# Analyzing Motivation of Private Engineering College Students: A Fuzzy Logic Approach

(A case study of private Engineering College)

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***Abstract*—A method for analyzing and comparing group of students motivation using fuzzy logic is proposed. A fuzzy inference system is designed and implemented using Simulink in Matlab[19] with fuzzy statistical analysis to include: (i) The evaluation process becomes robust and consistent by reducing the degree of subjectivity of the evaluator; (ii) The self potentiality is highlighted by indicating individual distinctions and (iii) It provides the evaluators with an encouraging, stimulating, self reliant guide that emphasizes individual characteristics. Twenty Four subjects of two different disciplines were involved in this study and were evaluated between branches as well as between sex .**

***Keywords-component; Fuzzy Logic, Anxiety, Motivation, Defuzzification, Fuzzification of variables, Fuzzy Inference System, Simulation***

## I. INTRODUCTION

A Educational Psychology is a field where we try to apply principles of Psychology in educational field to get some constructive outcomes. For Example: - When we wish to improve the performance of students or when we want students to have a brighter outlook etc. education contains both a psychological & social dimension. Present day education system puts lot of pressure on students to perform well. "Competitive world" is the phrase we hear all day & almost by everyone. So, in this tough scenario to perform well is also a huge task for students. Keeping in mind the family pressure & pressure from society & also individual's desire to perform well makes him a boiling pot.

All these factors sum up to create an environment full of tension, anxiety, fear & stress, around the students. As the anxiety comes into the picture, so comes the motivation. Now, the relationship between anxiety & motivation is not so simple. If Anxiety is too low or too high it will not produce the adequate amount of Motivation & the results will not be favorable. Anxiety of certain level will only motivate students to perform well.

Anxiety is a psychological and psychological state characterized by cognitive, somatic, emotional, and behavioral components[2]. These components combine to create an unpleasant feeling that is typically associated with uneasiness, apprehension, fear or worry. Anxiety is a generalized mood condition that can often occur without an identifiable triggering stimulus. As such, it is distinguished from fear, which occurs in the presence of an observed threat. Additionally, fear is related to the specific behaviors of escape and avoidance, whereas Anxiety is the result of threats that are perceived to be uncontrollable or unavoidable [1].

Motivation is the activation or energization of goal-oriented behavior. Motivation is said to be intrinsic or extrinsic. The term is generally used for humans but, theoretically, it can also be used to describe the causes for animal behavior as well. This article refers to human motivation. According to various theories, motivation may be rooted in the basic need to minimize physical pain and maximize pleasure, or it may include specific needs such as eating and resting, or a desired object, hobby, goal, state of being, ideal, or it may be attributed to less-apparent reasons such as altruism, selfishness, morality, or avoiding morality. Conceptually, motivation should not be confused with either volition or optimism [2].

In everyday discussion, the uses of imprecise and vague terms like "It is a cold day" or "You are very good" or "The tall guy over there" are usually heard. The words such as cold, very good, and tall have no clear boundaries. Each individual has their own interpretations of the meaning [9]. Thus, for some people, good in examination implies a total mark above 70 percent while for others, it may be 55 percent. [8] Kantardzic tossed a slightly different example of vague phenomena in the real world. Rain is a common natural phenomenon that is difficult to describe precisely since it can rain with varying intensity, anywhere from a light shower to heavy downpour. Since the word rain does not adequately or precisely describe the wide variations in the amount and intensity of any rain event, rain is considered a vague phenomena. Very often, the concepts in the human brain for perceiving, recognizing, and categorizing natural phenomena are also vague and imprecise. The boundaries of these concepts are not clearly defined. Therefore, the judging and reasoning that emerge from them also become vague. In struggling to find a way of expressing succinctly the idea of vagueness in life Zadeh [10] proposed the idea of fuzzy sets.

### *A. The Fuzzy Logic Theory*

Fuzzy logic is an extension of Boolean logic which allows intermediate values between True and False. As in Boolean logic a true statement is expressed by the value "1" and a false statement by the value "0". However, unlike in probability theory, the value must not be interpreted as a confidence level but rather as a Membership Function (MF). Therefore, every statement is "True" to a certain degree and "False" to another. An interesting property of these MFs is that, because they vary between zero and one, they can be manipulated like probabilities; even though they are interpreted [11].

Psychology is not only a field in which profound applications of fuzzy logic are anticipated, but is also very important for the development of fuzzy set theory itself [11]. The interest of psychologist in fuzzy logic has visibly been growing since mid-1980s [12].

Earlier few models of personality traits were developed that included, introverted, extroverted, open, sensitive, realistic, selfish, hostile and fuzzy logic based adaptive model of emotions [13].

A new analytical method [4] for psychological research was proposed. In this paper study was done on 12 players of volleyball, basketball & football. Motivation level of players was compared between traditional method & fuzzy logic approach. For traditional method they were using Tripathi N.K.M. & Tripathi L.B.[14]. The empirical results demonstrated that the new approach is efficient and more realistic than the traditional method. To demonstrate the effectiveness and advantages of the new method, the results were presented in comparison to those obtained with the help of the traditional method.

