



Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[1 x 10 = 10]

- (i) The name of the operator that is present in fuzzy set theory, that is linguistic in nature, is:
 - a. Hedges
 - b. Lingual Variable
 - c. Fuzz Variable
 - d. All of the above
- (ii) What do you mean by NN architecture?
- (iii) Genetic Algorithm are a part of Evolutionary Computing - True/False?
- (iv) Hard computing produces precise results - True/False?
- (v) Core of soft Computing is
 - a) AI and Fuzzy
 - b) Fuzzy, Neural and Genetic
 - c) AI, Neural and Genetic
 - d) AI, Fuzzy and Genetic
- (vi) Promise of an ANN is that it can explain the result - True/False?
- (vii) Soft computing is used to solve non-linear issues - True/False?
- (viii) What do you mean by fuzzification?
- (ix) Backpropagation can be defined as _____
- (x) Matrix crossover is also known as One dimensional - True/False?
- (xi) What do you mean by height of a Fuzzy set?
- (xii) What is Counter Propagation Network(CPN)?

Group-B (Short Answer Type Question)

Answer any three of the following

[5 x 3 = 15]

2. Discuss fuzzy equivalence relations and list out its properties? [5]
3. Correlation between biological neuron & artificial neuron. [5]
4. Law of contradiction and law of excluded middle cannot be applied to fuzzy sets. Give proper justification to the statement. [5]
5. Significance of weights & bias values in ANN. [5]
6. How Induction Reasoning is used for Fuzzification process? [5]

Group-C (Long Answer Type Question)

Answer any three of the following

[15 x 3 = 45]

7. (a) Find the Fuzzy Hamming distance and Euclidean distance between given two fuzzy set: $A = \{ (x_1, 0.4), (x_2, 0.8), (x_3, 1.0), (x_4, 0.0) \}$, $B = \{ (x_1, 0.4), (x_2, 0.3), (x_3, 0.0), (x_4, 0.0) \}$. [7]
- (b) Suppose we have 2 universes for a thermistor problem and it is described by a collection of elements: $X = \{1, 2, 3\}$, $Y = \{1, 2, 3, 4, 5\}$. A crisp set A is defined on universe X and a crisp set B on universe Y as follows: $A = \{1, 3\}$, $B = \{2, 4, 5\}$. Find the values of R where the inference given as 'If A then B: R'. [8]
8. (a) Represent the standard fuzzy set operations using Venn diagram. What is cardinality of a fuzzy set? [7]
- (b) Consider the discrete fuzzy set defined on the universe $X = \{a, b, c, d, e\}$ as $A = \{1/a + 0.9/b + 0.6/c + 0.3/d + 0/e\}$. Using Jadhav's notation, find the λ cut sets for $\lambda = 0.6, 0.3$. [5]
- (c) Whether a power set can be formed for a fuzzy set. Justify your answer. [3]

9. (a) Differentiate between Normal and subnormal fuzzy set. Using Intuition and your own definition of the universe of discourse, plot fuzzy membership functions to the following variables: Liquid level in the tank [8]
 (a) Very small
 (b) Small
 (c) Empty
 (d) Full
 (e) Very full
 (b) Describe Lambda cut of a fuzzy set with the help of an example. Show that Lambda cut relation of fuzzy relation is crisp. [7]
10. (a) Compare supervised and unsupervised learning in ANN. [3]
 (b) Discuss various ANN architectures in details. [6]
 (c) Working Example for Classification of dataset using adaline & madaline. [6]
1. (a) Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as:
 $f(x) = (a + b) - (c + d) + (e + f) - (g + h)$, and let the initial population consist of four individuals with the following chromosomes: $x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$, $x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$, $x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 8\ 5$, $x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$. Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last. [5]
 (b) Perform the following crossover operations: i) Cross the fittest two individuals using one-point crossover at the middle point. ii) Cross the second and third fittest individuals using a two-point crossover (point's b and f). iii) Cross the first and third fittest individuals (ranked 1st and 3rd) using a uniform crossover. [5]
 (c) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved? [5]

*** END OF PAPER ***