DETERMINATION OF OUTSTANDING STUDENTS USING THE TOPSIS METHOD (Technique for Order Preference by Similarity to Ideal Solution)

Dwi Zaratunisah[1*], **Mohamad Tafrikan**[2]

[1]*Undergraduate Department of Mathematics, Faculty of Science and Technology, Universitas Islam Negeri Walisongo Semarang*
Jl. Walisongo No. 3-5, Ngaliyan District, Semarang 50185, Indonesia
[2]*Department of Mathematics, Faculty of Science and Technology, Universitas Islam Negeri Walisongo Semarang*
Jl. Walisongo No. 3-5, Ngaliyan District, Semarang 50185, Indonesia

*Corresponding author's e-mail: *dwizaratunisah_1908046014@student.walisongo.ac.id*

Article Info

Article History:

Received: 2026-01-26
Revised: 2026-04-25
Accepted: 2026-04-27
Available online: 2026-04-30

Keywords:

Decision Support System;
Topsis;
Outstanding Student

ABSTRACT

In this study, the authors apply one of the methods in making a decision, namely TOPSIS. The TOPSIS method was chosen because the concept is simple and easy to understand, computationally efficient and has the ability to measure the relative performance of decision alternatives in a simple mathematical form. This research was aimed at determining outstanding students, in which case the greatest value was obtained from V11 = 0.932.

How to cite this article:

Zaratunisah, D., & Tafrikan, M. (2026). *Determination of outstanding students using the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution). Journal of Information System and Data Intelligence*. Retrieved May 7, 2026, from https://propanoramic.com/index.php/JISDI/article/view/667

Journal homepage: *//propanoramic.com/index.php/JISDI*
Research Article · Open Access

1. INTRODUCTION

Mathematics is a study of subjects such as structure, numbers or quantities, change, and space [1]. There are various perceptions among philosophers and mathematicians regarding the scope and appropriate definition of mathematics. Mathematics can collaborate with other fields of science, for example combined with computation. Using mathematics and computational thinking is about finding the right way to describe patterns and processes that form scientific and engineering systems. The modern era has intensified the relationship between mathematics and computation, one of which is by solving problems in decision making [2].

A Decision Support System is a Computer-Based System used when making decisions for an organization. A Decision Support System can be fully computerized or human-powered or a combination of both [3]. A Decision Support System is used as a support tool for users or managers to solve specific problems. The database of a decision support system can be used to generate periodic reports or create information that is the result of simulation of one or more elements.

One application of techniques for simulation in decision support system models is multi-criteria decision making [4]. The development of computer technology is very beneficial for the development of MCDM science. The development of MCDM is closely related to the development of computer technology. With advanced computer technology, it is very helpful in conducting systematic analysis of complex MCDM problems. One of the MCDM methods is the TOPSIS Method.

TOPSIS stands for Technique for Order Preference by Similarity to Ideal. The TOPSIS method was first introduced by Yoon and Hwang in 1981 [5]. This method is one that is often used to efficiently resolve decision making. TOPSIS operates on the concept that the chosen alternative is the best one — the alternative that has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution. The more diverse the factors that need to be considered when making a decision, the more difficult it is to make one [6].

With the assistance of computer media when making a decision, the process can be simplified and more efficiently implemented. For example, in determining the solution to the problem of selecting a chairperson in a forum without having to do it manually. In relation to this problem, a decision support system was built to assist the organizers in determining the most appropriate outstanding student based on established indicators.

The achievement of the learning process at a university cannot be separated from the role of students. Students are the acting elements in higher education organizations. Students have the opportunity to carry out the process of learning, acting, research, and community service. Giving recognition to students with a good reputation is an important element in developing and fostering an academic atmosphere. In the selection of the best students, subjectivity of decision makers often arises, so to avoid problems, the selection is carried out using the MADM model. In this model, the method used is TOPSIS.

Previous research by Damar and Anton regarding the application of the TOPSIS method in a decision support system for determining outstanding teachers has been conducted in [7]. Furthermore, research by Ni Made Santiary, Putu Wulan Ciptayani, Ni Kadek Saptariani, and I Ketut Swardika on determining tourist locations in Bali City using the TOPSIS method is shown in [8]. In addition, research by Akmaludin and Badrul combining the AHP and TOPSIS methods for smartphone brand selection can be seen in [9].

