

IMPLEMENTATION OF ARAS ALGORITHM ON DECISION SUPPORT SYSTEM TO DETERMINE THE BEST LECTURER

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Abstract— In the world of higher education, lecturers are one of the main components in building quality and quantity. Good quality will give good results as well, to improve the quality of each lecturer, it is necessary to have an award given to lecturers from the campus so that it becomes a motivation for lecturers to improve the quality given to students and the community. AMIK Mitra Gama is a private campus located in the Duri Riau area, in this case to improve the quality of education one of the steps taken is to give awards and appreciation to the best lecturers who will be selected every year. To realize this, we need an easy calculation system that is carried out in the form of ranking according to the final value, therefore a decision support system using the ARAS method is chosen because it is very appropriate for the selection process and provides convenience in the calculations which are determined based on ranking. The decision support system using the ARAS method uses 8 criteria that are set as a reference in determining the best lecturers, namely Recent Education, Lecturer Functional Position, Lecturer Certification, Number of Journal Publications, Roles in Research, Journal Publication History, Research Grants, and Community Service. There are 10 lecturers in the field of computers who will be used as alternative data with lecturer codes D01, D02, D03, D04, D05, D06, D07, D08, D09, D10. The results obtained from this study are the lecturer code D04 = 0.0974, D06 = 0.0965, D09 = 0.0932, D07 = 0.0903, D03 = 0.0901 was selected as the best lecturer in 2021/2022. So that the results of this study can help the campus to determine the best lecturers every year fairly and be selected based on rankings.

Keywords: decision support system, additive ratio assesment, lecturer, AMIK mitra gama.

Intisari— Dalam dunia pendidikan perguruan tinggi, dosen merupakan salah satu komponen utama dalam membangun kualitas dan kuantitas. Kualitas yang baik akan memberikan hasil yang baik pula, untuk meningkatkan kualitas setiap dosen perlu adanya penghargaan yang diberikan kepada dosen dari pihak kampus agar menjadi motivasi para dosen meningkatkan kualitas yang diberikan kepada mahasiswa/i serta masyarakat. AMIK Mitra Gama merupakan kampus swasta yang berada di daerah Duri Riau, dalam hal ini untuk meningkatkan mutu pendidikan salah satu langkah yang dilakukan adalah pemberian penghargaan dan apresiasi kepada dosen terbaik yang akan dipilih setiap tahunnya. Untuk merealisasikan hal ini maka dibutuhkan sebuah sistem perhitungan yang mudah dan dilakukan dalam bentuk perangkingan sesuai nilai akhir, maka dari itu dipilih sebuah sistem pendukung keputusan menggunakan metode ARAS karena ini sangat tepat untuk proses pemilihan serta memberikan kemudahan dalam perhitungannya yang ditentukan berdasarkan rangking. Sistem pendukung keputusan menggunakan metode ARAS ini menggunakan 8 kriteria yang ditetapkan sebagai acuan dalam menentukan dosen terbaik yaitu Pendidikan terakhir, Jabatan Fungsional Dosen, Sertifikasi Dosen, Jumlah Publikasi Jurnal, Peran Dalam Penelitian, Riwayat Publikasi Jurnal, Hibah Penelitian, dan Pengabdian Masyarakat. Terdapat 10 dosen bidang komputer yang akan dijadikan sebagai data alternatif dengan kode dosen D01, D02, D03, D04, D05, D06, D07, D08, D09, D10. Hasil yang diperoleh dari penelitian ini adalah kode dosen D04 = 0,0974, D06 = 0,0965, D09 = 0,0932, D07 = 0,0903, D03 = 0,0901 terpilih sebagai dosen terbaik pada tahun 2021/2022. Sehingga dengan hasil penelitian ini dapat membantu pihak kampus untuk melakukan penentuan dosen terbaik setiap tahunnya dengan adil dan dipilih berdasarkan perangkingan.

Kata Kunci: sistem pendukung keputusan, additive ratio assesment, dosen, AMIK mitra gama.