The traditional achievement marks and the Fuzzy Logic Theory-based achievement marks of students were calculated and compared in the research by Cetin Semerci [6]. In this study, the traditional success grades of the students attending the Faculty of Education, University of Firat were calculated and compared with their success grades based on the fuzzy logic theory. In conclusion, a meaningful difference was found in favor of the fuzzy logic theory when traditional success grades and the success grades based on the fuzzy logic theory were compared. According to the study results, the positive effects of the fuzzy logic theory are as follows:

1. Applications of the fuzzy logic keep students active.
2. The fuzzy logic theory provides learning in depth.
3. The fuzzy logic theory diminishes examination anxiety.
4. The fuzzy logic theory provides a detailed measurement and evaluation.
5. The fuzzy logic theory enables a homogenous distribution by increasing the average success in classroom.

The fuzzy logic in the study of human behavior was used by [4] & [6] etc and was that much of the Information obtained by questionnaire due to uncertain in nature. Uncertainty in the Data that are related leads to the notion of imprecision. Using fuzzy data instead of raw data has an advantage of reducing uncertainty. According to them fuzzy logic approach gave clarity in results. According to the fuzzy logic theory, everything is a matter of degree and the central concept of this theory is the fuzzy sets. These fuzzy sets can be applied in education [6]. Because the point of view for cases in education is not like the logic 0-1. In this study we also found that success grades calculated by fuzzy logic give more accuracy than traditional method.

Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. The process of fuzzy inference involves all of the pieces that are described in the previous sections: Membership Functions, Logical Operations, and If-Then Rules. You can implement two types of fuzzy inference systems in the toolbox: Mamdani-type and Sugeno-type. These two types of inference systems vary somewhat in the way outputs are determined.

Simulink is a graphical extension to MATLAB for the modeling and simulation of systems. In Simulink, systems are drawn on screen as block diagrams. Many elements of block diagrams are available (such as transfer functions, summing junctions, etc.), as well as virtual input devices (such as function generators) and output devices (such as oscilloscopes). Simulink is integrated with MATLAB and data can be easily transferred between the programs.

### *B. About UPTU*

Uttar Pradesh Technical University (UPTU) was set up by the Government of Uttar Pradesh on May 8, 2000. According to the university's website, it is the biggest technical university in Asia. UPTU has 637 colleges under it. [3] UPTU is currently located in IET LUCKNOW campus in Capital of U.P.

The State Entrance Examination - Uttar Pradesh Technical University (SEE-UPTU) (formerly known as UPSEAT) is an annual college entrance examination in Uttar Pradesh for engineering, architecture, pharmacy and management courses. All institutions affiliated to UPTU admit students through centralized counseling of SEE-UPTU. The private institutions may, however, admit 15% of the total intake directly. The exam is conducted by the Uttar Pradesh Technical University.

### *C. About KIET*

The Krishna Institute of Engineering and Technology (KIET) is assumed to be one of the biggest emerging engineering institutes in the city of Ghaziabad. This year it is ranked second amongst all the colleges of UPTU. It is privately-owned Institution and aims towards preparing skilled engineers for the industries. The college is approved by the All India Council for Technical Education, AICTE, New Delhi, and is affiliated to the Uttar Pradesh Technical University,

Lucknow. All the seats of college are filled within 5000 rank. The average age of subjects ranges from 17 to 23 years.

KIET offers B. Tech. degree courses in five disciplines i.e., Computer Science and Engineering (CSE), Electronics and Communication Engineering, Electrical and Electronics Engineering (EN), Information Technology and Mechanical Engineering. But we have taken students of two branches Computer Science & Engineering, Electrical & Electronics Engineering.

In this paper we are applying fuzzy logic for comparison of motivation level of students of KIET. In the present study Twenty Four subjects (students) were involved in this study, twelve of them are Computer Science Engineering branch and Rest Twelve are of Electrical and Electronics Engineering branch. Out of each twelve subjects, six were boys & six were girls in both the sets. All the subjects are in the percentage range of 65% to 70% marks. We are conducting this study during their sixth semester, before and after the internal examination in the month of March 2010. We are comparing motivation level between these different branches (CSE & EN), as well as between boys and girls also.

The architecture of the fuzzy logic approach is shown in the Figure 1.

