BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE | **SEMESTER: V**
BRANCH: IT | **SESSION : MO/2018**

SUBJECT : IT5025 PRINCIPLES OF SOFT COMPUTING

TIME: 1.5 HOURS | **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Specify the difference between probability theory and possibility theory, with example. [2]

(b) Why excluded middle law does not get satisfied in fuzzy logic? Consider the discretize membership function for a transistor and resistor which are given as μ_T= {(0,0), (0.2,1), (0.7,2), (0.8,3), (0.9,4), (1,5)} and μ_R= {(0,0), (0.1,1), (0.3,2), (0.2,3), (0.4,4), (0.5,5)}. Find out the following operations: [3]
(i) Scalar cardinality of the fuzzy set R. (ii) Algebraic Sum and Bounded Sum (iii) Bounded Difference

Q2 (a) What are the significance of the parameters used to represent a bell shaped fuzzy membership function? [2]

(b) Define T-norm operator. Specify the most frequently used T-norm operators in fuzzy set theory. [3]

Q3 (a) Why fuzzy composition is required in fuzzy set theory? Consider two fuzzy relations R and S, mention four properties which are satisfied by the relations. [2]

(b) Consider the universe of discourse X= {1,2,3,4,5} and 'Small Integers' be defined as SI= {(1,1), (2,0.5), (3,0.4), (4,0.2)}. The fuzzy relation R: 'Almost Equal' be defined as given in the following table: [3]

	1	2	3	4
1	1	0.8	0	0
2	0.8	0.1	0.8	0
3	0	0.8	1	0.8
4	0	0	0.8	1

What is the membership function of the fuzzy set RSI: 'Rather Small Integers' if it is interpreted as the composition of SI and R.

Q4 (a) State precisely the mathematical interpretation of fuzzy extension principle. Apply extension principle f:X->Y, A∈X to the fuzzy set A= {(0.2, -2), (0.4, -1), (0.8, 0), (0.7,1), (0.9, 2)} where $f(x)=x^2-3$. Represent the relation graphically. [2]

(b) The capacity of an amplifier on a normalized universe say [0,100] can be described linguistically by the following fuzzy variables: [3]
Powerful= {(0,1), (0.4,10), (0.8,50), (1,100)} and weak= {(1,1), (0.9,10), (0.5,50), (0.2,80), (0,100)}.
Find the belongingness of the following linguistic phrases used to describe the capacity of various amplifiers.
(i) not very powerful and slightly weak, (ii) intensively weak, (iii) extremely powerful or not weak.

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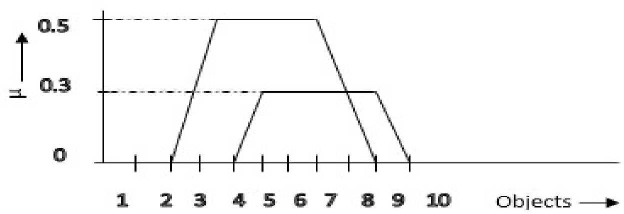
Q5 (a) State the quantitative difference between the defuzzification methods centroid of area(COA) and center of sum(COS) for the discrete objects (numerical) and corresponding membership values(μ) from the following membership graph. [2]



(b) Solve the following fuzzy relation using GMP rule. The given rule*: IF the temperature is High THEN the rotation is slow*. Deduce the fuzzy set for '*very high temperature*' for '*quite slow rotation*'. Consider High(H), Very High (VH), SLOW(S), Quite Slow (QS). The universal set for temperature and rotation per minute are X= {30, 40, 50, 60, 70, 80, 90, 100} and Y= {10, 20, 30, 40, 50, 60} respectively. H= {(70,1), (80,1), (90, 0.3)}, S= {(30,0.8), (40, 1), (50, 0.6)} and QS= {(10,1), (20, 0.8)}. [3]

Q6 (a) Contrast and compare Mamdani and Sugeno fuzzy logic control system [2]

(b) Design a fuzzy logic control system for two input variables I_1 and I_2 and one output variable O using Mamdani approach. Three linguistic terms Low (LW), High (H) and Medium (M) are used to represent triangular/ rectangular membership functions for all the input-output variables. The universe of discourse of I_1, I_2 and O are {1, 2, 3}, {10, 20, 30} and {5,10, 15} respectively. The rule base is given in the following table: [3]

	I_2			
		LW	M	H
I_1	LW	LW	LW	M
	M	LW	M	H
	H	M	H	H

Determine the output of the controller for I_1= 1.6, I_2= 22.0 using mean of max defuzzification method.