INTRODUCTION

Lecturers are scientific teaching staff who have responsibility for implementing the Tri Dharma of Higher Education, which include: Teaching, Research and Community Service, as in Law Number 14 of 2005 which contains Teachers and Lecturers, Lecturers are designated as expert instructors and researchers with the main task of changing, creating, and disseminating knowledge, innovation, and expression through education, examinations, and local administration (Law No. 14 of 2005)[1].

College is an optional final stage in formal education, in this case it can be delivered in the form of universities, colleges, colleges, seminaries, music schools, and institutes of technology [2].

In every institution of higher education, whether in the form of universities, institutes, or colleges, it is necessary to evaluate the performance of the best employees, in this case the lecturers. This assessment is carried out to determine the effect of lecturers' teaching on students, because lecturers are the main focus in the transformation of knowledge provided by educational institutions to their students.

AMIK Mitra Gama is a private university located in the Duri area of Riau. As a campus education provider, AMIK Mitra Gama conducts performance assessments of lecturers. This is done in order to motivate lecturers in improving services to students and the community.

In determining the best lecturers, it is necessary to have a criterion or limitation that can be a reference in the selection and ranking as the best alternative in decision making. These criteria are taken from the lecturer performance load (BKD) which will then be expanded with several supporting sub-criteria. There are 4 main criteria, namely educational and teaching activities, research activities, service activities, and supporting activities [3].

Decision support system (DSS) is a system that is able to provide decision recommendations using several criteria determined through the method process in the decision-making system, namely AHP, SAW, ARAS and others. In the managerial world, the application of DSS in the decision-making process has been widely applied. Decision making using a decision support system with a value approach [4].

Additive Ratio Assasment (ARAS) method is one of the methods used in DSS based on multi-criteria with a ranking concept that uses the utility degree, namely by comparing the overall index value of each alternative to the overall index value of the optimal alternative [5]. The use of the ARAS method in decision making will be easier because

the ARAS method in general does a lot of ranking by comparing it with other alternatives so as to get more accurate results [6]. In contrast to other methods that are also used in DSS, namely the simple additive weighting (SAW) method which in its application requires two criteria, namely the benefit criteria and the cost criteria[7] which must then be reprocessed before the ranking results are obtained. In addition, there is also the Technique for Order Preference by Similarity to Positive Ideal (TOPSIS) method which in its application uses two kinds of solutions, namely positive ideal solutions and negative ideal solutions. Which will be the basis for consideration to find the best alternative decision by looking at the smallest distance of the positive solution and the largest distance of the negative solution[8].

The ARAS method performs the maximum summation of all criteria so that with one addition all variables can get accurate ranking results, this is what makes the ARAS method often used in decision support systems due to accurate variable determination and efficient results for one addition.

The ARAS method has been applied in research on a decision support information system for assessing lecturer performance which is designed using the PHP and MySQL programming languages as the database with alternative results that can be used as a reference in determining lecturer performance[9]. ARAS is also used in making lecturer performance appraisal applications as the main method for determining objective criteria and alternative data and can speed up the calculation process [10].

In a previous study entitled the application of the ARAS method in the assessment of the best teachers, the ARAS ranking method to obtain the results of the Best Teacher assessment was more targeted because the ranking process in the assessment was based on criteria and weighted calculations [11]. The ARAS method was also applied in a study entitled acceptance of non-cash food aid, with the aim that the beneficiaries are selected accurately and on target [12]. Decision support systems can also be applied in selecting the best high school and vocational schools [13].

A decision support system has also been implemented in the provision of rewards and punishments for bank bri employees as an effort to improve the performance of its employees [14]. The decision support system using ARAS was also carried out in the selection of the best military police [15] and the best danru chairman [16]. In previous studies to determine the best housing based on conditions and location, a decision-making system using the ARAS method was also carried out [17]. The results obtained from this study are not absolute but are in the form of an assessment based

on the weight of the criteria that have been determined and the alternatives ranked from the highest to the lowest value [18]. ARAS is a method in a decision-making system that has a utility to a function value so that efficient results are obtained on a number of feasible alternatives. ARAS is also used in the ranking method because it has an optimization value[19].

By making a decision support system using ARAS in determining the best lecturers on the AMIK Mitra Gama campus, it aims to be a lecturer reference in increasing creativity in conveying knowledge to students. As well as being a benchmark for institutions in improving the quality of education and curriculum on campus.