From those three existing studies, the authors conclude that the TOPSIS method support system application can resolve problems through criteria aligned with the objectives of the decisions made, so the authors aim to provide proof of whether the TOPSIS method can truly resolve the problem of determining the best student at a University.

This study was conducted with the aim of determining outstanding students through the use of the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution). The approach of this study is descriptive and precise. It is hoped that this TOPSIS method in supporting the decision system can help the organizers so that it can be more easily carried out.

2. RESEARCH METHODS

2.1 Research Stages

2.1.1 Questionnaire

In this case the authors distributed a Google Form related to the grades of each student, aimed at finding out the assessments distributed to several students to help the authors obtain data, and data was also taken from the academic guardian system (wali-siadik).

2.1.2 Observation

The authors conducted direct observations related to the established criteria, then the data sources were analyzed and subsequently expressed in written form.

2.1.3 Data Collection

Data was obtained from students of the mathematics study program, semester 7 A, UIN Walisongo Semarang. The number of respondents was 20 students, each of whom filled in the grades of several courses that had been determined by the authors.

2.1.4 Decision-Making Stages

There are also stages that need to be carried out when making decisions, which include:

1. Intelligence Phase

   The processes found in this stage include problem discovery, problem classification, problem description, and problem ownership. This stage is the process of tracing and detecting the scope of the problem and identifying the problems.

2. Design Phase

   This stage includes the process of creating, developing, and analyzing something that can possibly be implemented. It encompasses understanding the examination of good solutions and the problem or model of the problem. Various tasks within this stage include:
   a. Result prediction
   b. Selection stage
   c. Selection of selection principles
   d. Various model components
   e. Alternative development
   f. Model structure
   g. Scenario
   h. Result measurement

2.2 Data Analysis

The working steps of the TOPSIS method are [7]:

1. Building decision matrix D with m alternatives and n criteria that can be seen as in the following matrix (Equation 1):

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ \vdots \\ A_m \end{array} \begin{pmatrix} C_1 & C_2 & C_3 & \cdots & C_n \\ x_{11} & x_{12} & x_{13} & \cdots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2n} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & x_{m3} & \cdots & x_{mn} \end{pmatrix} \quad (1)$$

2. Building normalized decision matrix R. Each element of matrix D can be normalized using equation 2:

$$R = \begin{matrix} A_1 \\ A_2 \\ A_3 \\ \vdots \\ A_m \end{matrix} \begin{pmatrix} C_1 & C_2 & C_3 & \cdots & C_n \\ r_{11} & r_{12} & r_{13} & \cdots & r_{1n} \\ r_{21} & r_{22} & r_{23} & \cdots & r_{2n} \\ r_{31} & r_{32} & r_{33} & \cdots & r_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & r_{m3} & \cdots & r_{mn} \end{pmatrix} ; \; r_{\text{ij}} = x_{ij} \, . \left(\sum_{i=1}^{m} x_{ij}^2\right)^{\frac{-1}{2}} \quad (2)$$

(2)

3. Building weighted normalized matrix V. In this case, matrix V is given with weight W = [w1,w2,w3,...,wn]. Each element of matrix V can be calculated using equation 3:

$$V = \begin{matrix} A_1 \\ A_2 \\ A_3 \\ \vdots \\ A_m \end{matrix} \begin{pmatrix} C_1 & C_2 & C_3 & \cdots & C_n \\ v_{11} & v_{12} & v_{13} & \cdots & v_{1n} \\ v_{21} & v_{22} & v_{23} & \cdots & v_{2n} \\ v_{31} & v_{32} & v_{33} & \cdots & v_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ v_{m1} & v_{m2} & v_{m3} & \cdots & v_{mn} \end{pmatrix} ; v_{\text{ij}} = w_j . x_{ij} \quad (3)$$

