Application Decision Support System using PROMETHEE Method

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Abstract--- Decision making is a condition that must occur at various top management levels and sometimes interventions or conflict of interest occur in making decisions. Preference Ranking for Organization Method for Enrichment Evaluation (PROMETHEE) is a method that can be used to help decision makers in this case the best student selection decision at a university. Tests carried out using the PROMETHEE method can produce a complete ranking by eliminating the low value of each process in the PROMETHEE method and by develop application using programming language it's much faster to get decision.

Keywords--- Application DSS, Decision Support System, Promethee

I. Introduction

Determination of student pretensions is a matter that needs to be determined quickly and precisely. In terms of determining outstanding students, a number of considerations are needed that are quite numerous and complicated, namely standardization of values, requirements and policies of the university that change frequently every year. To obtain high-achieving and quality students in academics, the process of selecting students must determine the appropriate criteria and must be prepared to the maximum extent possible.

Because the selection process is still manual, so it is considered to be less than optimal and requires a considerable amount of time both in compiling the report and deciding the outstanding student must be determined as soon as possible to support the other system. To solve the above problems it is necessary to make a decision support system application to assist the university in selecting outstanding students.

Decision Support System[1]–[4] is used as an alternative application system that helps in making decisions for the determination of outstanding students. Decision making generally uses data and models to solve unstructured problems to be structured[5], so that the process of implementing student achievement can be done better. In making decisions there are several difficulties faced, including the various values that are processed, there are factors or criteria that influence the choices available[6], [7]. The process of determining student prescriptions is done for several classes that meet certain criteria including the problem of Multiple Criteria Decision Making (MCDM)[8]–[10] so that the settlement requires a Decision Support System. Another uniqueness of the Decision Support System is that there is a facility that is able to integrate the system installed with the user interactively, known as the dialog subsystem.

The method used in decision making is PROMETHEE (Preference Ranking for Organization Method For Enrichment Evaluation) method[11], [12]. This PROMETHEE method is a form of decision support model for decision making with various criteria and can be used to solve decision-making problems that rely on it as the main input. Decision support systems using the PROMETHEE method are able to analyze the criteria and alternatives that are compared and can provide alternative students with achievements that match the values and abilities of students.

II. Methodology

Decision making in an organization is the result of a continuous process of communication and participation of the entire organization[10]. The issue of decision making is basically a form of selection of various alternative actions that may be selected for which the process is through a certain mechanism, with the hope that it will produce the best decision. Preparation of a decision model is a way to develop logical relationships that underlie the problem of decision into a mathematical model, which reflects the relationship between the factors involved.
Decision Support Systems can provide benefits or benefits for the wearer[13]. Such benefits include:

a. Extending the ability of decision makers in processing data / information for users.
b. Helping decision makers in terms of saving the time needed to solve problems, especially various problems that are very complex and unstructured.
c. Provide solutions faster and the results are reliable.

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d. Although a Decision Support System, it may not be able to solve problems faced by decision makers, but it can be a stimulant for decision makers in understanding the problem. Because the decision support system is able to present various alternatives.
e. Decision Support Systems can provide additional evidence to provide justification so that it can strengthen decision-making positions.

Besides the various advantages and benefits as stated above, the Decision Support System also has a number of limitations, including:

a. There are several management abilities and human talents that cannot be modeled, so that the models in the system do not reflect the real problem.
b. The ability of a DSS is limited to the treasury of knowledge it has (basic knowledge and basic models).
c. The processes that can be performed by DSS usually depend also on the capabilities of the software it uses.
d. The decision support system does not have the intuition ability as possessed by humans. Because despite how sophisticated a DSS is, it is just a collection of hardware, software and operating systems that are not equipped with the ability to think.

PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation) is one of the methodologies in multi-criteria decision making[11], [14]. This methodology can be used to find the best alternative based on an assessment of several specified criteria. PROMETHEE is one of the rankings in the Multiple Criteria Decision Making. The definition of the PROMETHEE method is a method of determining the order (priority) in multi-criteria analysis. The main problem is simplicity, clarity, and stability. The presumption of the dominance of the criteria used in PROMETHEE is the use of values in outranking relationships. PROMETHEE functions to process data, both quantitative and qualitative data at once. Where all data is combined into one with the weight of the assessment that has been obtained through assessment or survey. The calculation steps with the PROMETHEE method are as.

a. Determination of alternative values from data.
b. Determine the type of preference function and preference value.
c. Calculation of preference index.
d. Calculation of preference direction is considered based on index values leaving flow, enter-flow and net flow.

$$\varphi(a1,a2)=\sum_{i-1}^{k}\pi \mathrm{P}_i(a1,a2);\forall\, a1\,a2\,\varepsilon A$$

III. Result and Discussion

The assessment process in determining students who have achieved so far is done manually. Assessment is done by using a percentage for each student without regard to the activities that each of the criteria has.

