Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech(IT)/SEM-7/IT-703-C/2009-10
2009
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)
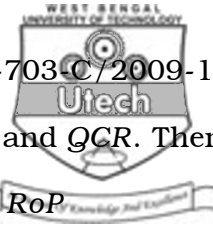
1. Choose the correct alternatives of the following :

    $10 \times 1 = 10$

    i)   The AND function with bipolar inputs and targets is realized by Hebb net, because

    a)   The problem is not linearly separable

    b)   The problem is linearly separable

    c)   The Hebb learning rule has the co-relational mechanism

    d)   none of these.

    ii) The competitive learning rule is suited for

    a)   Unsupervised network training

    b)   Supervised network training

    c)   Reinforced network training

    d)   none of these.

iii) Discrete Hopfield net is a

    a)   feed forward network   b)   feedback network

    c)   recurrent network   d)   none of these.

iv) The membership function values need always be described by discrete values.

    a)   True   b)   False.

v) The predicate logic statement of "*A* likes some of which *B* likes" is

    a) $\forall x \, (\text{likes} \, (B, x) \Rightarrow \text{likes} \, (A, x))$

    b) $\forall x \, (B, x) \Rightarrow \text{likes} \, (A, x)$

    c) $\exists x \, (\text{likes} \, (B, x) = \text{likes} \, (A, x))$

    d) $\exists x \, (\text{likes} \, (B, x) \wedge \text{likes} \, (A, x))$.

vi) Min is a

    a)   *t*-norm   b)   *t*-conorm

    c)   *s*-norm   d)   *s*-conorm.

vii) Mamdani type implication relation for the rule,

if *x* is *A* then *y* is *B* is given by $R \, (x, y) =$

    a) $\text{Min} \, (\mu_A \, (x) , \mu_B \, (y)$

    b) $(1 - \mu_A \, (x)) \vee \mu_B \, (y)$

    c) $\text{Max} \, (\mu_A \, (x), \mu_B \, (y))$

    d) $\text{Min} \, [1 , (1 - \mu_A \, (x) + \mu_B \, (y)$.

viii) The non-linearity in a neuron is used to model the

    a)   axon   b)   cell body

    c)   synapse   d)   dendron.

ix) Given *P, Q,* and *R* be relational matrices and $Q \subseteq R$. Then

    a) $PoQ \subseteq P \, o \, R$ b) $QoP \subseteq RoP$

    c) $PoQ \supseteq P \, o \, R$ d) $Q \, o \, P \supseteq R \, o \, P.$

x) For the schema ??? 1 ??, what is the O (H) and d (*H*) respectively ?

    a)   1 and 0   b)   1 and 1

    c)   0 and 1   d)   1 and 3.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. Classify the two-dimensional input pattern shown in the following figure using perceptron network. The symbol "*" indicates the data representation to be + 1 and "|" indicates data to be – 1. The patterns are I–F. For pattern I, the target is + 1 and for F, the target is – 1. The inital weights are all assumed to be zero, *i.e.*, θ = 0 and α = 1.

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    *     *     *          *     *     *

    |     *     |          *     *     *

    *     *     *          *     |     |

         "I"                    "F"            5
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3. Discuss about the different activation functions used of training artificial neural networks.   5

4. Define K-NN rule when the patterns of both classes w1 and w2 are equally likely to occur.   5

5. a) How can you realize crossover probability = 0·7 (Say) in a Genetic Algorithm program ?

   b) Average fitness of a scheme *H* and the entire population in a iteration of Genetic Algorithm are 20 and 10 respectively. If the population of schema H is at the current 'iteration is 100, what is its population in the next iteration due to selection only ?   2 + 3

6. State the delta learning rule in Widrow-Hoff's ADALINE neuron. Also state the condition for convergence of the learning rule and hence explain what happens when the condition for convergence is violated.   2 + 3

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following.   3 × 15 = 45

7. a) Explain the linearly separable in Perceptron net.

   b) Implement OR function with bipolar inputs and bipolar targets using Adaline Network training algorithm upto 2 epochs and state the stopping condition of the training algorithm.

   Assume the initial weights are $w_1 = w_2 = b = 0·2$ and $\alpha = 0·2$.

   c) Describe the difference between MRI and MRII algorithm.   3 + 8 + 4

8. a) What is fuzzy equivalence relation ?

b) Test whether the followings are equivalence relation or not ?

Draw the graphs of the equivalence relations.

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

c) Perform fuzy arithmetic operations (addition, multiplication) on the following membrership grade functions using α - cut method.

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

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

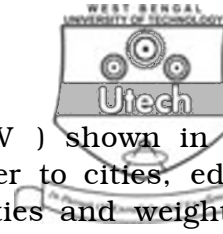$$= (5 - x) \text{ for } 4 < x \leq 5$$

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

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

$$= (32 - x) / 12 \text{ for } 20 < x \leq 32 \qquad 2 + 6 + 7$$

9. a) Describe how genetic algorithms differ from other optimization and search procedures.

b) Explain the cycle of genetic algorithm. What is crossover rate and mutation rate ?

c) The following graph G = (V, E, W) shown in the following figure, where vertices refer to cities, edges refer to connection between the cities and weight is associated with each edge given in the distance matrix, which represents the distance. Use Genetic Algorithm to find the minimum distance covered by the salesman.

Dia.

Distance matrix :

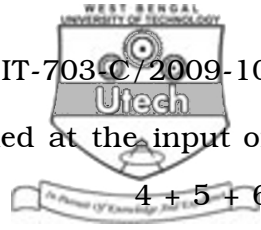| 1	0				
2	19	0			
3	19	21	0		
4	25	23	21	0	
5	22	21	20	22	0
	1	2	3	4	5

3 + 5 + 7

10. a) What is the advantage of bi-directional associative memory (BAM)?

b) Given input - output doublets $A_i - B_i$. Compute the weight matrix W of the BAM.

A_1 = [1 − 1 −1], B_1 = [1 −1]

A_2 = [−1 1 −1], B_2 = [−1 −1]

A_3 = [−1 −1 1], B_3 = [1 −1]

c)   Suppose, a probe vector A_1 is applied at the input of the BAM. How will you compute it ?   4 + 5 + 6

11. a)   What is pattern clustering ?

b)   How can pattern clustering be performed using k-means clustering ?

c)   Consider a pattern clustering problem in 2-dimension. Suppose we have six data points given by set s, where $(x_1 , x_2) \in s = \{ (1, 1), (1, 1\cdot5), (1\cdot5, 1), (6, 6\cdot5), (6\cdot5, 7), (7, 7\cdot5) \}$.

Show one step of clustering of the points in s into classes. What are the cluster centres after the first iteration ?

d)   What is the advantage of k-meoliod algorithm over the k-means algorithm ?   3 + 6 + 4 + 2

12. a)   What is a perceptron ? Explain how a perceptron can be used as a linear classifier ?

b)   Realize an AND-neuron using McCulloch-Pitts model.

c)   Consider a perceptron with two inputs x_1 and x_2 . Set the initial weights in a manner, so that for all input combinations except x_1 x_2 = 11, the outputs are correct. Show one step of corection in weights using perceptron learning algorithm.   4 + 5 + 6

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