4. Determining the positive ideal solution (PIS) A^+ and negative ideal solution (NIS) A^-. PIS (A^+) and NIS (A^-) are calculated with the normalized weighted rating using equations 4 and 5

$$\text{PIS} \; = \; A^+ = \left\{ \begin{matrix} max \\ i \end{matrix} \quad v_{ij}; j \in J \right\} = \; (v_1^+, v_2^+, v_3^+, \ldots, v_m^+) \quad (4)$$

$$\text{NIS} \; = \; A^- = \left\{ \begin{matrix} min \\ i \end{matrix} \quad v_{ij}; j \in J \right\} \; = \; (v_1^-, v_2^-, v_3^- , \ldots, v_m^-) \quad (5)$$

5. Calculating the separation measure using Euclidean distance. The separation of each alternative from PIS, D^+ can be calculated using equation 6. Meanwhile, the separation for each alternative from NIS, D^- can be calculated using equation 7.

$$D_i^+ \; = \; \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j{}^+)^2} \; , 1 \; \leq i \leq m \quad (6)$$

$$D_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j{}^-)^2} \; , 1 \leq i \leq m \quad (7)$$

6. Calculating the relative closeness from the ideal solution. The closeness of alternative A_i to A^+ can be calculated using equation 8.

$$RC_i{}^+ = \frac{D_i^-}{D_i^- + D_i^+} \, , \, 1 \leq i \leq m \quad (8)$$

7. Rank the order of alternatives in descending order based on the value $RC_i{}^+$.

3. RESULTS AND DISCUSSION

3.1 Criteria

The criteria used in determining outstanding students include:

1. Computational Mathematics Grade (C1)
2. Elementary Linear Algebra Grade (C2)
3. Statistical Methods Grade (C3)
4. Mathematical Modeling Grade (C4)
5. Real Analysis 1 Grade (C5)
6. Civic Education Grade (C6)
7. Ulumul Qur'an Grade (C7)
8. English Language Grade (C8)
9. Arabic Language Grade (C9)
10. Indonesian Language Grade (C10)

3.2 Compatibility Rating of Each Alternative

The compatibility rating of each alternative, assessed on a scale of 1-5, is:

1 = Very Poor

2 = Poor

3 = Fair

4 = Good

5 = Very Good

Meanwhile, the importance level of each criterion is also assessed on a scale of 1-5, namely:

1 = Very Poor

2 = Poor

3 = Fair

4 = Good

5 = Very Good

3.3 TOPSIS Method Calculation

Table 1 shows the compatibility rating of each alternative for each criterion.

Table 1. Research Data

No	Alternative	Criteria									
		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
1	A1	4	4	4	4	4	3,9	3,4	3,4	3,6	4
2	A2	4	4	3,6	3,7	3,3	4	3,6	3,9	3	4
3	A3	3,7	3,8	4	3,5	3	3,9	3,4	4	4	3,7
4	A4	3,8	2,8	3	3,1	4	3,9	3,5	4	3,4	3,7
5	A5	3,7	4	4	4	4	4	3,5	4	3,4	4
6	A6	3,8	3,4	3,1	3,5	4	3,8	3,4	4	3,3	3,1
7	A7	4	4	4	3,7	4	4	3,7	4	3,8	4
8	A8	3,8	4	2,5	3,5	3,1	3,9	3,4	3,4	3	3,6
9	A9	3,6	3,8	2,8	3,5	3,6	4	3,8	3,1	3,6	3,5
10	A10	3,6	3,9	2,8	3,5	2,8	3,9	3,5	4	3,4	3,1
11	A11	3,9	4	4	4	4	3,9	3,4	4	4	4
12	A12	3,6	4	4	3,7	4	3,9	3,5	4	3,5	4
13	A13	4	3,6	4	3,8	3,2	3,9	3,9	4	4	3,2
14	A14	3,7	3,8	3,3	4	4	3,8	3,4	4	3,5	4
15	A15	3,6	2,7	2,2	3	3,4	4	3,6	3,9	3,3	4
16	A16	3,9	4	2,4	3,7	3,8	4	3,5	4	3,5	4
17	A17	3,6	4	3,9	4	3,5	4	3,8	3,5	3,5	4
18	A18	3,7	3,8	3,4	3,5	3,1	3,9	3,1	3,9	3,9	4
19	A19	3,8	4	4	4	4	4	3,5	4	3,4	4
20	A20	3,6	3,3	2	3,5	3,5	3,8	3,4	3,5	3,4	3

