SOFT COMPUTING
(CSBS 3133)

Time Allotted : 2½ hrs   **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> from each group.

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

Group – A

1.   Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i)   What does the 0 membership value means in the set?
    (a) The object is fully inside the set
    (b) The object is not in the set
    (c) The object is partially present in the set
    (d) None of the above.

(ii)   The process of fuzzy interference system involves
    (a) membership functions   (b) fuzzy logic operators
    (c) if-then rules   (d) all the above.

(iii) Which of the following is not defuzzifier method?
    (a) Centroid of area   (b) Mean of maximum
    (c) Largest of maximum   (d) Hypotenuse of triangle.

(iv) A={1/a,0.3/b,0.2/c,0.8/d,0/e} B={0.6/a,0.9/b,0.1/c,0.3/d,0.2/e} What will be the complement of A?
    (a) {0/a,0.7/b,0.8/c,0.2/d,1/e}   (b) {0/a,0.9/b,0.7/c,0.2/d,1/e}
    (c) {0.8/a,0.7/b,0.8/c,0.7/d,1/e}   (d) {0/a,0.7/b,0.8/c,0.9/d,1/e}.

(v)   What denotes the support(A) in a fuzzy set?
    (a) {x|ua(x)>0}   (b) {x|ua(x)<0}
    (c) {x|ua(x)<=0}   (d) {x|ua(x)<0.5}.

(vi) Both fuzzy logic and artificial neural network are soft computing techniques because
    (a) both gives precise and accurate result
    (b) ANN gives accurate result, but fuzzy logic does not
    (c) in each, no precise mathematical model of problem is acquired
    (d) fuzzy gives exact result but ANN does not.

(vii) Which selection strategy works with negative fitness value?
    (a) Roulette wheel selection   (b) Stochastic universal sampling
    (c) Tournament selection   (d) Rank selection.

(viii) Operations in the neural networks can perform what kind of operations?
   (a) Serial   (b) Serial or parallel
   (c) Parallel   (d) None of the above.

(ix) What is the feature of ANNs due to which they can deal with noisy, fuzzy, inconsistent data?
   (a) Distributive nature of networks   (b) Associative nature of networks
   (c) Both associative & distributive   (d) None of the above.

(x) What is hebb's rule of learning?
   (a) The system learns from its past mistakes
   (b) The strength of neural connection get modified accordingly
   (c) The system recalls previous reference inputs & respective ideal outputs
   (d) None of the above.

Fill in the blanks with the correct word

(xi) The intersection of two fuzzy sets is the _____of each element from two sets.

(xii) Mutation is applied on _____candidates.

(xiii) Evolutionary algorithms are a _____ based approach.

(xiv) Feature of ANN in which ANN creates its own organization or representation of information it receives during learning time is _____.

(xv) The values of the set membership is represented by _____.

Group - B

2. Table 1 shows a population of strings. Assuming that the string represents a binary encoding of a number n, and that the fitness function is given by Fi = 100/n , fill in the rest of the table using the roulette wheel algorithm to generate a mating pool. Complete Table 2 by randomly selecting mates and single crossover sites to generate a new population. Calculate Fi for each member of the new population. Is this an improvement?

Table 1: Table for question 1

String no.	String	n	F_i	$\frac{F_i}{\Sigma F_i}$	No. surviving	Mating pool
1	10111	23	4.35			
2	00111					
3	01001					
4	01010					

Table 2: Table for question 1

Mating pool	Mate	Crossover site	New population	n	New F_i

[(CO2)(Analyse/IOCQ)]
(6 + 6) = 12

3. Three selection strategies are very much common in GA implementation. The strategies are
    S1: Roulette-wheel selection
    S2: Rank-based selection
    S3: Tournament selection
    Compare the above mentioned four selection strategies based on Population diversity
    and Chance of stagnation. *[(CO2)(Analyse/IOCQ)]*
    (3 × 4) = 12

Group - C

4. (a) Find the weights using perceptron network for NAND function when all the
        inputs and outputs are presented in bipolar form. *[(CO3)(Apply/IOCQ)]*
    (b) What is the importance of threshold in perceptron network? *[(CO3)(Remember/LOCQ)]*
    6 + 6 = 12

5. (a) Draw the flowchart for Adaline training process. *[(CO3)(Understand/LOCQ)]*
    (b) Implement OR function with bipolar inputs and outputs using Adaline network.
        [(CO3)(Analyse/IOCQ)]
    6 + 6 = 12

Group - D

6. The membership function for a transistor (A) and a resistor (B) are given bellow:
    $A\tilde{}(x)$={(x_1,0.0),(x_2,0.2),(x_3,0.7),(x_4,0.8),(x_5,0.9),(x_6,1.0) }
    $B\tilde{}(x)$={(x_1,0.0),(x_2,0.1),(x_3,0.3),(x_4,0.2),(x_5,0.4),(x_6,0.5) }
    Find out the value of the following: Algebraic sum, Algebraic product, Bounded sum,
    Bounded product. *[(CO4)(Apply/IOCQ)]*
    (4 × 3) = 12

7. (a) Two fuzzy relations are given by

$$R = \begin{array}{c} \\ x1 \\ x2 \end{array} \begin{array}{cc} y1 & y2 \\ 0.6 & 0.3 \\ 0.2 & 0.9 \end{array} \quad \text{and} \quad S = \begin{array}{c} \\ y1 \\ y2 \end{array} \begin{array}{ccc} z1 & z2 & z3 \\ 1.0 & 0.5 & 0.3 \\ 0.8 & 0.4 & 0.7 \end{array}$$

   Find out fuzzy relation T as a composition between the fuzzy relations.
        [(CO4)(Apply/IOCQ)]

(b)   Describe the features of membership functions.   *[(CO4)(Remember/LOCQ)]*

(4 + 4) + 4 = 12

Group - E

8. Write short notes on NSGA – I and NSGA – II.   *[(CO6)(Remember/LOCQ)]*

(6 + 6) = 12

9. Explain PSO algorithm with a suitable example.   *[(CO6)(Understand/LOCQ)]*

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.67	58.33	0

Course Outcome (CO):

After the completion of the course students will be able to
CSBS3133.1.   Describe about soft computing concepts, technologies and their role in problem solving.
CSBS3133.2.   Analyze the genetic algorithms and their applications to solve optimization problems.
CSBS3133.3.   Demonstrate different neural network architectures, algorithms, applications and their limitations.
CSBS3133.4.   Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
CSBS3133.5.   Identify the need for approximation analysis and rough set theory in developing applications.
CSBS3133.6.   Inspect various soft computing techniques in order to solve Multi-Objective Optimization Problem (MOOP)

LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.