



Fuzzy Logic Inference System for Determining The Quality Assesment of Student's Learning ICT

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Abstract

The Assesment that held in the school is one of the learning process in education who do it by teacher. One of the course that examined is Computer Application. In the computer application have 3 topic, they are Microsoft Word, Microsoft Excel, Microsoft Power Point. The assesment for student's at politecnic about learning computer application have 3 criteria in the selection. First of all, the students have ability to operate computer system generally, it has understanding the formula on microsoft excel, the students have skill toward any application. In this study, fuzzy logic used for determining the quality assesment of student's learning Information and Communication Technology (ICT) as a tools to analyze any constraint that are known as min-max method. As a result, we have found that the students have good for analyzing in the application from the each question or case of study when the course it has been examined.

Keywords: Assesment, Fuzzy Logic, Quality, Computer Application, Course

1. INTRODUCTION

The assesment is one of learning process in education. It is the last of phase when the lecturers would seen the learning achievement. Therefore, it means that learning were measured by lecturers as master of class when the course will the end. A lecturer will going to assesment toward students both in the class and the laboratory on the particularly a course. In the computer application assesment there are any factors in which influence to a result from during examination, such as behavioral intention, ability understanding a question that is showed, skill, ability to analyze, etc. Today the lecturers very difficult to find how many student have the best result after examination is finished.

However, the lecturers have the data about detail of a student when its contains fully number. In addition, for during assesment that have obcjet oriented standard of quality in the school, so that the lecturers might see the subjective factors. The behavioral student is one of subjective factor when they have good personal. In conclusion, the assesment is a the measuring achievement learning process both in the class and laboratory.

In this study, the material that will examined during assesment in the laboratory. There are operating system, microsoft word, microsoft power point, and microsoft excel. In addition, the examined will be completed by students for 2 hours; besides , both practical and theory will conducted.

2. METHODS

2.1. Fuzzy Logic

The Fuzzy logic was first introduced by Professor Lotfi A Zadeh of California University in June 1965 [14],[3],[7]. It is from generalization of classical logic that have two grade of membership, that is 0 and 1. The fuzzy sets "A" on the universe of "X" is expressed as a set of a sequence pair both discrete and continuous [7].

$$A = \{(x, \mu A(x)) | x \in X \quad (1)$$

There is $\mu A(x)$ as the membership function of fuzzy sets "A". The membership function maps each $x \in X$ at value between 0 and 1, so that is called membership grade, and and is denoted μ . The Fuzzy logic derived from fuzzy set, this is different from a set of assertive; where, an object can be a member or not a member (assertive the set)^(nelly).

The fuzzy set has two attributes[10],[6-7]. First of all, its naming the groups represent the state of the natural language (fast, normal, slow). Second, the value to be the size of variable like 34, 23,2 [5]. Furthermore, things that need to be considered are as follows:

1. Membership Function

The curve shows the mapping of points of data input into the membership value. It has interval 0 until 1[6].

2. Fuzzy Logic Operator

The first of all, AND operator (interception set) is the result of operation (α – predicate), and it to capture the smallest value between the elements of the set, and the is denoted as $\mu A \cap B = \min(\mu A[x], \mu B[y])$. Next, OR operator is union operation; where, its to capture smallest value between the elements of the set, and is denoted as $\mu A \cup B = \max(\mu A[x], \mu B[y])$. Another the fuzzy logic operator is NOT operator that is related set of complement, and is denoted as $\mu A' = 1 - \mu A[x]$.

In the fuzzy logic, membership function that is use triangular curve can be seen in Figure 1 and the curve representation the shoulder in Figure 2; besides, the triangle curve is the combine 2 lines in Figure 3. There is membership function as follow.

$$\mu [x] = \begin{cases} 0; & x \leq a \text{ or } x \geq c \\ \frac{x-a}{b-a} & a \leq x \leq b \\ \frac{c-x}{c-b} & b \leq x \leq c \end{cases} \quad (2)$$

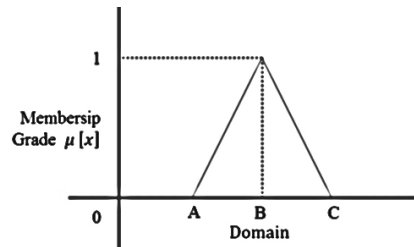


Figure 1. The membership function with the triangle curve

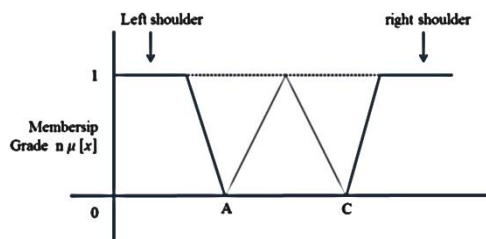


Figure 2. The membership function curve shoulder

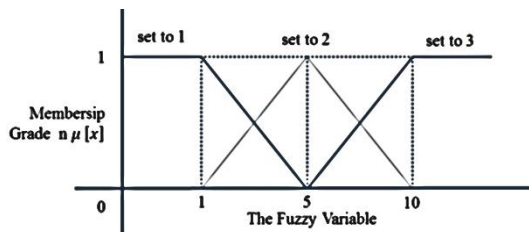


Figure 3. Triangular membership function curve, and curve of membership function shoulder

2.2. Mamdani Method

The Mamdani Method is known min-max method, it was introduced by Ebrahim Mamdani in the 1975. According to Sri Kusumadewi, to get output required four stages, namely:

a. Establishment Fuzzy Sets

In the Mamdani Method, both input and output variable divided into one or more of fuzzy sets can be seen in Figure 4.