The value of each student to be accepted will be compared with the scores of other participants. The system does not have a certain standard value and the parameter values and weights for each of the free criteria are determined based on management conditions. The parameter value and the given weight state the priority order of criteria. The system only provides information on the results of the assessment in the form of ranking in ascending order.

Table 1. Sample Value

No	Criteria	C1	C2	C3	C4	C5	C6	C7	Total
1	A1	80	90	77	83	28	42	50	450
2	A2	80	75	75	85	32	53	60	460
3	A3	70	80	90	60	40	70	60	470
4	A4	70	89	78	69	30	54	90	480
5	A5	89	70	78	69	30	44	40	404
6	A6	66	70	71	89	29	66	40	431
7	A7	80	66	89	67	33	90	53	478
8	A8	90	81	77	65	32	76	88	509
9	A9	87	86	90	66	34	54	78	495
10	A10	78	68	80	76	33	89	55	479
11	A11	89	60	60	70	30	78	45	432
12	A12	75	75	83	70	31	65	76	475
13	A13	65	65	60	60	30	83	81	444
14	A14	70	79	64	67	32	91	59	462

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15	A15	70	89	90	66	35	97	69	516
16	A16	90	90	76	76	35	50	66	483
17	A17	87	78	60	70	31	90	54	470
18	A18	65	66	60	71	33	78	85	458
19	A19	66	76	60	72	32	96	56	458
20	A20	78	89	67	73	30	88	89	514

After the calculation process of the criteria values displayed in the table, the next step is to calculate the multi-criteria preference index, while the results of the sample data count are as follows:

$$\varphi(a1, a2) = \sum_{i-1}^{k} \pi \mathrm{P}_i (a1, a2); \forall\, a1\, a2\, \varepsilon A$$

The formula above is made in stages and displays the results of PROMETHEE based on the existing values, here is the PROMETHEE result table.

Table 2. PROMETHEE Result

No	**Alternative**	Value
1	A1	0,735
2	A2	0,685
3	A3	0,66
4	A4	0,679
5	A5	0,679
6	A6	0,62
7	A7	0,65
8	A8	0,70
9	A9	0,723
10	A10	0,67
11	A11	0,618
12	A12	0,658
13	A13	0,53
14	A14	0,644
15	A15	0,7
16	A16	0,739
17	A17	0,655
18	A18	0,59
19	A19	0,619
20	A20	0,675

Table 2 above shows the results of calculations using the PROMETHEE method and the highest value from the table A16 is an alternative alternative compared to other alternatives, for applications that implement the methods Promethee can be seen in Figures 1 to 3 below.

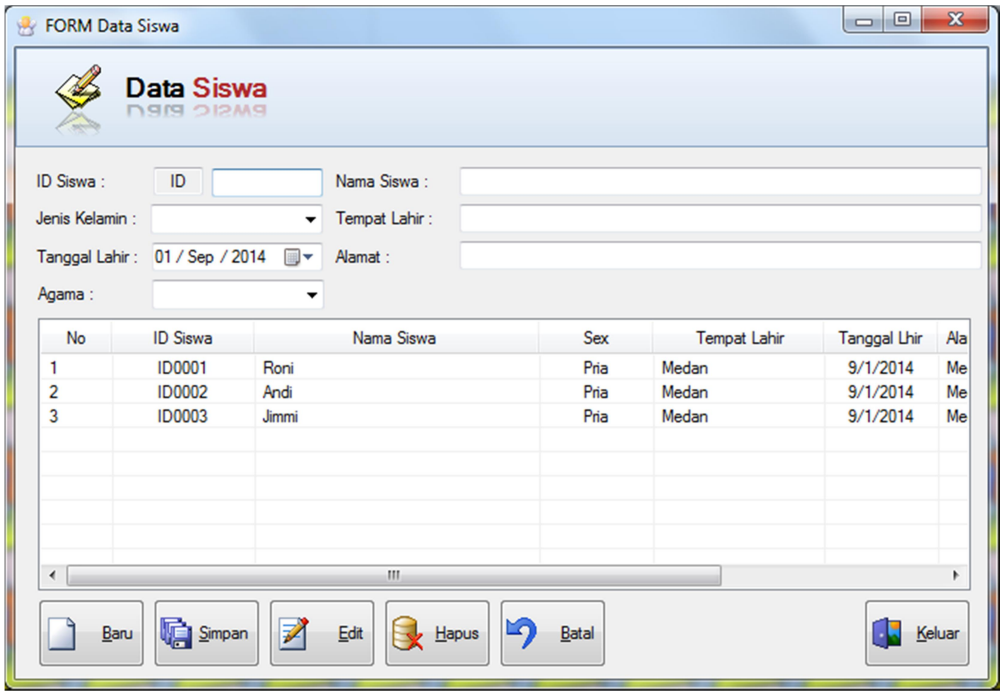

Figure 1. Master Student

Figure 1 is an interface that is used to input student data which will be processed using the PROMETHEE method, and in this data there's will be at least 20 sample data as in table 1.

