Introduction to Soft Computing

Solution to Practice Sheet FL-3

Topic:

- *Defuzzyfication techniques*
- *Fuzzy logic controller*

1) Defuzzification is done to obtain

   (a) Crisp output
   (b) The best rule to follow
   (c) Precise fuzzy value
   (d) None of the above

2) One difference between Mamdani approach and Takagi-Sugeno appraoch to FLC design is That

   (a) Mamdani approach needs defuzzification module whereas Takagi-Sugeno approach does not
   (b) Takagi-Sugeno approach does not require any fuzzification module whereas Mamdani approach needs
   (c) Takagi-Sugeno approach is less interpretable but more accurate
   (d) All of the above

3) If A and B are two fuzzy sets and $x \in A, y \in B$. Let $C = A \oplus B$. Then

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

4) Takugi-Sugeno approach to FLC design is computationally more expensive compared to Mamdani approach because

   (a) Mamdani approach considers a less number of rules in fuzzy rule base
   (b) Searching a rule in Mamdani approach is simple and hence less time consuming
   (c) Takagi-Sugeno approach consider a large number of rules in fuzzy rule base
   (d) Computation of each rule in Takagi-Sugeno approach is more time consuming

5) "The train is running fast". Here 'fast' can be represented by

   (a) Fuzzy Set
   (b) Crisp Set
   (c) Fuzzy & Crisp Set
   (d) None of the mentioned

6) In Lamda-cut method the value of λ can be

(a) Greater than 10
(b) Between 1 and 10
(c) Between 0 and 1
(d) Any value

7) Suppose, a fuzzy set **Young** is defined as follows:

$$Young = \{(10,0.5),\ (20,0.8),\ (30,0.8),\ (40,0.5),\ (50,0.3)\}$$

Then the crisp value of **Young** using MoM method is

(a) 25
(b) 20
(c) 35
(d) 50

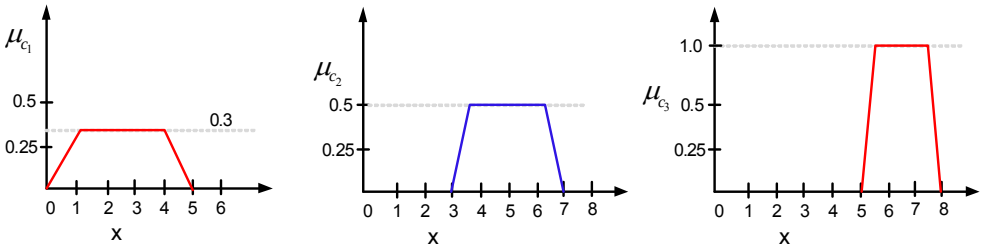
8) If the fuzzy set has two sub regions, then the centre of gravity of the sub region _____ can be used to calculate the defuzzified value.

(a) with the median of all the area
(b) with the mean of all the area
(c) with the largest area
(d) with the smallest area

9) Which of the following is not a centroid method?

(a) Centre of gravity method (CoG)
(b) Centre of sum method (CoS)
(c) Centre of area method (CoA)
(d) Centre of Mass (CoM)

10) Consider the three output fuzzy sets as shown in the following plots:



The crisp value of $C = C_1 \cup C_2 \cup C_3$ using CoG method is

(a) 4.9
(b) 5.2
(c) 3.9
(d) 5.8

11) For a fuzzy relation R

$$R = \begin{bmatrix} 0.7 & 0.2 & 0.3 \\ 0.9 & 0.5 & 1 \\ 0.8 & 0.3 & 0.7 \end{bmatrix}$$

λ-cut relations for $\lambda = .8$

(a) $R_0 = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$

(b) $R_0 = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

(c) $R_0 = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

(d) $R_0 = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

12) What are the following sequence of steps taken in designing a fuzzy logic machine?

(a) Fuzzification->Rule evaluation->Defuzzification
(b) Rule evaluation->Fuzzification->Defuzzification
(c) Fuzzy Sets->Defuzzification->Rule evaluation
(d) Defuzzification->Rule evaluation->Fuzzification

13) If the output fuzzy set $C = C_1 \cup C_2 \cup \ldots\ldots\ldots C_n$, then the crisp value according to Centre of Sum (CoS) is defined as (Symbols have their usual meaning)

(a) $x^* = \frac{\sum_{i=1}^{n} x_i.(A_i)}{\sum_{i=1}^{n} A_i}$

(b) $x^* = \frac{\sum x_i.\mu_c(x_i)}{\sum \mu_c(x_i)}$

(c) $x^* = \frac{\sum_{i=1}^{n} x_i A_{c_i}}{\sum_{i=1}^{n} A_{c_i}}$

(d) $x^* = \frac{\sum_{i=1}^{n} \mu_{c_i}(x_i).x_i}{\sum_{i=1}^{n} \mu_{c_i}(x_i)}$

14) If A is a fuzzy set, then $\overline{(A)}_\lambda \neq \overline{A_\lambda}$

(a) except for value of $\lambda = 0.5$
(b) except for value of $\lambda = 1$
(c) except for value of $\lambda = 0$
(d) for all values of λ

15) If R is a fuzzy set, then $\overline{(R)}_\lambda \neq \overline{R_\lambda}$

(e) except for value of $\lambda = 0.5$
(f) except for value of $\lambda = 1$
(g) except for value of $\lambda = 0$
(h) for all values of λ