B.TECH/ECE/EE/8TH SEM/INFO 4282/2019

SOFT COMPUTING APPLICATION (INFO 4282)

Time Allotted : 3 hrs

Full Marks: 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A (Multiple Choice Type Questions)

- 1. Choose the correct alternative for the following: $10 \times 1 = 10$
 - Which of the following algorithms can be used to train a single-laver (i) feedforward network? (a) Hard competitive learning (b) Soft competitive learning (c) A genetic algorithm (d) all of the above.
 - Ranking is a technique used for (ii)
 - (a) deleting undesirable members of the population
 - (b) obtaining the selection probabilities for reproduction
 - (c) copying the fittest member of each population into the mating pool
 - (d) moving the fittest member of each population into the mating pool.

| (iii) | Neural networks are complex | with many parameters. |
|-------|-----------------------------|----------------------------|
| | (a) linear functions | (b) nonlinear functions |
| | (c) discrete functions | (d) exponential functions. |

_____ is an ability to learn how to do tasks based on the data given (iv) for training or initial experience. (a) Self organization

(b) Adaptive learning (d) Robustness.

A perceptron is a (v)

(c) Fault tolerance

- (a) feed-forward neural network
- (b) back-propagation algorithm
- (c) back-tracking algorithm
- (d) feed forward-backward algorithm.
- In artificial neural network interconnected processing elements are called (vi) (a) nodes or neurons (b) weights (c) axons (d) none of these.

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- (vii) What is the Fuzzy Approximation Theorem (FAT)? (a) A fuzzy system can model any continuous system (b) The conversion of fuzzy logic to probability (c) A continuous system can model any fuzzy system (d) Fuzzy patches covering a series of fuzzy rules. (viii) Fuzzy logic is a form of (b) crisp set logic (a) two-valued logic (c) many-valued logic (d) binary set logic. (ix) Which is not a fuzzy connective? (a) Conjunction (b) Disjunction (c) Implication (d) AND. The crossover points of a membership function are defined as the (x) elements in the universe for which a particular fuzzy set has values equal to (a) infinity (b) 0 (c) 1 (d) 0.5. Group – B What is soft computing? How is it different form hard computing? (a) Differentiate between order based crossover and position based (b)crossover with proper example.
- Explain with example the different mutation operators. (c)

(2+2)+5+3=12

- 3. (a) State and explain schema theorem.
 - Explain why do we prefer rank selection over the method of roulette-(b)wheel selection in genetic algorithm?

6 + 6 = 12

Group - C

Perform the following fuzzy arithmetic operation $C = A^*B$ through 4. (a) extension principle by fuzzifying the function z(x * y) = x * y for the given fuzzy set:

A = 0/0 + 0.2/1 + 0.4/2 + 0.6/3 + 0.8/4 + 1.0/5.B = 1/0 + 0.8/1 + 0.6/2 + 0.4/3 + 0.2/4 + 0/5.

(b) What do you mean by convex and non-convex fuzzy set? Explain with proper diagram.

9 + 3 = 12

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2.

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5. (a) Let the universe of integers be U = {1,2,3,4,5}. The primary linguistic terms are 'Low' and 'High', which are mapped onto U. The fuzzy set for 'Low' and 'High' are given as follows:
'Low' = {1/1 + 0.8/2 + 0.6/3 + 0.4/4 + 0.2/5} 'High' = {0.2/1+ 0.4/2 + 0.6/3 + 0.8/4 + 1/5}. Find the linguistic modified fuzzy set:

(i) Very low (ii) Not very Low (iii) Not very Low and not very very High (iv) Intensively Low.

(b) Let R and S be two fuzzy relations defined here:

| | 17. | Ve | N/o | X 7. | | G. | 7.0 | 7.0 | 7. | |
|-----------|------------|------------|------------|-------------|------------|------|------------|------------|------------|--|
| | y 1 | y 2 | y 3 | y 4 | | [41 | L 2 | Z 3 | 4 4 | |
| X1 | (0.9 | 0.7 | 0.5 | 0.5 | y 1 | 0.9 | 0.7 | 0.6 | 0.5 | |
| $R = x_2$ | 0.7 | 0.4 | 1.0 | 0.2 | $S = y_2$ | 0.8 | 0.3 | 0.2 | 0.7 | |
| X3 | 0.8 | 0.9 | 0.4 | 0.1 | y 3 | 0.9 | 0.3 | 1.0 | 0.9 | |
| | | | | | y 4 | 0.8 | 0.9 | 0.7 | 0.8 | |
| | | | | | | ~ | | | ~ | |

Compute the result RoS using max-min composition and R.S using max product composition.

6 + 6 = 12

Group – D

6. (a) Solve the following fuzzy relation equations by Zadeh Max Min composition:

If rainfall is 'High', drought is 'Low'. Deduce the drought level when the rainfall is very high. Take High (rainfall) = $\{0.5/2 + 0.8/3 + 1/4\}$ and Low (drought) = $\{1/1 + 0.6/2 + 0.2/3\}$. The universe discourse for the rainfall rate is X and drought level is Y as

 $X = \{1,2,3,4\}, Y = \{1,2,3\}.$

(b) What do you mean by fuzzification? Explain with suitable example. Write any three fuzzy implication operators.

6 + (3 + 3) = 12

7. (a) Consider a single layer perceptron having two inputs and one output. Let thresold be 0.5, learning rate be 0.6, bias be -2 and weigh values are $w_1 = 0.3$ and $w_2 = 0.7$. Given the input patterns in the table, compute the value of the output and train using perceptron learning rule for one epoch.

| X1 | X ₂ | D |
|----|----------------|----|
| 1 | 1 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | -1 |
| 0 | 0 | 1 |

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(b) Explain any four activation function used in neural network.

8 + 4 = 12

Group – E

- 8. (a) Derive the expression of weight adjustment of the back-propagation neural network.
 - (b) What are the features of second generation neural network?
 - (c) Write the advantages and disadvantages of BPNN algorithm.

6 + 3 + 3 = 12

 $(2 \times 6) = 12$

- 9. Writhe short notes (any two):
 - (i) Hopfield network
 - (ii) Adaptive resonance theory
 - (iii) XOR network using BPNN
 - (iv) Pattern recognition.