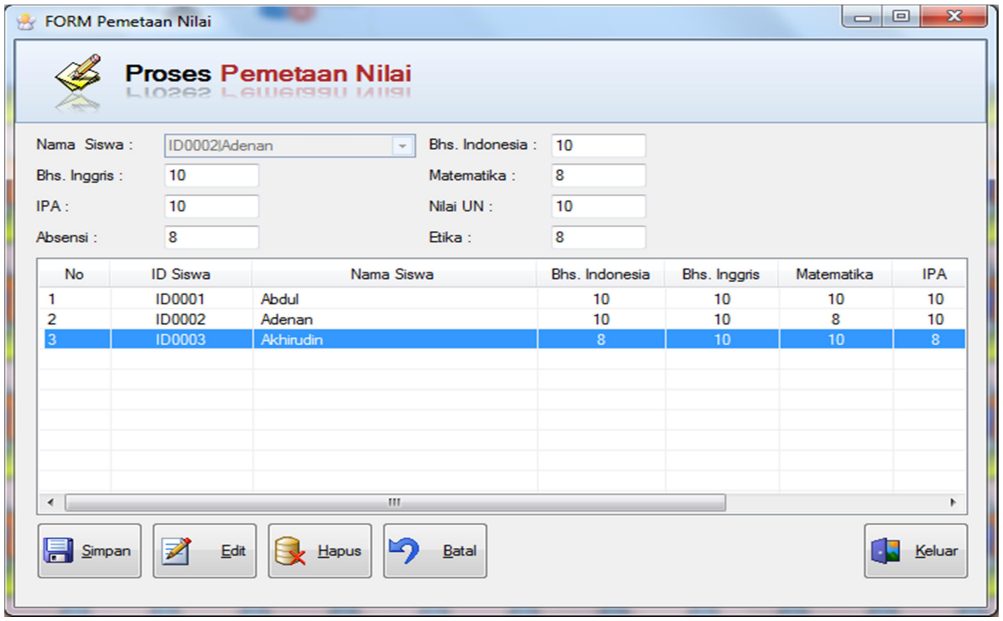

Figure 2. Mapping Value

Figure 2 is an interface that is used to input student value data which will be processed using the PROMETHEE method, and in this data there's will be at least 20 sample value as in table 1.

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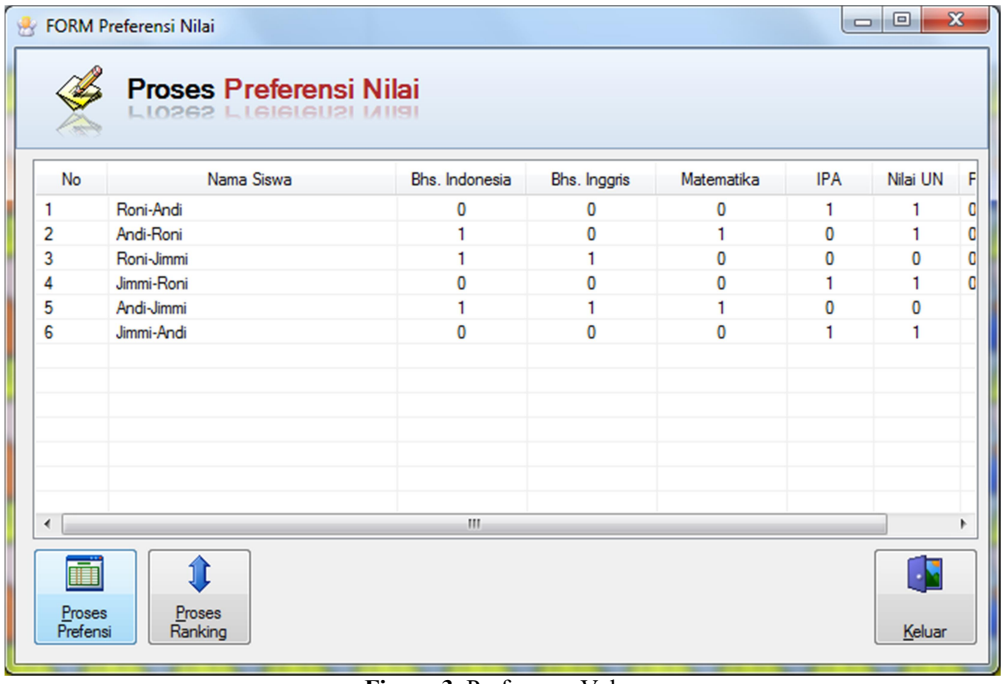

Figure 3. Preference Value

Figure 3 is the result of the preference calculation process by applying the PROMETHEE method and at the end of the process when all data samples are tested it will produce the same value as table 2.

IV. Conclusion

The PROMETHEE method that is used as a tool in determining student achievement can help management in making decisions. The PROMETHEE method is not the only method that can be used as a support for decision making and this method can be combined with other methods so that the results are better and more accurate.

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