## II. OBJECTIVE

The objective of this investigation is three-fold:

(a) Is to illustrate Mamdani fuzzy inference for a set of fuzzy rules & simulate using Simulink in Matlab.
(b) To examine the comparison motivation level between two different branches (CSE & EN)
(c) To examine the comparison motivation level between boys and girls

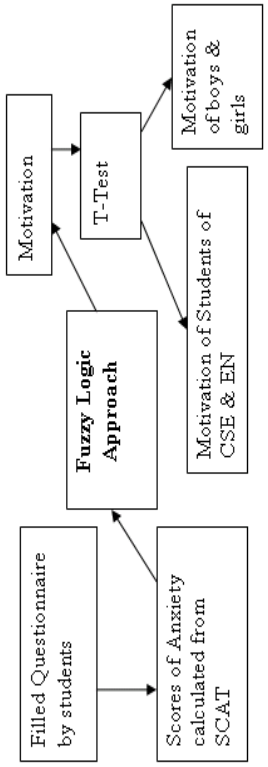


Figure 1. Schematic View of the Fuzzy Logic Approach applied

## III. METHODOLOGY

### A. *Subjects*

The participants are 24 students of B. Tech. IIIrd year (2009-2010 session), twelve of them are Computer Science & Engineering branch and rests Twelve are of Electrical & Electronics Engineering branch of KIET, Ghaziabad. Out of each twelve subjects, six were boys & six were girls in both the sets.

### B. *Research Instrument*

a. Sinha's Comprehensive Anxiety Test (SCAT) developed by Sinha & Sinha [15] to assess anxiety level of participants.
b. MATLAB 7.0 is used to design the Mamdani Fuzzy Inference System & simulation

### C. *Procedure*

Liaison with the students occurred one week prior to testing. During this period, a verbal consent of the students was received later; a written consent explaining the aims of the research was given to provide information.

A Fuzzy Inference System is designed in Matlab with one input (Anxiety) and one output (Motivation). Anxiety has five membership functions(Fig. 1). Each membership function represents a linguistic variable. For Anxiety linguistic variables for membership functions are: very low, low,

moderate, high, very high. Output variable Motivation has three membership functions: low, moderate, high (Fig. 2).

We have two sets of SCAT Questionnaire filled by the students. The students completed the Questionnaire in half an hour. One is filled before the start of sessional exams held from 4th March 2010 to 6th March 2010 and the other one was filled after the sessional exams. Each questionnaire contains 90 questions. Each question has two options yes and no. According to SCAT for each yes, we count 1. Total number of yes is the anxiety level of the student. Further, Anxiety is fuzzified with the help of triangular shaped membership functions shown in Fig. 2 (see Annexure 1). The function name is trimf which is used for triangular shaped member function. The degree of support is used to shape the output fuzzy set. The consequent (Motivation) of fuzzy rule assigns an entire fuzzy set to the output. This fuzzy set is represented by a membership function that is chosen to indicate the linguistic values. In general one rule is not effective. So that Nine rules are designed in this system. The output of each rule is a fuzzy set. The output fuzzy sets for each rule are then aggregated into a single output fuzzy set (Annexure 2). Finally the resulting set is defuzzified, or resolved to a single number (see Table II). Fuzzy Inference Systems shows how the whole process works from beginning to end for a particular type of fuzzy inference system called a Mamdani type.

We also simulate the fuzzy inference system using Simulink. In this we use the fuzzy toolbar in Simulink. We design the model using the fuzzy controller with ruleviewer. The result of simulation is shown in Annexure.

The t-test for comparing the motivation level of the students of two branches (CSE & EN) and boys & girl's students was used. In simple terms, the t-test compares the actual difference between two means in relation to the variation in the data (expressed as the standard deviation of the difference between the means).

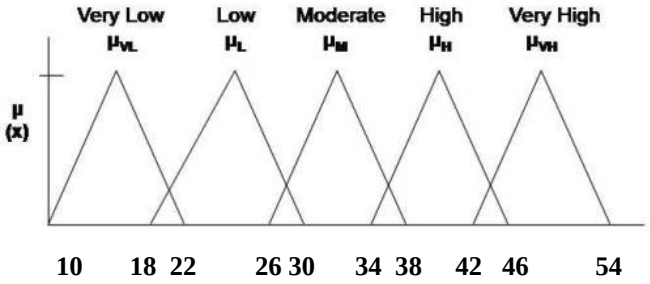


Figure 2. Fuzzy Sets for Anxiety

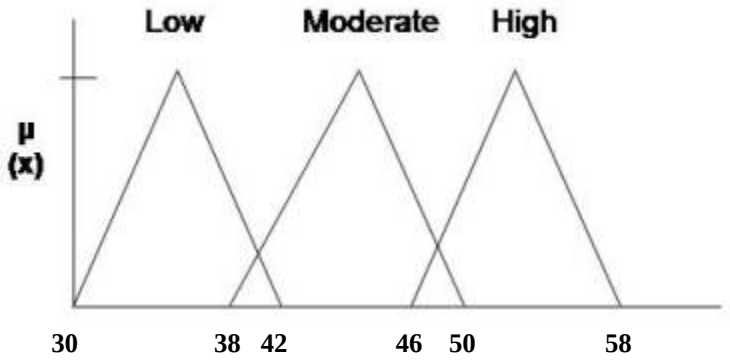


Figure 3. Fuzzy Sets for Motivation

Every member will be attached to a set of numerical value between 0 and 1 called membership grade in the fuzzy set.