MATERIALS AND METHODS

The stages in research using the ARAS algorithm on a decision support system to determine the best lecturers are as follows:

1. Identifying problems, namely problems found when making decisions in determining the best lecturers on the AMIK Mitra Gama campus in accordance with the information and data obtained.
2. Analyzing the problem, namely the problem found in determining the best lecturer and then analyzing it.
3. Data collection, namely collecting data needed for research needs by means of observation, literature and interviews.
4. Establish criteria, namely to be a reference in the calculation process using the ARAS method in determining a decision.
5. Data analysis, namely the data that has been obtained will be managed and from the data can also be given a weight for each criterion.
6. Implementation of ARAS in order to obtain the best results in determining a decision.
7. Alternate ranking, which is to carry out a ranking process in order to get the highest value from all alternative data.
8. System evaluation, namely conducting a system evaluation process with accuracy to be a comparison between the actual data and the data resulting from the calculation of the ARAS method.
9. Conclusion, which is to draw a conclusion on the data that has been analyzed and processed previously so as to produce an accurate decision in this research.

The data used by the author in this study was sourced directly from the AMIK Mitra Gama campus which was obtained by direct observation. The data used as a reference in this study is a list of the names of lecturers in the field of computers at the AMIK

Mitra Gama campus. There are 10 lecturers who will be implemented in the ARAS method for the calculation process based on the criteria that have been set in determining the best lecturers.

Techniques in data collection used by the author are:

1. Observation, the writer collects data from the object of research directly by observing and visiting the campus of AMIK Mitra Gama.
2. Literature study, namely the author approaches using several references such as journals and books related to the research topic.
3. Interviews, namely the authors conduct direct discussions with the relevant campus parties to be able to obtain the necessary information as research material.

The following are the steps in the calculation using the ARAS method:

1. Formation of Decision Making Matrix.

$$X = \begin{bmatrix} X_{01} & \dots & X_{0j} & \dots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \dots & X_{ij} & \dots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \dots & X_{mj} & \dots & X_{mn} \end{bmatrix}$$

$$i = \overline{0, m}; j = \overline{1, n}; \dots \dots \dots (1)$$

Which one :

- m = number of alternatives
- n = number of criteria
- X_{ij} = performance value of alternative *i* against *j*
- X_{0j} = optimum value of criteria

2. Normalization of Decision Making Matrix for all criteria.

$$X = \begin{bmatrix} X_{01} & \dots & X_{0j} & \dots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \dots & X_{ij} & \dots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \dots & X_{mj} & \dots & X_{mn} \end{bmatrix}$$

$$i = \overline{0, m}; j = \overline{1, n}; \dots \dots \dots (2)$$

$$X_{ij} = \frac{X_{ij}}{\sum_{i=0}^m X_{ij}} X_{ij} \dots \dots \dots (3)$$

If the proposed criteria have a minimum value, then for the normalization process there are 2 stages, that is :

$$X_{ij} = \frac{1}{X_{*ij}} ; X_{ij} = \frac{X_{ij}}{\sum_{i=0}^m X_{ij}} X_{ij} \dots \dots \dots (4)$$

3. Determine the matrix weights that have been normalized in stage 2.



$$\sum_{j=1}^n W_j = 1 \dots\dots\dots(5)$$

4. Determine the optimum function value.

$$S_i = \sum_{j=1}^n X_{ij} ; i = o, m \dots\dots\dots(6)$$

S_i is the overall index value on the i -th alternative [20].

5. Set the rating level.

$$K_i = \frac{S_i}{S_0} ; i = \overline{o, m} \dots\dots\dots(7)$$

RESULTS AND DISCUSSION

1. Alternative Data

In making a decision system required data to be processed and referred to as alternative data (D1) as shown in Table 1 below.

Table 1. List of Computer Lecturers
AMIK Mitra Gama

No	Lecturer Code	Study program
1	D01	Informatics Management
2	D02	Computer Engineering
3	D03	Computer Engineering
4	D04	Informatics Management
5	D05	Informatics Management
6	D06	Computer Engineering
7	D07	Computer Engineering
8	D08	Informatics Management
9	D09	Informatics Management
10	D10	Informatics Management

2. Determining the Criteria and Weights

In determining the ranking of each of the available alternative data, the process of assigning a weight value is first carried out. To determine the weight value of each criterion (W1) can be seen in Table 2 below.