The decision maker provides preference weights as:

W = (3, 4, 5, 5, 5, 4, 2, 3, 5, 3)

Note that criteria C1 (Computational Mathematics Grade), C2 (Elementary Linear Algebra Grade), C3 (Statistical Methods Grade), C4 (Mathematical Modeling Grade), C5 (Real Analysis 1 Grade), C6 (Civic Education Grade), C7 (Ulumul Qur'an Grade), C8 (English Language Grade), C9 (Arabic Language Grade), C10 (Indonesian Language Grade) are benefit criteria.

1. Weighted Normalization Matrix

Y =

0,711	0,95	1,308	1,218	1,229	0,889	0,432	0,594	1,138	0,713
0,711	0,95	1,177	1,127	1,014	0,911	0,457	0,681	0,948	0,713
0,658	0,903	1,308	1,066	0,922	0,889	0,432	0,699	1,265	0,66
0,676	0,665	0,981	0,944	1,229	0,889	0,445	0,699	1,075	0,66
0,658	0,95	1,308	1,218	1,229	0,911	0,445	0,699	1,075	0,713
0,676	0,808	1,014	1,066	1,229	0,866	0,432	0,699	1,043	0,553
0,711	0,95	1,308	1,127	1,229	0,911	0,47	0,699	1,201	0,713
0,676	0,95	0,818	1,066	0,953	0,889	0,432	0,594	0,948	0,642
0,64	0,903	0,916	1,066	1,106	0,911	0,483	0,542	1,138	0,624
0,64	0,926	0,916	1,066	0,861	0,889	0,445	0,699	1,075	0,553
0,693	0,95	1,308	1,218	1,229	0,889	0,432	0,699	1,265	0,713
0,64	0,95	1,308	1,127	1,229	0,889	0,445	0,699	1,106	0,713
0,711	0,855	1,308	1,157	0,984	0,889	0,496	0,699	1,265	0,571
0,658	0,903	1,079	1,218	1,229	0,866	0,432	0,699	1,106	0,713
0,64	0,641	0,719	0,914	1,045	0,911	0,457	0,681	1,043	0,713
0,693	0,95	0,785	1,127	1,168	0,911	0,445	0,699	1,106	0,713
0,64	0,95	1,275	1,218	1,076	0,911	0,483	0,611	1,106	0,713
0,658	0,903	1,112	1,066	0,953	0,889	0,394	0,681	1,233	0,713
0,676	0,95	1,308	1,218	1,229	0,911	0,445	0,699	1,075	0,713
0,64	0,784	0,654	1,066	1,076	0,866	0,432	0,611	1,075	0,535

2. Determining the positive ideal solution matrix and negative ideal solution matrix

A+	0,711	0,95	1,308	1,218	1,229	0,911	0,496	0,699	1,265	0,713
A-	0,64	0,641	0,654	0,914	0,861	0,866	0,394	0,542	0,948	0,535

3. The preference value of each alternative is obtained as follows

Table 2. Preference Value of Each Alternative

Alternative	Preference Value	Ranking
v1	0,837	3
v2	0,63	11
v3	0,693	10
v4	0,499	16

v5	0,817	5
v6	0,563	13
v7	0,889	2
v8	0,378	18
v9	0,512	14
v10	0,429	17
v11	0,932	1
v12	0,813	6
v13	0,73	8
v14	0,716	9
v15	0,291	20
v16	0,511	15
v17	0,769	7
v18	0,628	12
v19	0,82	4
v20	0,304	19

3.4 Matlab Software Calculation

V =

Columns 1 through 15

0.8368 0.6295 0.6934 0.4994 0.8174 0.5633 0.8893 0.3784 0.5124 0.4293 0.9319
0.8135 0.7303 0.7156 0.2905

Columns 16 through 20

0.5105 0.7689 0.6279 0.8203 0.3038

4. CONCLUSION

After going through a series of processes in determining a decision support system using the TOPSIS method, it can be concluded that this method can be applied to speed up work with the help of software. From the V values, it can be seen that V11 has the largest value, so it can be concluded that the 11th alternative will be selected. The authors are aware that in writing this journal there are still many errors. Therefore, the authors sincerely apologize. To further strengthen the research, development is certainly needed, for example by adding additional variables.

