

CS/B.Tech(IT-New)/SEM-7/IT-703B/2013-14

2013

SOFT COMPUTING**Time Allotted : 3 Hours****Full Marks : 70***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.***GROUP - A****(Multiple Choice Type Questions)**Choose the correct alternatives for the following : $10 \times 1 = 10$

- i) Let us assume that a fuzzy set A is defined as follows :

$$A = \frac{0.1}{50} + \frac{0.3}{60} + \frac{0.5}{70} + \frac{0.8}{80} + \frac{1}{90} + \frac{1}{100}$$

What will be the value of $| A |$?

- | | |
|--------|-------------------|
| a) 3.7 | b) 6 |
| c) 1.7 | d) none of these. |

- ii) "Fittest will be survivor" is true for

- | | |
|------------------------|----------------------|
| a) Simulated annealing | b) Genetic Algorithm |
| c) Tabu search | d) ACO. |

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- iii) Artificial neural network is based on the concept
- gradient descent technique
 - biological neuron
 - random descent technique
 - both (a) and (b).
- iv) The boundary of the fuzzy set A is defined by those elements x of the universe such that
- $\mu_{A(x)} = 1$
 - $\mu_{A(x)} = 0$
 - $0 < \mu_{A(x)} < 1$
 - $0 \leq \mu_{A(x)} \leq 1$.
- v) Which of the following is/are found in Genetic Algorithms ?
- Evolution operator
 - Selection operator
 - Reproduction operator
 - Mutation operator
- of these
- (I) & (II)
 - (I), (II) & (III)
 - (II), (III) & (IV)
 - All of these.
- vi) Consider two Fuzzy sets A and B which are as follows :
 $A = \{(0,0.2),(1,0.5),(3,0.3)\}, B = \{(0,0.4),(1,0.6),(3,0.9)\}$
then $B - A$ will be
- $\{(0,0.2), (1,0.1), (3,0.1)\}$
 - $\{(0,0.2), (1,0.5), (3,0.8)\}$
 - $\{(0,0.2), (0,0.1), (0,0.1)\}$
 - none of these.

- vii) The Hebbian learning rule is type of learning.
- supervised
 - competitive
 - Boltzmann
 - reinforcement.
- viii) Let A is a normalized fuzzy set, then the set has
- at least one element x in the universe whose membership value is 1
 - all elements in the universe have membership value of 1
 - none of the elements in the universe has membership value of 1
 - at least one element x in the universe.
- ix) Kohonen network / adaptive resonance theory model is
- purely unsupervised
 - supervised
 - reinforcement
 - none of these.
- x) Selecting only maximum cost value gene from gene pool for crossover is known as
- Elitism
 - Tournament selection
 - Steady state selection
 - Random selection.

GROUP - B**(Short Answer Type Questions)**Answer any three of the following. $3 \times 5 = 15$

What is meant by supervised, reinforcement and unsupervised learning rules ?

Let A, B be fuzzy sets defined on universe of discourse X .Prove that $|A| + |B| = |A \cup B| + |A \cap B|$.

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4. Differentiate between Perceptron rule of training and Delta rule of training.

5. $R = \begin{bmatrix} 0.3 & 0 & 0.7 & 0 \\ 0 & 0.1 & 0.9 & 0.6 \\ 0.2 & 0 & 0.5 & 0 \\ 0 & 0.3 & 0 & 1 \end{bmatrix}$

Determine

- a) The domain, range, and height of the relations
 - b) The resolution forms of the relations.
6. Describe two selection techniques for reproduction in Generic Algorithm.

GROUP - C**(Long Answer Type Questions)**Answer any three of the following. $3 \times 15 = 45$

7. a) Explain the extension principle.
 b) Let the function f map ordered pairs from $U_1 = \{a, b, c\}$ and $U_2 = \{x, y, z\}$ to $V = \{p, q, r\}$. Let the function f be specified by a mapping matrix as follows :

$$f = \begin{matrix} & \begin{matrix} x & y & z \end{matrix} \\ \begin{matrix} a \\ b \\ c \end{matrix} & \begin{pmatrix} r & r & p \\ p & q & q \\ q & r & p \end{pmatrix} \end{matrix}$$

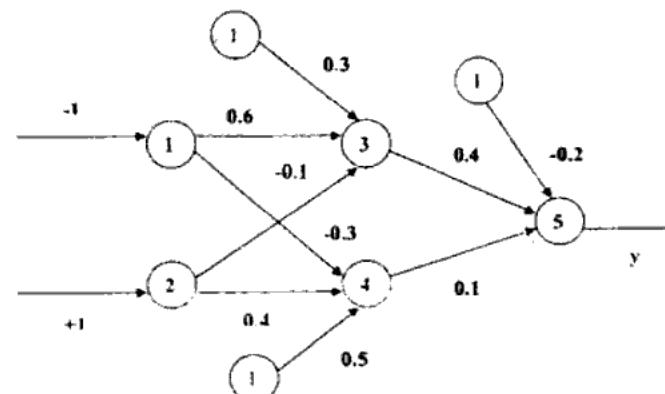
From the elements of the mapping matrix f , we can identify the mapping function that results in the elements of the mapping matrix. Let A_1 and A_2 be fuzzy sets defined on U_1 and U_2 , respectively,

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$$A_1 = 0.2/a + 0.6/b + 0.8/c \text{ and } A_2 = 0.5/x + 1/y + 0.3/z.$$

Use the extension principle to find the membership function of the fuzzy set $B = f(A_1, A_2)$.

- c) Distinguish between Centroid method and centre for largest area method of diffuzification. $6 + 4 + 5$
- i. a) Write down the training algorithm of BPN based on delta learning rule.
 b) Using the back-propagation network, find the new weights after one epoch for the net shown in the following figure. It is presented with the input pattern $\{-1, +1\}$ and the target output is $+1$. Use a learning rate $\alpha = 0.25$ and bipolar sigmoidal activation function.



6 + 9

- j. a) Explain the functioning of a Radial Basis Function (RBF) network with an example.

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- b) Consider a Kohonen self-organizing net with two cluster units and five input units. The weight vectors for the cluster units are given by

$$\omega_1 = [1.0, 0.9, 0.7, 0.5, 0.3]$$

$$\omega_2 = [0.3, 0.5, 0.7, 0.9, 1.0]$$

Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $\omega = [0.0, 0.5, 1.0, 0.5, 0.0]$. Using a learning rate coefficient 0.25, find the new weights for the winning input.

8 + 7

10. a) What is fuzzy equivalence relation ?
 b) Test whether the following are equivalence relation or not ? Draw the graphs of the equivalence relations.

No.	Set	Relation on the set
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- (i) People is the brother of
- (ii) People has the same parents are
- (iii) Points on a map is connected by a road to

- c) Perform fuzzy arithmetic operations (addition multiplication) on the following membership grade functions using α -cut method.

$$A(x) = 0 \text{ for } x \leq 3 \text{ and } x > 5$$

$$= (x - 3) \text{ for } 3 < x \leq 4$$

$$= (5 - x) \text{ for } 4 < x \leq 5$$

$$B(x) = 0 \text{ for } x \leq 12 \text{ and } x > 32$$

$$= (x - 12)/8 \text{ for } 12 < x \leq 20$$

$$= (32 - x)/12 \text{ for } 20 < x \leq 32$$

2 + 6 +

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1. a) State the technical implication in respect of a simple GA of the following :

i) Crossover rate

ii) Mutation rate

iii) Population size.

- b) Justify the importance of encoding in GA.

- c) What is elitism ? How is it relevant to convergence of a GA ?

(3 × 2) + 4 + (2 + 3)

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