Table 2. Kriteria dan Nilai Bobot

No	Criteria (C _i)	Information	Score Weight (%)
1	C1	Last education	10
2	C2	Functional Position	15
3	C3	Lecturer Certification	20
4	C4	Number of Article Publications	15
5	C5	Role in Research	15
6	C6	Journal Publication History	10
7	C7	Research Grant	10
8	C8	Community dedication	5

In Table 2, it is explained that the initials (Ci) of the criteria are given along with a description of each criterion, then the weight and variable values are given for each criterion. For the last education criteria (C1) as shown in Table 3 below.

Tabel 3. Last Education Criteria (C1)

Variable	Parameter	Value Weight
S3	Very good	5
S2	Good	4

In Table 3 there are variables for the latest education criteria, namely Strata-3 (S3) and Strata-2 (S2). The weight value of each variable is 5 with very good parameters and 4 with good parameters.

Table 4. Functional Position Criteria (C2)

Variable	Parameter	Value Weight
Head Lecturer	Very good	5
Lecturer	Good	4
Expert Assistant	Pretty good	3

In Table 4 there are criteria for functional positions with 3 variables, namely Head Lector, Lector, and Expert Assistant. The highest parameter is very good with a weight value of 5 and the lowest parameter is 3 with a weight value of 3.

Table 5. Lecturer Certification Criteria (C3)

Variable	Parameter	Value Weight
Already	Very good	5
Not yet	Good	4

In Table 5 there are criteria for lecturer certification. The weight value is 5 for those who have been certified by lecturers and the value is 4 for those who have not been certified by lecturers.

Table 6. Criteria for the Number of Journal Publications (C4)

Variable	Parameter	Value Weight
2 Titles / Year	Very good	5
1 Title / Year	Good	4
0 Titles / Year	Not good	2

In Table 6 there are three variables for the criteria for the number of journal publications, namely 2 titles/year, 1 title/year, and 0 titles/year. In this case, the variable determination is based on 1 academic year, namely 2021/2022 odd to 2021/2022 even. The highest weight value is 5 with very good parameters and the lowest weight value is 2 with less good parameters.

Table 7. Criteria for Roles in Research (C5)

Variable	Parameter	Value Weight
1st author	Very good	5
2nd author	Good	4
Author 3 to 5	Pretty good	3

In Table 7 there are criteria for the role in the study which has three variables, namely the 1st author, 2nd author, and 3rd author to 5. In this case the determination of variables is based on 1 academic year, namely 2021/2022 odd to 2021/2022 even. For the highest weight value is 5 and the lowest weight value is 3.

Table 8. Criteria for Article Publication History (C6)

Variable	Parameter	Value Weight
International Journal	Very good	5
Accredited National Journal	Good	4
National Journal	Pretty good	3

In Table 8 there are criteria for journal publication history which has three variables, namely international journals, accredited national journals, and national journals. The highest weight value is 5 with very good parameters and the lowest weight value is 3 with quite good parameters.

Table 9. Research Grant Criteria (C7)

Variable	Parameter	Value Weight
Ministry of Education and Culture	Very good	5
Local Government / University	Good	4
Nothing	Not Good	2

In Table 9 there are research grant criteria which have three variables, namely Kemdikbudristek, local government/university, and none. In this case the variable is based on 1 academic year, namely 2021/2022 odd to 2021/2022 even. For the highest weight value is 5 with very good parameters and the lowest weight value is 2 with less good parameters.

Table 10. Criteria for Community Service (C8)

Variable	Parameter	Value Weight
National	Very Good	5
Local / Regional	Good	4
Nothing	Not Good	2

In Table 10 there are criteria for community service which have three variables, namely national, local / regional, and none. For the highest weight value is 5 with very good parameters and the lowest weight value is 2 with less good parameters.