In the above model anxiety and motivation are treated as the state fuzzy variable. Fuzzifications of variables lie under the trade off between precision in renewed decision and computation time. Each of the system states that fuzzy variables are decomposed into a reasonable number of fuzzy regions [7]. Each region should overlap somewhat between 10% and 50% with its neighbors. The two system input state variables were fuzzified anxiety and motivation [17].

*D. Rule Base*

1. If anxiety is very low then motivation is moderate.
2. If anxiety is low then motivation is moderate.
3. If anxiety is low then motivation is high.
4. If anxiety is moderate then motivation is high.
5. If anxiety is moderate then motivation is moderate.
6. If anxiety is moderate then motivation is low.
7. If anxiety is high then motivation is moderate.
8. If anxiety is high then motivation is high.
9. If anxiety is very high then motivation is moderate.

Table Ia: Computer Science and Engineering branch before examination

| S.no. | x | μvL (x) | μL (x) | μM (x) | μH (x) | μvH (x) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $\alpha_5$ | $\alpha_6$ | $\alpha_7$ | $\alpha_8$ | $\alpha_9$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 24 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 25 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 31 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 |
| 5 | 35 | 0.0 | 0.0 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 |
| 6 | 34 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| 7 | 18 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 19 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 21 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 25 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 33 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 |
| 12 | 34 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 |

1..6 boys

7..12 Girls

Table Ib: Computer Science and Engineering branch after examination

| S.no. | x | μvL (x) | μL (x) | μM (x) | μH (x) | μvH (x) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $\alpha_5$ | $\alpha_6$ | $\alpha_7$ | $\alpha_8$ | $\alpha_9$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 23 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 24 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 31 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 |
| 5 | 35 | 0.0 | 0.0 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 |
| 6 | 54 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |
| 7 | 13 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 13 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 20 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 27 | 0.0 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 39 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 |
| 12 | 11 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

1..6 boys

7..12 Girls

Table Ic: Electrical and Electronics Engineering branch before examination

| S.no. | x | μvL (x) | μL (x) | μM (x) | μH (x) | μvH (x) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $\alpha_5$ | $\alpha_6$ | $\alpha_7$ | $\alpha_8$ | $\alpha_9$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 18 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 40 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 0.0 |
| 4 | 43 | 0.0 | 0.0 | 0.0 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 |
| 5 | 44 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 |
| 6 | 44 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 |
| 7 | 11 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 17 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 20 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 33 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 |
| 11 | 39 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 |
| 12 | 42 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.0 |

1..6 boys

7..12 Girls

### *E. Inference*

The truth value for the premise of each rule is computed, and applied on the conclusion part of each rule. This results in one fuzzy subset to be assigned to each output variable for each rule. Usually MIN or PRODUCT are used as inference rule. In MIN inferencing, the output membership function is clipped off at a height corresponding to the rule premise's computed degree of truth (weight of the rule, α). In PRODUCT inferencing, the output membership function is scaled by the rule premise's computed degree of truth.

### *F. Composition*

All of the fuzzy subsets assigned to each output variables are combined together to form a single fuzzy subset for each output variable. Usually MAX or SUM are used for composition. In MAX composition, the combined output fuzzy subset is constructed by taking point wise maximum over all of the fuzzy subsets assigned to variable by the inference rule. In SUM composition, the combined output fuzzy subset is constructed by taking the point wise sum over all of the fuzzy subsets assigned to the output variable by the inference rule.

Table Id: Electrical and Electronics Engineering branch after examination

| S.no. | x | μvL (x) | μL (x) | μM (x) | μH (x) | μvH (x) | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\alpha_4$ | $\alpha_5$ | $\alpha_6$ | $\alpha_7$ | $\alpha_8$ | $\alpha_9$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 18 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 40 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.0 | 0.0 |
| 4 | 42 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.0 |
| 5 | 43 | 0.0 | 0.0 | 0.0 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 |
| 6 | 44 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.0 |
| 7 | 11 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 15 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 29 | 0.0 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 34 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 |
| 11 | 46 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| 12 | 48 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 |

1..6 boys

7..12 Girls

### *G. Defuzzification*

Defuzzification is the process of producing a quantifiable result in fuzzy logic, given fuzzy sets and corresponding membership degrees. It is typically needed in fuzzy control systems. These will have a number of rules that transform a number of variables into a fuzzy result, that is, the result is described in terms of membership in fuzzy sets. Defuzzification is interpreting the membership degrees of the fuzzy sets into a specific decision or real value. Two of the common techniques for defuzzification are the centroid and the maximum method. In the centroid method, the crisp value of the output variable is computed by finding the variable value of the centre of gravity of the membership function for the fuzzy value. In the maximum method, one of the variable values at which the fuzzy subset has its maximum truth value is chosen as the crisp value for the output variable.

