|---|---|---|
| Very Good | 1 | 3 |
| Poor | 0,333 | 1 |
| Amount | 1,333 | 4 |

   b) Compiling a Criteria Value Matrix

**Table 31.** Normalization Matrix (Criteria Value Matrix) SP/Improvement

| | Very Good | Poor | Amount | Priority | Subcriteria Priority |
|---|---|---|---|---|---|
| Very Good | 0,750 | 0,750 | 1,500 | 0,750 | 1 |
| Poor | 0,250 | 0,250 | 0,500 | 0,250 | 0,333 |

   c) Compiling a Row Addition Result Matrix

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**Table 32.** SP/Improvement Row Sum Result Matrix

| | Very Good | Poor | Amount |
|---|---|---|---|
| Very Good | 0,8 | 0,8 | 1,5 |
| Poor | 0,2 | 0,3 | 0,5 |

d) Perform CR (Consistency Ratio) Calculations

**Table 33.** SP/Improvement Calculation Matrix

| | Number of Rows | Priority | Results |
|---|---|---|---|
| Very Good | 1,5 | 0,75 | 2,25 |
| Poor | 0,5 | 0,25 | 0,75 |
| Amount | | | 3 |

After getting the $\sum$ CF value of 2.2, we will calculate the average CF value ($\lambda$ max), CI, IR, and CR, according to the formulas in equations 6,7,8.
Settlement:

$$\lambda \text{ max } = \frac{\sum CF}{n} = \frac{3}{2} = 1{,}5$$

$$\text{CI } = \frac{\lambda \text{ max} - n}{n-1} = \frac{1{,}5-2}{2-1} = \frac{-0{,}5}{1} = -0{,}5$$

The IR value is seen in the random consistency index table, with the value n = 2 = 0.

$$\text{CR } = \frac{CI}{RI} = \frac{-0{,}5}{0} = 0$$

$$\text{CR } < 0{,}1$$

After knowing the priority of the criteria and sub-criteria, the results matrix is compiled as follows:

**Table 34.** Results Matrix

| GPA | Study Period | Organization | Class Type | SP/Remedial |
|---|---|---|---|---|
| 0,383 | 0,288 | 0,149 | 0,123 | 0,057 |
| With Compliments | With Compliments | Very Good | Very Good | Very Good |
| 1 | 1 | 1 | 1 | 1 |
| Very Satisfactory | Satisfying | | | |
| 0,552 | 0,41 | Poor | Poor | Poor |
| Satisfying | Enough | 0,20 | 0,333 | 0,333 |
| 0,304 | 0,167 | | | |

From Table 34, it can be concluded that the GPA criteria have a priority value of 38.3%, Study Period 28.8%, Organization 14.9%, Class Type 12.3%, SP/Remediation 5.7%:

**Table 35.** Final Grades

| Student | GPA | Study Period | Organization | Class Type | SP/Remedial | Total |
|---|---|---|---|---|---|---|
| Student A | 0,383 | 0,288 | 0,149 | 0,123 | 0,02 | 0,963 |
| Student B | 0,383 | 0,288 | 0,03 | 0,123 | 0,057 | 0.881 |
| Student C | 0,211 | 0,288 | 0,149 | 0,123 | 0,02 | 0,791 |
| Student D | 0,383 | 0,288 | 0,03 | 0,123 | 0,057 | 0,881 |

From Table 35, it can be concluded that Student D will be the Best Graduate Student with a priority value of 0.963 = 96.3%. Meanwhile, the next are Students A and B with a priority value of 0.881 = 88.1%, and Student C with a priority value of 0.791 = 79.1%, and Student D with a priority value of 0.881 = 88.1%.

## 4. CONCLUSION

Based on the results of the research that has been conducted, it was found that the Analytical Hierarchy Process (AHP) method is effective in the decision-making process to determine the best graduates at Budi Darma University Medan. This study considers five main criteria, namely: Grade Point Average (GPA), study period, organizational activity, class type, and the number of courses that have undergone improvement (SP/Remediation). From the results of the analysis using the AHP method, it is known that the criteria with the highest weighting is GPA at 38.8%, followed by study period at 28.8%, organizational activity 14.9%, class type 12.3%, and SP/Remediation at 5.7%. This shows that GPA is the most dominant factor in determining the best graduates, while SP/Remediation has the smallest influence. In addition, the calculation of the alternative students assessed produces the following

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ranking: Student A obtained a final score of 0.963 and was ranked first as the best graduate. Followed by Students B and D, who both obtained a score of 0.881, and Student C with a score of 0.791. These scores demonstrate that the AHP method is capable of providing objective and measurable assessments based on predetermined criteria. Thus, the application of the AHP method in this decision support system can provide a systematic and accurate solution in the process of determining the best graduates, and can be used as a reference in making more transparent and data-driven academic policies.

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