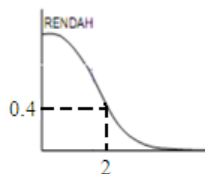


Figure 4. Establishment Fuzzy Sets [8]

b. Implication Function Application

In the Mamdani Method, implication function used is the minimum. The examples of process implications of the application functionality can be seen in Figure 5 [9].

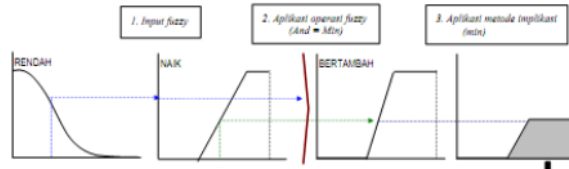


Figure 5. Application Function Minimum Implications [8]

c. The composition of rules

There are several methods that can be used in making the compositions of rules, namely max (maximum), additive, and probabilistic OR (Kusumadewi)

a) Max Method (Maximum)

In the max method, the solution of fuzzy sets are obtained by taking the maximum value rules. In general, it can written :

$$\mu_{sf} = [x_i] \leftarrow \max(\mu_{sf}[x_i], \mu_{kf}[x_i])$$

with

$$\mu_{sf}[x_i] = \text{nilaikeanggotaansolusifuzzysampaisatuanke} - i$$

$$\mu_{kf}[x_i] = \text{nilaikeanggotaankonsekuenfuzzysampaisatuanke} - i$$

b) Additive Method (Sum)

When the additive method is used, the solution of fuzzy sets are obtained by bounded-sum toward all output in fuzzy area. In general, it can written [8] :

$$\mu_{sf} = [x_i] \leftarrow \min(1, \mu_{sf}[x_i] + \mu_{kf}[x_i])$$

with

$$\mu_{sf}[x_i] = \text{nilaikeanggotaansolusifuzzysampaisatuanke} - i$$

$$\mu_{kf}[x_i] = \text{nilaikeanggotaankonsekuenfuzzysampaisatuanke} - i$$

c) Probabilistic Methods OR (probor)

In the probabilistic method OR (probor), the solution is obtained by means of fuzzy setsdo product of all output fuzzy area. Generally written [8-10]:

$$\mu_{sf}[x_i] \leftarrow (\mu_{sf}[x_i] + \mu_{kf}[x_i]) - (\mu_{sf}[x_i] * \mu_{kf}[x_i])$$

with

$$\mu_{sf}[x_i] = \text{nilaikeanggotaansolusifuzzysampaisatuanke} - i$$

$$\mu_{kf}[x_i] = \text{nilaikeanggotaankonsekuenfuzzyaturanke} - i$$

d) Assertions (defuzzification)

The composition of fuzzy rules to generate an output in the form of numbers in domain The fuzzy set. The are several methods that can be used for the defuzzify, among others [8].

2.3. Research Methodology

In this study, we have several steps methodology in order to support our research will be conducted. The several research methodology in which we have proposed as follows [1], [5], [9]:

a. Identification of Data

Identification of data will conducted by to determinant of variables that were needed in the calculating and analyze of problems. The assesment for ICT (Information and Communication Technology) on the laboratory, and including several point are ability to operate computer system, every student has understanding the formula on microsoft excel, the students have skill toward any application, the last it has behavioral during the examination.

b. Establishment of Fuzzy Sets

In the method mamdani both input variables and output variables divided into one or more fuzzy sets.

c. Implication Function Application

In mamdani method, application functions used for each - each rule is a function Min.

d. Defuzzy

The process of affirmation of (defuzzyfication) using statistical software matlab using the facilities provided on the toolbox fuzzy [12-14].

3. RESULTS AND DISCUSSION

3.1. Collecting and processing data

In this study, the data which were collected includes assesment data that already examined such as microsoft word, microsoft excel, microsoft power point, and operating system in Augustust 2016. These data also are collected both in the class and the laboratory with different of time. We have taken some of sample as many as 20 students, and each sample will represented the subject. There are the data assesment in Table 1.

Table 1. Result Final Test on Assesment Computer Application

Subject	X			Y
	X1	X2	X3	
1	79	69	99	51
2	76	74	54	68
3	88	61	69	59
4	88	51	81	77
5	63	61	67	74
6	61	74	88	66
7	52	83	64	90
8	76	88	69	98
9	58	53	80	50
10	83	50	97	99
11	74	53	57	58

12	95	70	92	71
13	98	67	88	99
14	58	55	73	72
15	74	62	86	61

Description:

X1 : Microsoft Word

X2 : Microsoft Excel

X3 : Microsoft Power Point

Y : Operating System

Data processing was performed with determining the variables, the rules of discourse and followed with forming a fuzzy sets. Determination of variables, and the rules of discourse can be collected on the table ,and on the table. The next step is a make membership function for each the variable X1, X2, X3, and Y as shown in Table 2 and Table 3.