In the present study, PRODUCT method is used for inferencing, SUM method is used for composition and CENTROID method is used for defuzzification.

Anxiety levels are fuzzified according to membership functions shown in Fig1 & mapped to the rules specified in Rule base.

Defuzzification process is used to calculate the motivational levels of the students. Motivational Levels are calculated before and after the exam. (see Table II).

TABLE II: MOTIVATIONAL LEVELS

| BRANCH | TIME | GENDER | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| CSE | BEFORE | BOYS | Anxiety | 11.0 | 24.0 | 25.0 | 31.0 | 35.0 | 54.0 |
| | | | Motivation | 44.0 | 48.0 | 48.0 | 44.0 | 44.0 | 44.0 |
| | | | | | | | | | |
| | | GIRLS | Anxiety | 18.0 | 19.0 | 21.0 | 25.0 | 33.0 | 34.0 |
| | | | Motivation | 44.0 | 44.0 | 44.0 | 48.0 | 44.0 | 44.0 |
| | | | | | | | | | |
| | AFTER | BOYS | Anxiety | 11.0 | 23.0 | 24.0 | 31.0 | 35.0 | 54.0 |
| | | | Motivation | 44.0 | 48.0 | 48.0 | 44.0 | 44.0 | 44.0 |
| | | | | | | | | | |
| | | GIRLS | Anxiety | 13.0 | 13.0 | 20.0 | 27.0 | 39.0 | 11.0 |
| | | | Motivation | 44.0 | 44.0 | 44.0 | 48.0 | 48.0 | 44.0 |
| | | | | | | | | | |
| EN | BEFORE | BOYS | Anxiety | 18.0 | 18.0 | 40.0 | 43.0 | 44.0 | 44.0 |
| | | | Motivation | 44.0 | 44.0 | 48.0 | 48.0 | 48.0 | 48.0 |
| | | | | | | | | | |
| | | GIRLS | Anxiety | 11.0 | 17.0 | 20.0 | 23.0 | 39.0 | 42.0 |
| | | | Motivation | 44.0 | 44.0 | 44.0 | 48.0 | 48.0 | 48.0 |
| | | | | | | | | | |
| | AFTER | BOYS | Anxiety | 18.0 | 18.0 | 40.0 | 42.0 | 43.0 | 44.0 |
| | | | Motivation | 44.0 | 44.0 | 48.0 | 48.0 | 48.0 | 48.0 |
| | | | | | | | | | |
| | | GIRLS | Anxiety | 11.0 | 15.0 | 29.0 | 34.0 | 46.0 | 48.0 |
| | | | Motivation | 44.0 | 44.0 | 48.0 | 44.0 | 48.0 | 44.0 |

* Before stands for "before class test"

* After stands for "after class test"

* 1, 2, 3, 4, 5, 6 stands for student number

*Anxiety is calculated with help of Sinha's Comprehensive Anxiety Test

*Motivation is calculated with the help of fuzzy logic where input is anxiety

Same calculation is done for other inputs with different output fuzzy sets and following results are obtained.

t-test table is used to see the level of association between the sex as well as branch of the respondent, Motivation estimated by fuzzy method

Table IIIa: Table on motivation level before the test according to branch of the student

| Summary of Motivation before the test | | | |
|---|---|---|---|
| Branch | Mean | Std. Dev. | Freq. |
| CSE | 45.00 | 1.81 | 12 |
| EN | 46.33 | 2.06 | 12 |
| Total | 45.67 | 2.01 | 24 |

Before the test Motivation in EN students is higher than that of CSE students (see Table IIIa).

Even after the test there is no difference in the motivation levels of the students of two branches(see Table IIIb).

Table IIIb: Table on motivation level after the test according to branch of the student

| Summary of Motivation after the test | | | |
|---|---|---|---|
| Branch | Mean | Std. Dev. | Freq. |
| CSE | 45.33 | 1.97 | 12 |
| EN | 46.00 | 2.09 | 12 |
| Total | 45.67 | 2.01 | 24 |

Table IIIc: Table on motivation level before the test according to sex of the student

| Summary of Motivation before the test | | | |
|---|---|---|---|
| Sex | Mean | Std. Dev. | Freq. |
| Male | 46.00 | 2.09 | 12 |
| Female | 45.33 | 1.97 | 12 |
| Total | 45.67 | 2.01 | 24 |

Motivation levels of girls and boys are similar before the test(see Table IIIc).

Table IIId: Table on motivation level after the test according to sex of the respondent

| Summary of Motivation after the test | | | |
|---|---|---|---|
| Sex | Mean | Std. Dev. | Freq. |
| Male | 46.00 | 2.09 | 12 |
| Female | 45.33 | 1.97 | 12 |
| Total | 45.67 | 2.01 | 24 |

Again no change is seen in the motivation levels after the test(see Table IIId).

