Introduction to Soft Computing

Solutions to Practice Sheet : FL-1

Topics:

- *Introduction to Soft Computing*
- *Fuzzy logic*
- *Fuzzy membership functions*
- *Operations on Fuzzy sets*

1) Any soft-computing methodology is characterized with

(a) precise solutions
(b) control actions are unambiguous and accurate
(c) Control action is formally defined
(d) algorithm which can easily adapt with the change of dynamic environment

2) A fuzzy set A is closed if:

(a) $\lim x \to -\infty\ \mu_A(x) = 1$and $\lim x \to +\infty\ \mu_A(x) = 0$
(b) If $\lim x \to -\infty\ \mu_A(x) = \lim x \to +\infty\ \mu_A(x) = 0$
(c) If $\lim x \to -\infty\ \mu_A(x) = 0$ and $\lim x \to +\infty\ \mu_A(x) = 1$
(d) If $\lim x \to -\infty\ \mu_A(x) = \lim x \to +\infty\ \mu_A(x) = 1$

3) The support of Fuzzy Set A is the set of all points x in X (is the universe of discourse) such that

(a) $\mu_A(x) > 0$
(b) $\mu_A(x) = 1$
(c) $\mu_A(x) = 0.5$
(d) $\mu_A(x) \neq 1$

4) An equivalence between *Fuzzy vs. Probability* to that of *Prediction vs. Forecasting* is

(a) $Fuzzy \approx Prediction$
(b) $Fuzzy \approx Forecasting$
(c) $Probability \approx Forecasting$
(d) None of the above

5) Both fuzzy logic and artificial neural network are soft computing techniques because

(a) Both gives precise and accurate results.
(b) Artificial neural network gives accurate result, but fuzzy logic does not.
(c) In each, no precise mathematical model of the problem is required.
(d) Fuzzy gives exact result but artificial neural network does not.

6) Which of the following cannot be stated using fuzzy logic?

(a) Color of an apple
(b) Height of a person

(c) Date of birth of a student
(d) Speed of a car

7) Following which one is the example of ***Sigmoid Membership*** function?

(a) $\mu(x: c, \sigma) = e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$

(b) $\mu(x: a, c) = \frac{1}{1+e^{-[a(x-c)]}}$

(c) $\mu(x: a, b, c) = \frac{1}{1+\left|\frac{x-c}{a}\right|^{2b}}$

(d) $\mu(x: a, b, c) = \begin{cases} 0 & x \leq a \\ \frac{x-a}{b-a} & a \leq x \leq b \\ \frac{c-x}{c-b} & b \leq x \leq c \\ 0 & c \leq x \end{cases}$

8) How is Fuzzy Logic different from conventional control methods?

(a) IF and THEN Approach
(b) FOR Approach
(c) WHILE Approach
(d) DO Approach

9) The height h(A) of a fuzzy set A is defined as h(A) = support A(x), where x belongs to A. Then the fuzzy set A is called normal when

(a) h(A)=0
(b) h(A)<0
(c) h(A)=1
(d) h(A)>1

10) Fuzzy logic is a form of

(a) Two-valued logic
(b) Crisp set logic
(c) Many-valued logic
(d) Binary set logic

11) For $k > 1$, which of the following concept can be used to generate other linguistic hedge

(e) Concentration and Dilation
(f) Dilation
(g) Concentration
(h) None of the above

12) Given two fuzzy set A and B

$A = \{(x1, 0.5), (x2, 0.1), (x3, 0.4)\}$ and $B = \{(x1, 0.2), (x2, 0.3), (x3, 0.5)\}$

Union of the two set, that is, $A \cup B$ is given by

(a) $\{(x1,\ 0.5),\ (x2,\ 0.1),\ (x3,\ 0.4)\}$
(b) $\{(x1,\ 0.5),\ (x2,\ 0.3),\ (x3,\ 0.5)\}$
(c) $\{(x1,\ 0.2),\ (x2,\ 0.3),\ (x3,\ 0.5)\}$
(d) $\{(x1,\ 0.2),\ (x2,\ 0.1),\ (x3,\ 0.4)\}$

13) Given two Fuzzy Sets *A* and *B* with MFs μ_A and μ_B, respectively. Algebraic product or Vector product is given by:

(a) $\mu_A(x) \cdot \mu_B(x)$
(b) $\mu_A(x) + \mu_B(x) - \mu_A(x).\mu_B(x)$
(c) $\min\{1, \mu_A(x) + \mu_B(x)\}$
(d) $\max\{0, \mu_A(x) + \mu_B(x) - 1\}$

14) Two fuzzy sets A and B with membership functions $\mu_A(x)$ and $\mu_B(x)$, respectively defined as below.

A = **Hot Climate** with $\mu_A(x)$ as the MF.
B = **Cold Climate** with $\mu_B(x)$ as the M.F.

Pleasant climate is given by:

(a) $1 - \mu_B(x)$
(b) $\max(\mu_A(x), \mu_B(x))$
(c) $\min(\mu_A(x), \mu_B(x))$
(d) $1 - \mu_A(x)$

15) What is the **Bandwidth** of fuzzy set A which is given as follow?

$$A = (10,0.1), (15,0.2), (20,0.5), (25,0.4), (30,0.4), (35,0.5), (40,0.2), (45,0.1)$$

(e) 15
(f) -15
(g) 35
(h) 20