Table 2. Fuzzy Variable and Rules of Discourse

Function	Variable	Rules Of Discourse	Notes
Input	X	30 – 95	Final test for Microsoft Office
	Y	25 – 90	Final test for Operating System
Output	Z	0 – 100	The quality assesment result

Table 3. Fuzzy Sets

Function	Variable	Fuzzy Sets Name	Rules Of Discourse	Domain Unit
Input	X	Less	[30 – 95]	30 – 60
		Moderate		50 – 80
		Good		60 – 95
	Y	Less	[25 – 90]	25 – 53
		Moderate		50 – 70
		Good		55 – 90
Ouput	Z	Less	[0 – 100]	0 - 60
		Moderate		30 – 70
		Good		40 – 100

There are several rules in which would identified related assesment, and this indicated as achievement at the particular courses who were followed by the students, they are as follow [13]:

- If (Microsoft Office (X) is Less) and (Operating System (Y) is Less) then (Quality(Z) is Less)
- If (Microsoft Office (X) is Less) and (Operating System (Y) is Moderate) then (Quality(Z) is Less)
- If (Microsoft Office (X) is Less) and (Operating System (Y) is Good) then (Quality(Z) is Moderate)
- If (Microsoft Office (X) is Less) and (Operating System (Y) is Moderate) then (Quality(Z) is Moderate)

- e. If (Microsoft Office (X) is Less) and (Operating System (Y) is Good) then (Quality(Z) is Good)
- f. If (Microsoft Office (X) is Less) and (Operating System (Y) is Good) then (Quality(Z) is Less)
- g. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Less) then (Quality(Z) is Less)
- h. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Less) then (Quality(Z) is Moderate)
- i. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Moderate) then (Quality(Z) is Moderate)
- j. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Good) then (Quality(Z) is Moderate)
- k. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Good) then (Quality(Z) is Good)
- l. If (Microsoft Office (X) is Moderate) and (Operating System (Y) is Good) then (Quality(Z) is Less)
- m. If (Microsoft Office (X) is Good) and (Operating System (Y) is Less) then (Quality(Z) is Less)
- n. If (Microsoft Office (X) is Good) and (Operating System (Y) is Moderate) then (Quality(Z) is Moderate)
- o. If (Microsoft Office (X) is Good) and (Operating System (Y) is Moderate) then (Quality(Z) is Good)
- p. If (Microsoft Office (X) is Good) and (Operating System (Y) is Good) then (Quality(Z) is Moderate)
- q. If (Microsoft Office (X) is Good) and (Operating System (Y) is Good) then (Quality(Z) is Good)

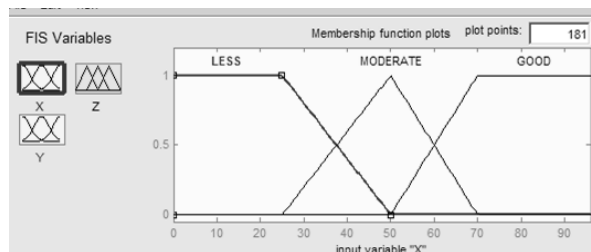


Figure 6. Membership function X

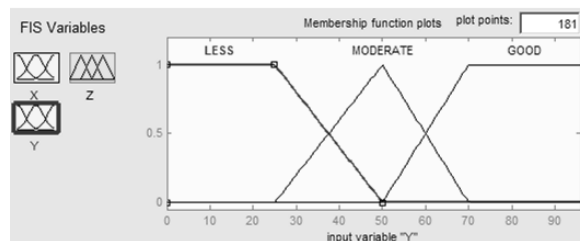


Figure 7. Membership function Y

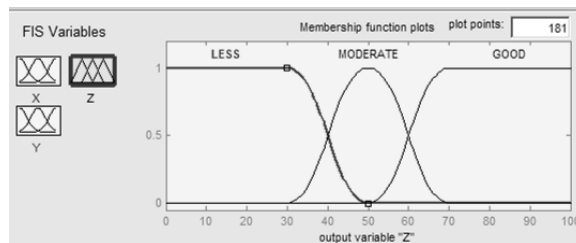


Figure 8. Membership function Z

The Figure 6, and the Figure 7 indicates the set each variable input as criteria assessment, and Figure 8 describes the output generated from two input variabel set.

4. CONCLUSION

All step in this study about fuzzy logic that discussed, and analyze its had the case of examination in the lab with course on computation mastery been done. As a result, this study will provides the statement namely: most the students have a good for achievement in computation course especially the microsoft office that can be shown by final examination. In addition, the assesment that the fuzzy logic can to clasified the degree of achievement of learning outcomes. The next research, this study include the method that discussed assesment topic, it will considered to rating as the development in the fuzzy logic as well as recomendation system with their collaboration.

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