## IV. CONCLUSION

Fuzzy logic can be an extremely versatile and flexible tool for data that are complex, vague, and imprecise. Fuzzy logic addresses such applications perfectly as it resembles human decision making with an ability to generate precise solutions from certain or approximate information. Using fuzzy data instead of raw data has an advantage of reducing uncertainty. We found that motivation level of branch EN students is slightly higher than the branch CSE students before the exam. But after exam there is no difference in motivation between them. The reason is that CSE students get job easily through campus placement thus CSE students are less motivated than EN students in exam.

## REFERENCES

[1] Ohman, A. (2000). Fear and anxiety: Evolutionary, cognitive, and clinical perspectives. In M. Lewis & J. M. Haviland-Jones (Eds.). Handbook of emotions. (pp.573-593). New York: The Guilford Press.

[2] Seligman, Martin E.P. (1990). Learned Optimism New York: Alfred A. Knopf, Inc. p. 101. ISBN 0-394-57915-1.

[3] http://www.uptu.ac.in/academics/inst_list.asp

[4] Govind Singh Kushwaha & Sanjay Kumar, Pant University of Technology & Agriculture. Role of the Fuzzy System in Psychological Research, Europe's Journal of Psychology 2/2009, pp.123-134. www.ejop.org

[5] Averkin, A.N. Tarasov, V.B.(1987). The fuzzy modeling relation and its application in psychology and artificial intelligence, Fuzzy Sets and Systems, 22, 1-2, 3-24.

[6] Cetin Semerci, Department of Educational Sciences, Faculty of Edication, Firat University, 23119 Elazig – Turkey. The Influence of fuzzy Logic Theory On Students Achivement, The Turkish Online Journal of Educational Technology –TOJET April 2004 ISSN: 1303-6521 volume 3 Issue 2. Article 9.

[7] Cox, E.(1992). Fuzzy Fundamentals, IEEE Spectrum, October, 58-61

[8] Kantardzic, M. (2003). Data Mining: Concepts, Models, Methods and Algorithms. New York: John Wiley & Sons.

[9] Lazim, M.A. Abdullah, W.S.W., & Abu Osman M.T.(2004). Fuzzy sets in the Social Sciences: An Overview of Related Researches. Journal Teknologi, 41(E) Dis. : 43-54 Kolej University Sains dan Teknologi Malaysia (KUSTEM).

[10] Zadeh, L.A. (1965). Fuzzy Set, Information and Control. 8: 338 – 353.

[11] Zetenyi, T (1988). Fuzzy sets in psychology, Amsterdam, North Holland.

[12] Smithson, M. (1982). Applications of fuzzy sets concepts to Social Science, Journal of Mathematical Social Science, 2,(1982) 257-274.

[13] El-Nasr, M.S., Yen, J., Loerger, T.R. (2000). FLAMI-Fuzzy logic Adaptive model of emotions. Autonomous agents and multi-agent systems, Kluwer Academic Publishers Netherlands, (2000) 219-257

[14] Tripathi N.K.M. & Tripathi L.B.(1980). Manual for Approval Motive Scale (AMS), National Psychological Corporation, Agra.

[15] Sinha A.K.P. & Sinha L.N.K.(1985). Manual for Sinha's Comprehensive Anxiety Test (SCAT), National Psychological Corporation, Agra.

[16] Ahmed Mustafa, Aisha-Hassan A Hashim, Othman Khalifa & Shihab A Hamed. Signal Processing: An International Journal, Volume(2) : Issue (4)

[17] Oden, G.C. (1979). A Fuzzy Logical Model of Letter identification: Correction to Oden Journal of Experimental Psychology: Human Perception and Performance, Volume 5, Issue 4, Page 656.

