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**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA****(An Autonomous Institute Affiliated to AKTU, Lucknow)****MASTER OF TECHNOLOGY (M. Tech)****(SEM: 1 Theory Examination (2020-2021))****SUBJECT NAME: SOFT COMPUTING****Time: 3 Hours****Max. Marks: 70****General Instructions:**

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of 4 pages & 8 questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- **Section A** - Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each. You are expected to answer them as directed.
- **Section B** - Question No-3 is Long answer type -I question with external choice carrying 4marks each. You need to attempt any five out of seven questions given.
- **Section C** - Question No. 4-8 are Long answer type -II (within unit choice) question carrying 7 marks each. You need to attempt any one part a or b.
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

**SECTION – A**

- 1. Select the correct option for each question** **[5x1=5]** **CO**
- a.** Core of soft Computing is..... **(1)** **CO1**
- (i) Fuzzy Computing, Neural Computing, Genetic Algorithms  
(ii) Fuzzy Networks and Artificial Intelligence  
(iii) Artificial Intelligence and Neural Science  
(iv) Neural Science and Genetic Science
- b.** Conventional Artificial Intelligence is different from soft computing in the **(1)** **CO2**  
sense:
- (i) Conventional Artificial Intelligence deal with predicate logic where as soft computing deal with fuzzy logic  
(ii) Conventional Artificial Intelligence methods are limited by symbols where as soft computing is based on empirical data  
(iii) Both (a) and (b)  
(iv) None of the above
- c.** Alternative name for Fuzzy Inference Systems **(1)** **CO3**
- (i) Fuzzy Expert System  
(ii) Fuzzy Modelling  
(iii) Fuzzy Logic Controller  
(iv) All the Options
- d.** Sequence of steps carried out while designing a fuzzy logic machine **(1)** **CO4**
- (i) Fuzzification --> Rule Evaluation --> Defuzzification  
(ii) Rule Evaluation -->Fuzzification -->Defuzzification  
(iii) Defuzzification-->Rule Evaluation -->Fuzzification  
(iv) Fuzzy Sets-->Defuzzification-->Rule Evaluation
- e.** Genetic algorithms guarantee convergence **(1)** **CO5**
- (i) True (ii) False

2. Answer the following questions in brief. All questions are compulsory [5×2=10] CO
- a. Which one would you prefer: Soft computing or Hard computing and why? (2) CO1
  - b. Can we implement any Boolean function using a network of Perceptrons? Prove your answer with the help of an example. (2) CO2
  - c. Given 2 fuzzy sets:  $A = \{\frac{1}{2} + \frac{0.5}{3} + \frac{0.3}{4} + \frac{0.2}{5}\}$  and  $B = \{\frac{0.5}{2} + \frac{0.7}{3} + \frac{0.2}{4} + \frac{0.4}{5}\}$ . Find the following: i)  $A \cup B$  ii)  $A \cap B$  (2) CO3
  - d. Two fuzzy sets A and B, both defined on X, are as follows: (2) CO3

$\mu(X_i)$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$
<b>A</b>	0.1	0.7	0.8	1.0	0.7	0.1
<b>B</b>	1.0	0.9	0.5	0.2	0.1	0

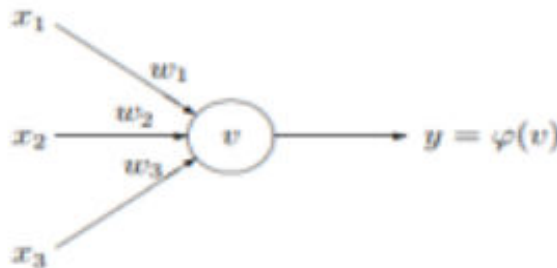
Find: i)  $A_{0.6}$  ii)  $(A \cup B)_{0.8}$

- e. What two requirements should a problem satisfy in order to be suitable for solving it by a Genetic Algorithm? (2) CO5

**SECTION – B**

3. Answer any five of the following- [5x4=20] CO

- a. Consider the diagram below: It is a single artificial neuron with three inputs: (4) CO2



