ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING

SECOND SEMESTER EXAMINATION, 2018/2019 ACADEMIC SESSION

COURSE TITLE: FUZZY LOGIC AND PROGRAMMING

COURSE CODE: ECE 534

EXAMINATION DATE: JULY 16, 2019

COURSE LECTURERS: Prof. A. I. Oluwaranti/Mr. Isaac Elesemoyo

HOD's SIGNATURE

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. ANSWER QUESTION **ONE** AND ANY OTHER THREE ONLY.
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

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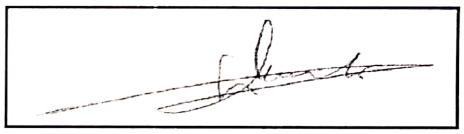

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Question 1[Compulsory]

Fuzzy logic membership function graph can be represented either as Triangular, Trapezoidal, Gaussian, Bell and Sigmoid. Write out the equation for finding membership function in each case and draw their diagrammatic representation on the graph sheet provided. [15 marks]

Question 2

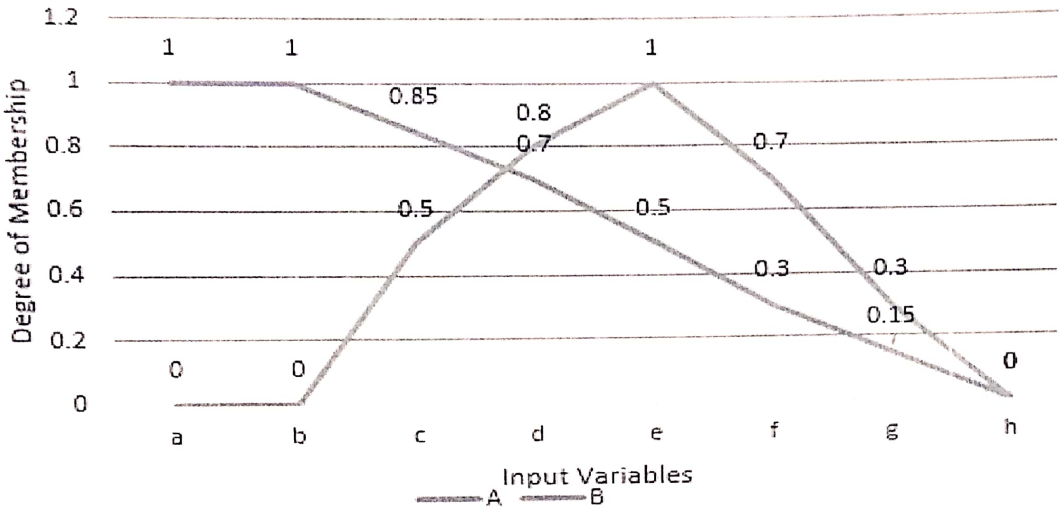

Figure 1: Graph of Fuzzy sets A and B

a. The graph in Figure 1 shows the fuzzy sets A (blue) and B (red).
   i. Write the set expression of the two sets [5 marks]
   ii. Find the union of the two sets (A U B) [2 marks]
   iii. Find the intersection of the two sets (A ∩ B) [2 marks]
   iv. Find the product of the two sets (AB) [2 marks]
   v. Find the cross product of the two sets (A x B) [4 marks]

Question 3

a. Discuss the following concepts.
   i. Dilation
   ii. Concentration
   iii. Intensification
   iv. Normalization [5 marks]

b. Given the fuzzy set A = {0/1, 0.5/2, 0.8/3, 1.0/4, 0.7/5, 0.3/6, 0.0/7} find,
   i. DIL(A) [2 marks]
   ii. CON(A) [2 marks]
   iii. INT(A) [3 marks]
   iv. NORM(A) [3 marks]

Question 4

a. Explain what you understand by the following concepts in Fuzzy logic.
   i. Membership function
   ii. Support of a fuzzy set
   iii. Crossover point
   iv. Fuzzy Singleton
   v. Level Sets [5 marks]

b. A Japanese company wants to produce an Air Conditioning System, that will combine Humidity Level in a room to the temperature level as inputs and the effect will be on the speed of the fan

of the air conditioner. You have been consulted to help derive a fuzzy rule based system that will map the humidity level and temperature level to the control of the Fan. Given that the Set of the TEMPERATURE is {LOW, MODERATE} which translate to 16-22.5°C and 22-28°C respectively and HUMIDITY is {DRY, NOTTOODRY, SUITABLE, NOT_TOO_WET, WET} which translates to 0-21%, 20-43%, 42-54%, 53- 75% and 70-100% respectively and the control of the fan result in SPEED set of {STOP, SLOW, MEDIUM, FAST} . Write out the rules to perform this fuzzy operation. [10 marks]

Question 5

a. Discuss the following concept as related to fuzzy logic
   i. Subset in fuzzy logic
   ii. Union of two fuzzy sets
   iii. Intersection of two fuzzy sets
   iv. Set product in fuzzy logic
   v. Power set in fuzzy Logic [5 marks]

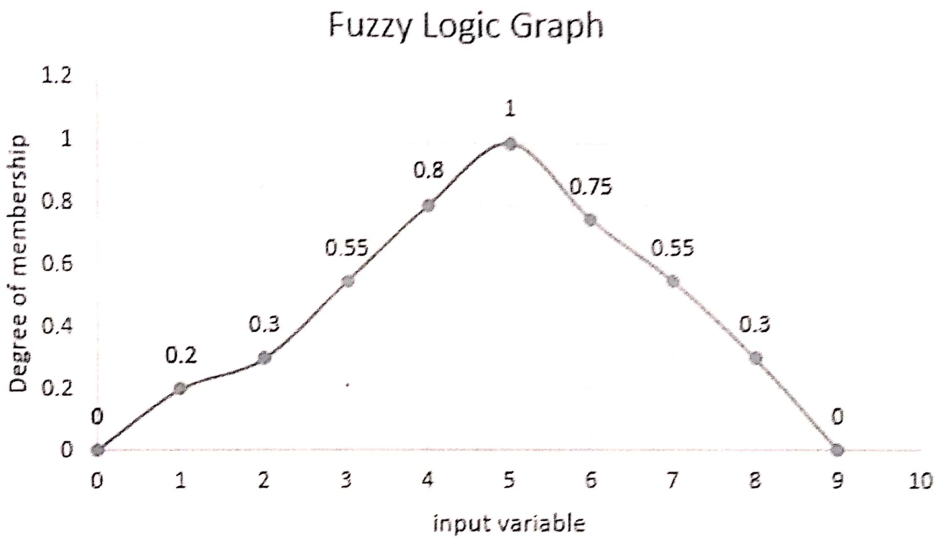

Figure 2: Fuzzy logic graph 1

b. Consider the graphical illustration in figure 2 showing the representation of the fuzzy set Z. Find:
   i. $\mu(z)$ [2 marks]
   ii. Complement of Z [2 marks]
   iii. Cardinality of Z [2 marks]
   iv. 0.5level of Z [2 marks]
   v. $Z_{0.55}$ [2 marks]

Question 6

b. Explain with example the concept of fuzzy logic. [4 marks]
c. Compare and contrast Fuzzy logic and the following
   i. Multi-valued logic
   ii. Probability
   iii. Boolean Logic
   iv. Set Theory [8 marks]
d. List three areas where fuzzy logic is applied [3 marks]