[18] **http://www.ats.ucla.edu/stat/stata/** last sited on 30 March' 2010

[19] **http://www.mathworks.com** last sited on 9 June'2010

ANNEXURE 1

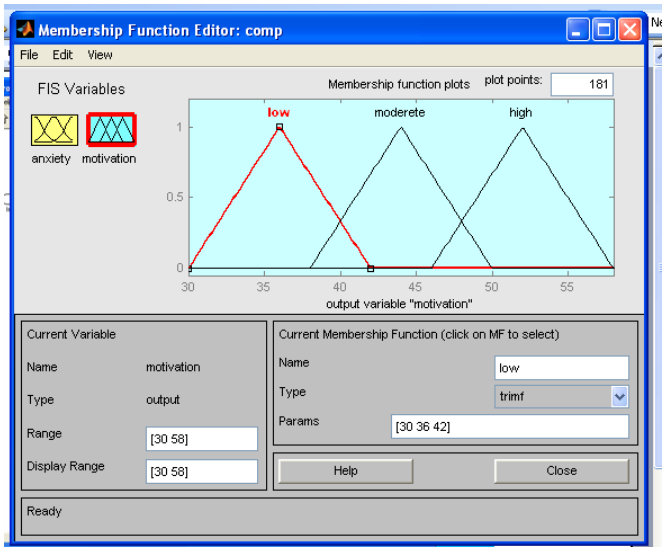


Figure 4. Membership function Editor

