

Introduction to Soft Computing

Practice Sheet FL-3

Topic:

- *Defuzzification 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 approach 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) Takagi-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

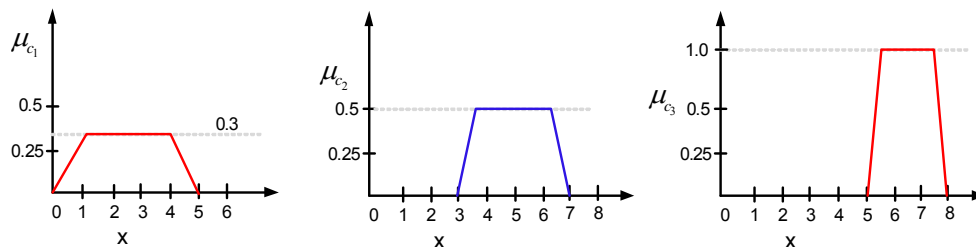
8) If the fuzzy set has two sub regions, then the centre of gravity of the sub region _____ can be used to calculate the defuzzified value.

- (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 $\lambda = .8$

$$\begin{aligned} \text{(a) } R_0 &= \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} \\ \text{(b) } R_0 &= \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} \\ \text{(c) } R_0 &= \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \\ \text{(d) } R_0 &= \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} \end{aligned}$$

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

$$\begin{aligned} \text{(a) } x^* &= \frac{\sum_{i=1}^n x_i(A_i)}{\sum_{i=1}^n A_i} \\ \text{(b) } x^* &= \frac{\sum x_i \mu_c(x_i)}{\sum \mu_c(x_i)} \\ \text{(c) } x^* &= \frac{\sum_{i=1}^n x_i A_{c_i}}{\sum_{i=1}^n A_{c_i}} \\ \text{(d) } x^* &= \frac{\sum_{i=1}^n \mu_{c_i}(x_i) \cdot x_i}{\sum_{i=1}^n \mu_{c_i}(x_i)} \end{aligned}$$

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