Name : ………………………………………………………………

Roll No. : ……………………………………………………………

Invigilator's Signature : …………………………………………

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2011

SOFT COMPUTING

Time Allotted : 3 Hours　　　　　　　　　　*F l 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 for the following :　10 × 1 = 10

　　i) Acquired knowledge is stored in the ANN with the help

　　　of

　　　a) activation function　　b) local induced field

　　　c) synaptic weight　　　d) input signal.

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    ii)   In .... learning all neurons compete in input pattern and the wining neuron undergoes weight adjustment.

        a)   Supervised   b)   Competitive

        c)   Boltzmann   d)   Reinforcement.

    iii)   In GA term 'Gene' is termed as

        a)   coded design vector   b)   coded design variable

        c)   every bit   d)   none of these.

    iv)   A particular set of genes in genome is called

        a)   alleles   b)   chromosome

        c)   locus   d)   genotype.

    v)   Let A and B are two fuzzy sets with membership function μ, then $\mu_{A \cup B}(x)$ is equal to

        a) $\{\mu_A(x) + \mu_B(x)\}$ b) $\{\mu_A(x) - \mu_B(x)\}$

        c) $\min\{\mu_A(x), \mu_B(x)\}$ d) $\max\{\mu_A(x), \mu_B(x)\}$.

    vi)   The proposition logic lacks the ability to symbolize

        a)   quantification   b)   connectivity

        c)   equivalence   d)   negation.

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vii) The side of each chromosome for the problem maximizing a function $f(x) = x^2$ in the interval $0 \le x \le 31$ is

a)   six   b)   five

c)   four   d)   three.

viii) Which one is unsupervised learning rule ?

a)   Error-correction   b)   Delta

c)   Widrow-Hoff   d)   Hebbian.

ix) In simple perceptron learning rule change of synaptic weight is proportional to

a)   product of error and i/p signal

b)   produc f i/p and o/p signals

c)   product of error and o/p signals

d)   gradient of cost function.

x)   Consider the fuzzy set A given by

$A = \{ 0 / 0{\cdot}4 + 1 / 0{\cdot}6 + 3 / 0{\cdot}9 \}$ then cardinality of A will be

a)   0   b)   4·0

c)   1·0   d)   1·9.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define α-cut and strong α-cut of a fuzzy set A on universe of discourse X. Hence, prove that $^{\alpha}\left(\overline{A}\right) = ^{(1-\alpha)+}A$.   2 + 3

3. Design two layer perceptron network that implements AND function.

4. Explain the Aggregation operation with example. Also mention the necessary conditions to be satisfied by aggregator operator   2 + 3

5. Explain the impl c tion of the following events on Genetic Algorithm performance :

   i)   Change in cross-over probability

   ii)   Change in mutation probability.

6. What is Delta learning rule ? How is this applied in ANN ?

        3 + 2

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GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Discuss the operation of the Hopfield neural network with reference to its state updating procedure.   5

    b) State and prove the perceptron convergence theorem.   5

    c) A collection of 20 'birds' is to be classified into five different classes. The feature sp ce comprises the 'claw size', 'body colour', 'size , 'tail orientation' and 'food habits'. Design an MLP architecture to classify the birds. What wou d be the size of training and testing sets ?   5

8. a) Show that fuzzy union and fuzzy intersection satisfy the properties of *T*-norm and *S*-norm respectively.   3 + 3

    b) Let *A, B* be two fuzzy sets defined on the universe of discourse *X*. Prove that

    i) $|A| + |B| = |A \cup B| + |A \cap B|$

    ii) $(A \cup B)^{c} = A^{c} \cap B^{c}$

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  iii) $(A \cap B)^c = A^c \cup B^c$ where $\cup, \cap$ represent   fuzzy

   union and intersection respectively. 3×3

9.   a)   What is a fuzzy relation ? How is the cardinality of a

   fuzzy relation determined ? $2 + 1$

  b)   Consider the following fuzzy sets :

$$\tilde{A} = \frac{0 \cdot 2}{x_1} + \frac{0 \cdot 5}{x_2} + \frac{1 \cdot 0}{x_3}$$

$$\tilde{B} = \frac{0 \cdot 3}{y_1} + \frac{0 \cdot 9}{y_2}$$

   Find out the Cartesian prod ct $A \times \tilde{B}$.   2

  c)   Let $X = \{x_1, x_2\}$; Y $\{y_1 \ y_2\}$; $Z = \{z_1, z_2, z_3\}$ such that

$$\tilde{R} = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{c} y_1 \quad y_2 \\ \left[\begin{array}{cc} 0 \ 7 & 0 \cdot 5 \\ 0 \ 8 & 0 \cdot 4 \end{array} \right] \end{array} \text{and } \tilde{S} = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{c} z_1 \quad z_2 \quad z_3 \\ \left[\begin{array}{ccc} 0 \cdot 9 & 0 \cdot 6 & 0 \cdot 2 \\ 0 \cdot 1 & 0 \cdot 7 & 0 \cdot 5 \end{array} \right] \end{array}$$

   F nd $\tilde{T} = \tilde{R} \times \tilde{S}$.   4

  d)   What is a fuzzy rule base ?   2

  e)   Explain how fuzzy set concepts may be used for

   handling linguistic attributes.   2

  f)   Explain fuzzy number system.   2

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10. a) What are different parameters of a GA ? Explain significance of them. 5

b) Illustrate (i) FPS (ii) FRS (iii) Rank selection. 3×2

c) What is an objective function ? Consider finding $x \in [0, 15]$ (x : non-negative integer) such that

$$1 + x + x^3 = 225$$

Frame the objective function for finding a solution of the above equation. 2 + 2

11. a) "XOR function is linearly separable by a single decision boundary line." Comment. 3

b) Does perceptron requi e supervised learning ? 2

c) Compare feedforward and feedback networks. 2

d) Define the following : 4×2

   i) Supervised learning

   ii) Unsupervised learning

   iii) Self-supervised learning

   iv) Reinforced learning.

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