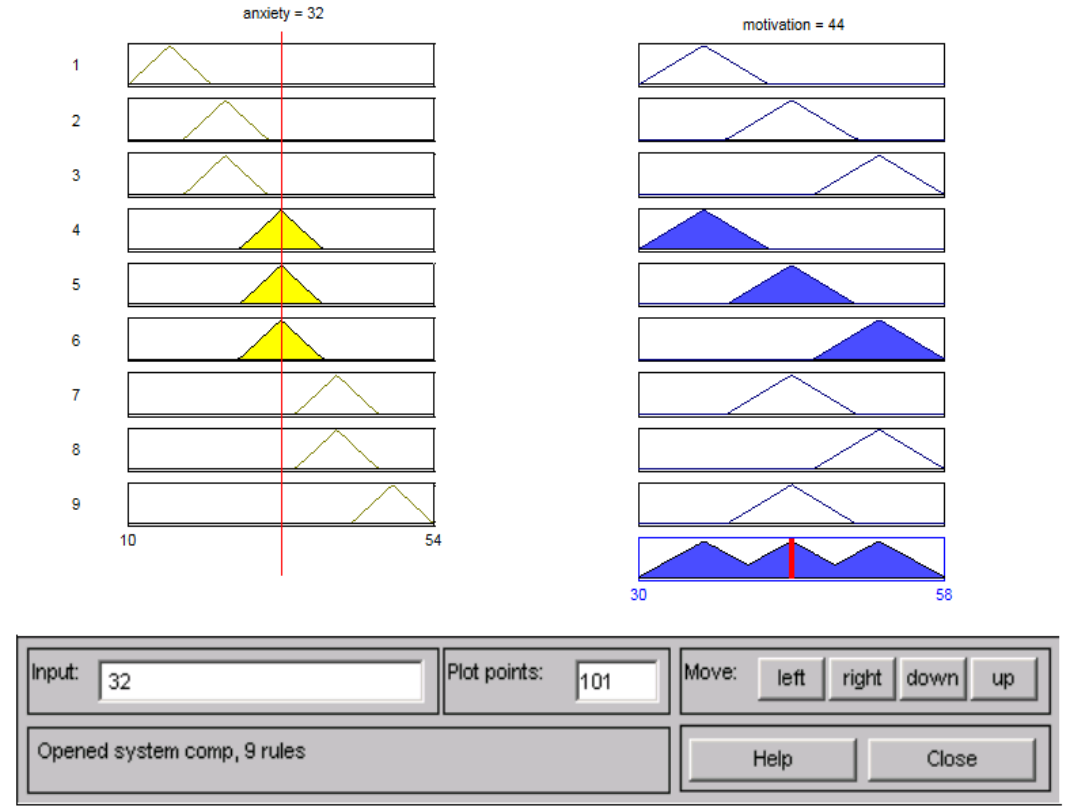


Figure 5. Rule Viewer

ANNEXURE 2

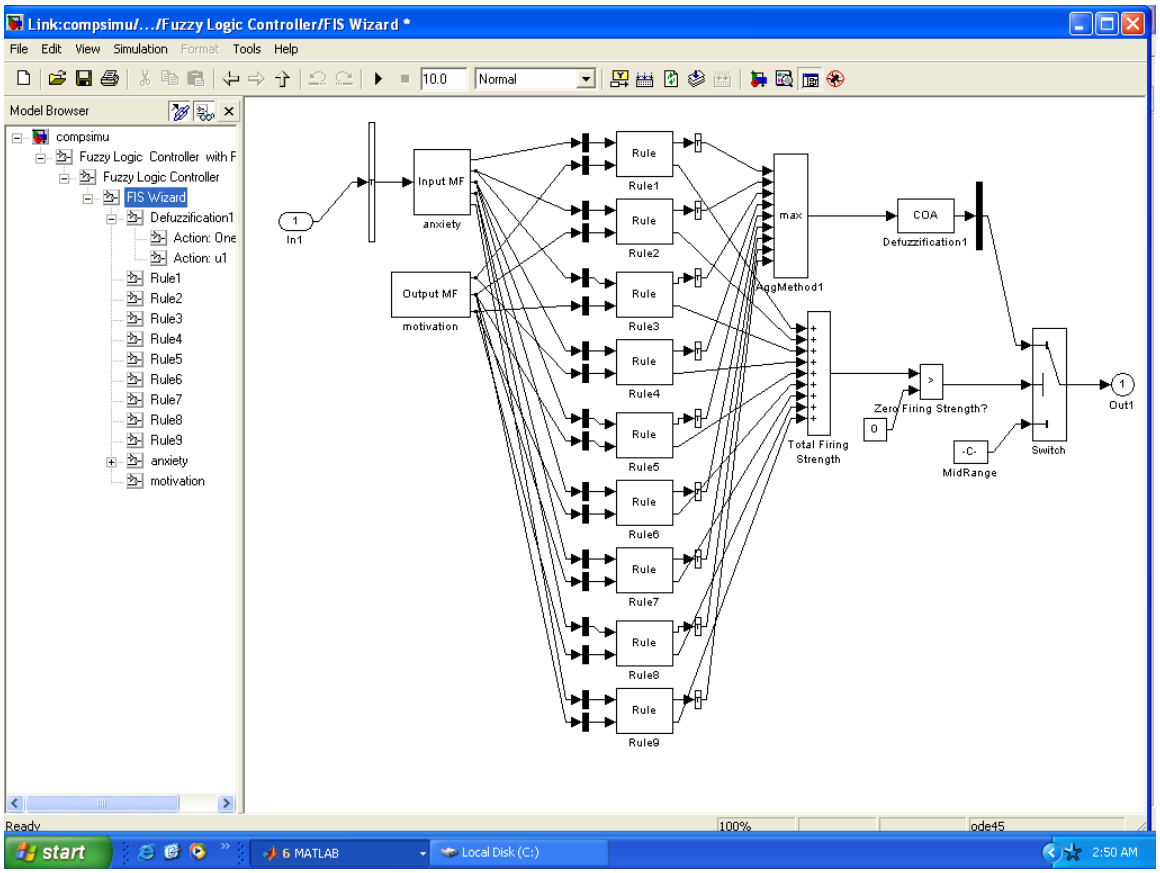


Figure 6. Block Diagram of Fuzzy Inference System

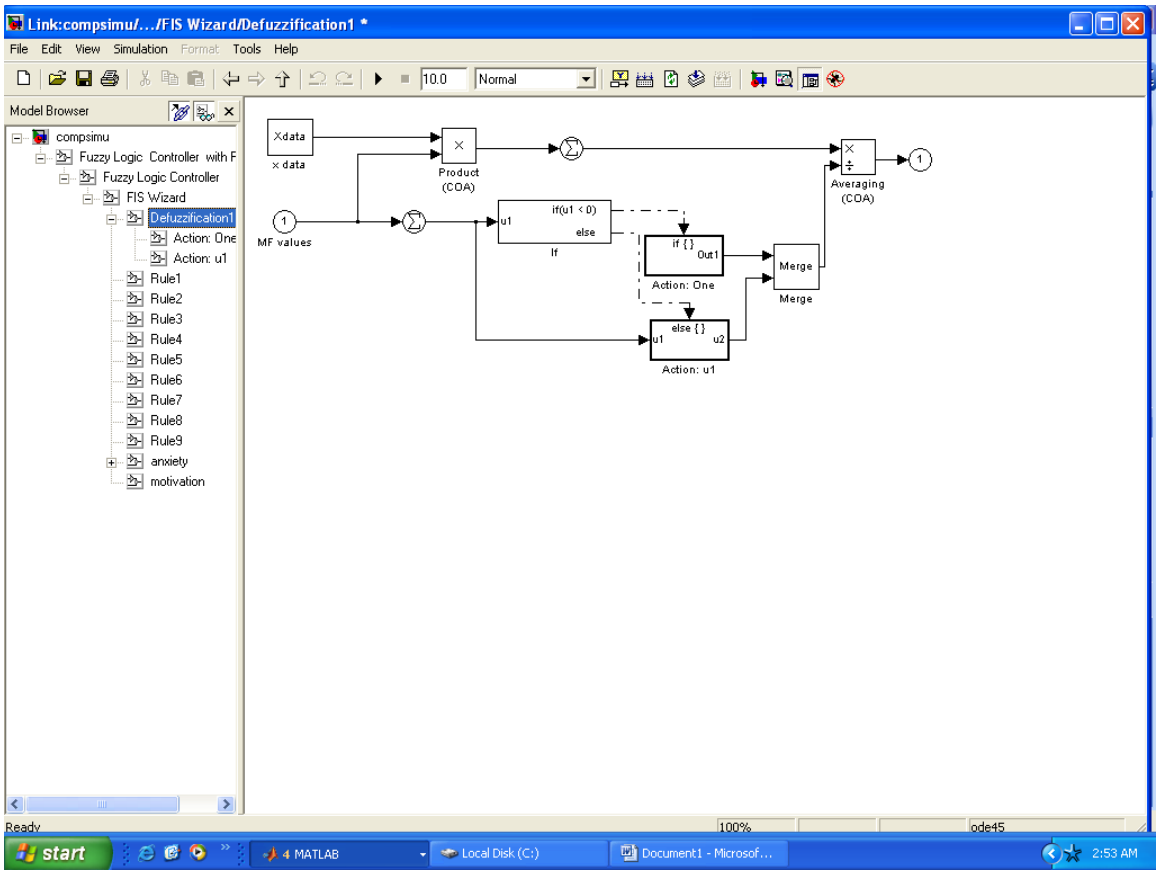


Figure 7. Defuzzification Process