Acknowledgment

-

REFERENCES

[1] E. Ataei, “Application of TOPSIS and Fuzzy TOPSIS Methods for Plant Layout Design,” World Applied Sciences Journal, vol. 7, pp. 908–913, 2013.

[2] Harliana, “Design of a Decision Support System for Sub-Contractor Selection Using TOPSIS,” Citek Journal, vol. 1, pp. 89–101, 2014.

[3] U. Mara, “Application of the TOPSIS Method for Determining the Winner of a Storytelling Competition at the Secondary School Level,” Jutisi, vol. 5, no. 2, 2016.

[4] O. P. Utami, "Decision Support System for High School Major Selection Using Fuzzy Logic and Simple Additive Weighting Methods," Universitas Mulawarman, 2017.

[5] E. A. Tukan and J. Kennedy, "Student Achievement Decision Support System Using the TOPSIS Method," Konferensi Nasional Sistem Informasi, vol. 4, pp. 6–7, 2016.

[6] A. A. Chamid, "Application of the TOPSIS Method for Determining the Priority of House Condition," Simetris: Journal of Mechanical Engineering, Electrical and Computer Science, vol. 7, no. 2, 2016.

[7] D. W. T. Putra, S. Novia Santi, G. Y. Swara, and E. Yulianti, "TOPSIS Method in Decision Support System for Tourist Object Selection," Jurnal Teknolf, vol. 8, no. 1, 2020.

[8] S. Mallu, "Decision Support System for Determining Contract Employees to Become Permanent Employees Using the TOPSIS Method," Jurnal Ilmiah Teknologi dan Informasi Terapan, vol. 1, no. 2, 2015.

[9] I. Muzakkird, "Application of the TOPSIS Method for a Poor Family Decision Support System in Panca Karsa Village," Ilkom Jurnal Ilmiah, vol. 9, no. 3, 2017.

[10] Sri Kusumadewi, "Application of Fuzzy Logic for Decision Support Systems," Yogyakarta: Graha Ilmu, 2010.

[11] Rivanda Putra Pratama, "Decision Support System for Selecting Outstanding Students in Junior High School Using the VIKOR and TOPSIS Methods," vol. 3, no. 2, 2017.

[12] Sri Kusumadewi, Sri Hartati, Agus Harjoko, and Retantyo Wardoyo, Fuzzy Multi-Attribute Decision Making (Fuzzy MADM). Yogyakarta: Graha Ilmu, 2006.

[13] Kusrini, Concepts and Applications of Decision Support Systems. Yogyakarta: Andi, 2007.

[14] G. A. Wimatsari, G. D. Ketut, and W. B. Putu, "Multi-Attribute Decision Making for Scholarship Selection Using a Modified Fuzzy TOPSIS," International Journal of Computer Science, vol. 10, no. 1, 2013.

[15] D. Herawatie and E. Wuryanto, "Selection of Outstanding Diploma Students Using the TOPSIS Method," National Seminar on Information and Communication Technology, 2016.

[16] D. Novita, T. Herlambang, M. Tafrikan, K. Oktafianto, R. A. Sinulingga, and H. Arof, "Analysis of the Best Laptop Selection System Using Simple Additive Weighting (SAW) Method and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) Method," Nonlinear Dynamics and Systems Theory, vol. 24, no. 6, pp. 625–634, 2024.

[17] M. Y. Anshori, I. H. Santoso, T. Herlambang, M. Tafrikan, M. Adinugroho, K. Oktafianto, and A. A. Firdaus, "Analysis of Customer Satisfaction Survey on E-Wallets Using Simple Additive Weighting and TOPSIS Methods," Nonlinear Dynamics and Systems Theory, vol. 24, no. 1, pp. 28–40, 2024.