3. Determine the criteria and weight values

Step 1: formation of a decision matrix (*decision making matrix*)

Table 11. Decision Matrix

(D _i)	C1	C2	C3	C4	C5	C6	C7	C8
D00	4	4	5	5	5	4	5	4
D01	4	4	5	5	3	4	2	2
D02	4	4	5	4	3	4	2	4
D03	4	4	4	4	3	4	5	4
D04	4	4	5	5	4	4	5	2
D05	4	4	5	4	4	4	2	2
D06	4	4	5	5	5	4	2	4
D07	4	3	5	4	3	4	5	4
D08	4	3	4	4	3	4	5	2
D09	4	3	4	5	5	4	5	2
D10	4	3	4	5	5	4	2	2

For all criteria worth Max

In Table 11 there are 8 criteria, namely C1-C8 and 10 alternative data, namely D01-D10. D00 is an additional initialization for the criteria column with a max value taken from the highest value for each criterion.

Step 2: normalize the decision matrix for all criteria that have been scored.

$$X = \begin{bmatrix} 4 & 4 & 5 & 5 & 5 & 4 & 5 & 4 \\ 4 & 4 & 5 & 5 & 3 & 4 & 2 & 2 \\ 4 & 4 & 5 & 4 & 3 & 4 & 2 & 4 \\ 4 & 4 & 4 & 4 & 3 & 4 & 5 & 4 \\ 4 & 4 & 5 & 5 & 4 & 4 & 5 & 2 \\ 4 & 4 & 5 & 4 & 4 & 4 & 2 & 2 \\ 4 & 4 & 5 & 5 & 5 & 4 & 2 & 4 \\ 4 & 3 & 5 & 4 & 3 & 4 & 5 & 4 \\ 4 & 3 & 4 & 4 & 3 & 4 & 5 & 2 \\ 4 & 3 & 4 & 5 & 5 & 4 & 5 & 2 \\ 4 & 3 & 4 & 5 & 5 & 4 & 2 & 2 \end{bmatrix}$$

The matrix above is added from top to bottom of each row to get the results [44, 40, 51, 50, 43, 44, 40, 32].

After all the matrices are added up, then normalization of the matrix is carried out for all the criteria that have been determined. The results of each calculation of the decision matrix from criteria C1 to C8 are obtained with normalized results as follows:

0,0909	0,1000	0,0980	0,1000	0,1163	0,0909	0,1250	0,1250
0,0909	0,1000	0,0980	0,1000	0,0698	0,0909	0,0500	0,0625
0,0909	0,1000	0,0980	0,0800	0,0698	0,0909	0,0500	0,1250
0,0909	0,1000	0,0784	0,0800	0,0698	0,0909	0,1250	0,1250
0,0909	0,1000	0,0980	0,1000	0,0930	0,0909	0,1250	0,0625
0,0909	0,1000	0,0980	0,0800	0,0930	0,0909	0,0500	0,0625
0,0909	0,1000	0,0980	0,1000	0,1163	0,0909	0,0500	0,1250
0,0909	0,0750	0,0980	0,0800	0,0698	0,0909	0,1250	0,1250
0,0909	0,0750	0,0784	0,0800	0,0698	0,0909	0,1250	0,0625
0,0909	0,0750	0,0784	0,1000	0,1163	0,0909	0,1250	0,0625
0,0909	0,0750	0,0784	0,1000	0,1163	0,0909	0,0500	0,0625

Step 3: Determination of normalized weights by means of matrix multiplication as in step 2. The weights used for The multiplication in step 3 is **0,1 , 0,15 , 0,2 , 0,15 , 0,1 , 0,1 , 0,05.**

The weight value used is obtained from Table 2 which was determined in the previous step. The results of all multiplication can be seen from the following matrix:

0,0091	0,0150	0,0196	0,0150	0,0174	0,0091	0,0125	0,0063
0,0091	0,0150	0,0196	0,0150	0,0105	0,0091	0,0050	0,0031
0,0091	0,0150	0,0196	0,0120	0,0105	0,0091	0,0050	0,0063
0,0091	0,0150	0,0157	0,0120	0,0105	0,0091	0,0125	0,0063
0,0091	0,0150	0,0196	0,0150	0,0140	0,0091	0,0125	0,0031
0,0091	0,0150	0,0196	0,0120	0,0140	0,0091	0,0050	0,0031
0,0091	0,0150	0,0196	0,0150	0,0174	0,0091	0,0050	0,0063
0,0091	0,0113	0,0196	0,0120	0,0105	0,0091	0,0125	0,0063
0,0091	0,0113	0,0157	0,0120	0,0105	0,0091	0,0125	0,0031
0,0091	0,0113	0,0157	0,0150	0,0174	0,0091	0,0125	0,0031
0,0091	0,0113	0,0157	0,0150	0,0174	0,0091	0,0050	0,0031

Step 4: determine the value of the optimum function by summing each criterion value for each alternative obtained from the multiplication of the weight matrix. For the results of the matrix calculation of the optimum function values as follows:

From the results of the calculations that have been carried out, the results of the ranking levels of each alternative are obtained. The value of each rank is ordered from the highest to the lowest as in Table 12 below:

0,1040
0,0864
0,0865
0,0901
0,0974
0,0869
0,0965
0,0903
0,0832
0,0932
0,0857

Table 12. Rank Level

Lecturer Code	Score (K _i)	Rank
-	0,1040	-
D01	0,0864	8
D02	0,0865	7
D03	0,0901	5
D04	0,0974	1
D05	0,0869.	6
D06	0,0965	2
D07	0,0903	4
D08	0,0832	10
D09	0,0932	3
D10	0,0857	9

The results obtained from the overall value of the optimum function above if added up are **0,10000.**

Step 5: determine the highest ranking level of all existing alternative values by dividing by the alternative value 0 (D0). The results for the distribution are as follows:
0,1040. 0,0864. 0,0865. 0,0901. 0,0974. 0,0869. 0,0965. 0,0903. 0,0832. 0,0932. 0,0857.

All alternative data in Table 12 that have been processed using the ARAS method have different values (K_i). The results for determining the best lecturers for 2021/2022 based on the highest scores can be seen in Table 13 below:



Table 13. Highest - Lowest Ranking Results

Lecturer Code	Score (K _i)	Rank	Results
D04	0,0974	1	Best
D06	0,0965	2	Best
D09	0,0932	3	Best
D07	0,0903	4	Best
D03	0,0901	5	Best
D05	0,0869	6	-
D02	0,0865	7	-
D01	0,0864	8	-
D10	0,0857	9	-
D08	0,0832	10	-



Image 1. Criteria Data Page On Application



Image 2. The Best Lecturer Ranking Results Using the Application

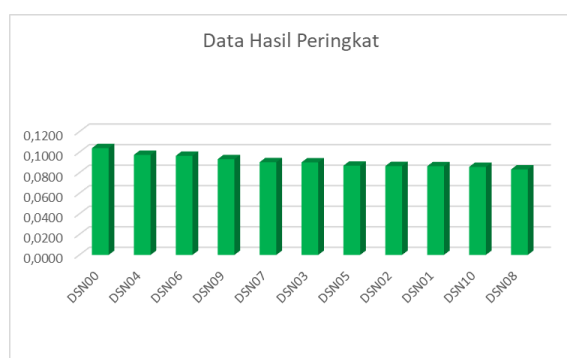


Image 3. Graph of Ranking Results

In Image 1, based on the Table of Best Lecturer assessment results in 2021/2022 based on the highest-lowest scores, there are 5 lecturers who got

the highest scores, namely **D04, D06, D09, D07, D03** who were selected as the best lecturers.

CONCLUSION

In this research, the decision support system to determine the best lecturer performs data analysis and calculation process using the ARAS method. The implementation of ARAS in this study is very helpful in determining the maximum and appropriate results based on the data that has been presented. There are 10 alternative data included in the calculation process, then there are 8 criteria used in this study. Based on the results obtained after using the tier method, there were 5 lecturers with the highest scores, namely D04 = 0.0974, D06 = 0.0965, D09 = 0.0932, D07 = 0.0903, D03 = 0.0901 was chosen as the best lecturer in 2021/2022. So with the results obtained from this research, it can help the campus in determining the best lecturers based on predetermined criteria with fast and objective calculations.

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