- a) The node has three inputs  $x = \{x_1, x_2, x_3\}$  that receive only binary signals {either 0 or 1}. How many different input patterns this node can receive? (4) CO2
- b) Find the number of combinations if the node had four inputs? (4) CO2
- b. Mention the steps performed in training and learning a Multi-layer feed forward neural network (4) CO2
- c. What should be done if the fitness values of two individuals are same i.e.; when then there is a tie in the match (4) CO5
- d. Explain the Fuzzy relation with its properties and operations (4) CO3
- e. Compare Rank based selection with Roulette wheel method with an example (4) CO5
- f. Show that the fuzzy set  $\mu_A(X_i) = \frac{1}{1+5x}$  satisfies DeMorgan's Law (4) CO3
- g. Write pseudo code for Travelling Salesman Problem using genetic algorithm and explain it with an example (4) CO5

SECTION – C

CO

**4 Answer any one of the following-****[5×7=35]**

- a. Discuss some important applications of Soft computing (7) CO1

**OR**

- b. What are the different types of learning mechanisms? Discuss in detail (7) CO2

**5. Answer any one of the following-**

- a. Suppose that an investment scheme company decided to deploy a new system for assessing this scheme's worthiness of its customers. The new system is using a feed-forward neural network with a supervised learning algorithm. Discuss in detail what should the company have before the system can be used? Discuss problems associated with this requirement. (7) CO2

**OR**

- b. Consider the following observation: while fitting a linear regression to the data: As you increase the amount of training data, the test error decreases and the training error increase. The train error is quite low (almost what you expect it to), while the test error is much higher than the train error. (7) CO2

What do you think is the main reason behind this behaviour?

**6. Answer any one of the following-**

- a. In neighbourhoods, there may be several storm-water ponds draining to a single downstream trunk sewer. In this neighbourhood the city monitors all ponds for height of water caused by storm events. For two storms (labelled A and B) identified as being significant based on rainfall data collected at the airport, determine the corresponding performance of the neighbourhood storm-water ponds. Suppose the neighbourhood has five ponds, that is,  $X = [1, 2, 3, 4, 5]$ , and suppose that significant pond storage membership is 1.0 for any pond that is 70% or more to full depth. For storm A, the pond performance set is: (7) CO3

$$A = \left\{ \frac{0.5}{1} + \frac{0.6}{2} + \frac{0.8}{3} + \frac{1}{4} + \frac{1}{5} \right\}.$$

$$B = \left\{ \frac{0.2}{1} + \frac{0.4}{2} + \frac{0.7}{3} + \frac{0.9}{4} + \frac{1}{5} \right\}.$$

To assess the impacts on pond performance, suppose only two ponds can be monitored due to budget constraints. Moreover, data from the storms indicate that there may be a difference in thunder burst locations around this neighbourhood.

(i) Which two of the five ponds should be monitored?

(ii) Determine the most conservative estimate of pond performance (i.e., find  $A \cup B$ ).

**OR**

- b. Consider 3 fuzzy sets:  $A = \left\{ \frac{1}{0} + \frac{0.7}{1} + \frac{0.3}{2} \right\}$ ,  $B = \left\{ \frac{0.5}{20} + \frac{1}{30} + \frac{0.6}{40} \right\}$ , (7) CO3

$$C = \left\{ \frac{0.7}{20} + \frac{0.9}{30} + \frac{0.4}{40} \right\}$$

On the basis of these membership functions, find the following:

(i)  $R = B \times A$

(ii) Max–min composition of  $C \circ R$

(iii) Max–product composition of  $C \circ R$

7. Answer any one of the following-

a. Discuss Fuzzy logic controller in detail (7) CO4

OR

b. Mention any defuzzification technique with the help of an example (7) CO4

8. Answer any one of the following-

a. Discuss the terms fitness function, crossover and mutation as used in genetic algorithms. Explain how genetic algorithms work with the help of an example pseudocode. (7) CO5

OR

b. Discuss Genetic algorithm based Backpropagation (7) CO5