Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CSE)/SEM-1/CST-1103A4/2011-12

2011
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 for any *ten* of the following : $10 \times 1 = 10$

   i) Fuzzy IF-THEN rule is a kind of

      a) Expert knowledge

      b) Supervised knowledge

      c) Unsupervised knowledge

      d) None of these.

   ii) $\mu_A(x)$ is a membership function whose value is within the range

      a) [0, 1] b) [– 1, 1]

      c) [1, 2] d) [– 1, 1].

iii) $a \wedge b = \min(a, b)$ is an example of

a) Monotonicity

b) Intersection

c) Negation

d) Associative.

iv) Which statement is true ?

a) PL (A) ≥ Bel (A) > m (A)

b) PL (A) ≥ Bel (A) ≥ m (A)

c) PL (A) ≤ Bel (A) ≤ m (A)

d) Bel (A) ≤ PL (A) ≤ m (A).

v) Linguistic variables are always

a) Fuzzy b) Crisp

c) Non-negative d) None of these.

vi) MILORD is a

a) Fuzzy expert system

b) Neural expert system

c) Fuzzy Neural system

d) None of these.

vii) $\mu C_l(w) = \alpha_i \mu C_i(w)$ is a rule given by

a) Mamdani b) Sugeno

c) Zadeh d) Takaki.

viii) Adaline is always

a) single linear unit

b) multiple linear unit

c) cross linear unit

d) none of these.

ix) Back propagation is a

a) learning algorithm

b) adaptive learning algorithm

c) simple learning algorithm

d) none of these.

x) Pixel is a

a) picture element

b) image element

c) both (a) & (b)

d) none of these.

xi) Acquisition of image is a part of

a) image segmentation

b) image restoration

c) image enhancement

d) all of these.

GROUP – B

(Short Answer Type Questions)

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

2. Write down the comparative study of classical crisp set & fuzzy crisp set. Draw its characteristic function.

3. Let A be a fuzzy set in U. Then the membership function of A can be expressed in terms of the characteristic function of its α cuts according to

$$\mu_A(x) = \sup_{\alpha \in [0,\,1]} \left[\alpha \wedge \mu_{A_\alpha}(x)\right]$$

$\forall\, x \in U_x$.

Where $\wedge$ denotes minimal operation and μ_{A_α} is the characteristic function of the crisp

set $A_\alpha\,(\alpha - cut) = \begin{cases} 0, \textit{ otherwise} \\ 1 \textit{ iff } x \in A_\alpha \end{cases}$.

4. Consider a fuzzy set $A = \frac{0{\cdot}1}{50} + \frac{0{\cdot}3}{60} + \frac{0{\cdot}5}{70} + \frac{0{\cdot}8}{80} + \frac{1}{90} + \frac{1}{100}$. Calculate all the α-cuts within the universe when $\bigcup_{\alpha \in A_\alpha} \alpha A_\alpha$.

5. Discuss beleif & plausibility with proper example. Write its measures in the term of fuzzy relation.

6. Write down the usefulness of fuzzifier & defuzzifier. What is fuzzy clustering ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Write step function, hard limiter, unipolar sigmoidal & bipolar sigmoidal functions with proper graph represenation. State Hebbian learning rule for ANN. What is perceptron learning rule ? Describe Adalilne in brief. 7 + 3 + 3 + 2

8. Describe Back-propagation learning algorithm. Write algorithm of back-propagation rule. 8 + 7

9. What is mutation ? Describe fitness sealing. Explain multipoint crossover with proper example.

Having $X = \{ p, q, r, s \}$ & $B = P (n)$ the focal elements of $M (.)$, Bel (.) Pl (.) is given as

elements	m (.)	Bel (.)	Pl (.)
{ p }	0	0	0·6
{ q }	0·15	0·15	1
{ r }	0	0	0·7
{ s }	0	0	0·85
{ Pq }	0	0·15	1
{ Pr }	0	0	0·7
{ Ps }	0	0	0·85
{ qr }	0	0·15	1
{ qs }	0·15	0·3	1
{ rs }	0	0	0·85
{ pqr }	0	0·15	1
{ pqs }	0	0·3	1
{ qrs }	0·1	0·4	1
{ prs }	0	0	0·85
{ qqrs }	0·6	0	1

Calculate Bel (q), Bel (qs), Pl (pq), Pl (prs). 2 + 4 + 3 + 6

10. What is image segmentation ? Write down the basic steps of digital image processing. What are grey seale & grey value ? Describe CMYK colour model. How grey level intensity values are related with fuzzy values ? 2 + 4 + 4 + 4 + 1

11. Write short notes on any *three* of the following : 3 × 5

a) Fuzzy partial ordering

b) Genetic algorithm — basic steps

c) Zadeh's extension principle

d) Linguistic variables with example

e) Supervised, unsupervised & reinforcement learning.

f) Verification of the following set to satisfy De'Morgan's law $\mu_A(x) = \frac{1}{1+2x}$.