

Indian Institute of Technology Kharagpur

Department of Mechanical Engineering

Instructions: Answer all the questions. Each question carries two marks. There is no negative marking for wrong answer. There is no part marking for the questions.

First Test (2020-2021) ; Total Marks: 20

Subject: MF41601: Soft Computing; Maximum Time: 1 hour; Date: 14.10.2020

Name:	Roll No.
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QUESTION 1:

Fig. A shows Triangular membership function distribution of a fuzzy set.

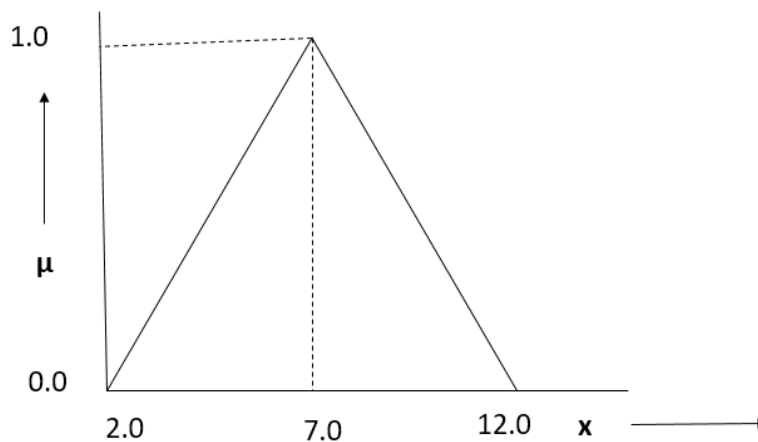


Fig. A: Triangular membership function distribution

The value of the membership (μ) corresponding to $x = 8.0$ is found to be equal to

- (a) 0.9
- (b) 0.7
- (c) 0.6
- (d) 0.8

Correct Answer:

QUESTION 2:

The membership function distribution of a fuzzy set is assumed to follow a Gaussian distribution with mean $m = 80$ and standard deviation $\sigma = 15$. Gaussian membership function distribution is expressed as follows:

$$\mu = \frac{1}{e^{\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2}}$$

Its 0.6 – cut is approximately found to be as

- (a) (45.00, 85.00)
- (b) (44.87, 88.17)
- (c) (64.84, 95.16)
- (d) (54.84, 85.16)

Correct Answer:

QUESTION 3:

Let us consider a fuzzy set $A(x)$ as follows:

$$A(x) = \{(x_1, 0.4), (x_2, 0.6), (x_3, 0.8)\}.$$

Its DILATION is determined as

- a. $\{(x_1, 0.30), (x_2, 0.40), (x_3, 0.50)\}.$
- b. $\{(x_1, 0.35), (x_2, 0.45), (x_3, 0.65)\}.$
- c. $\{(x_1, 0.49), (x_2, 0.68), (x_3, 0.86)\}.$
- d. $\{(x_1, 0.63), (x_2, 0.77), (x_3, 0.89)\}.$

Correct Answer:

QUESTION 4:

Let us consider two fuzzy sets as follows:

$$A(x) = \{(x_1, 0.2), (x_2, 0.3), (x_3, 0.4)\}$$

$$B(x) = \{(x_1, 0.4), (x_2, 0.5), (x_3, 0.6)\}$$

Their bounded sum $A(x) \oplus B(x)$ is determined as follows:

- a. $\{(x_1, 1.0), (x_2, 0.6), (x_3, 0.8)\}$
- b. $\{(x_1, 1.0), (x_2, 0.8), (x_3, 0.6)\}$
- c. $\{(x_1, 0.8), (x_2, 0.6), (x_3, 1.0)\}$
- d. $\{(x_1, 0.6), (x_2, 0.8), (x_3, 1.0)\}$

Correct Answer:

QUESTION 5:

Let us consider two fuzzy sets as follows:

$$A(x) = \{(x_1, 0.3), (x_2, 0.5), (x_3, 0.6)\}$$

$$B(x) = \{(x_1, 0.6), (x_2, 0.7), (x_3, 0.8)\}$$

Their algebraic difference $A(x) - B(x)$ is determined as follows:

- a. $\{(x_1, 0.2), (x_2, 0.2), (x_3, 0.3)\}$
- b. $\{(x_1, 0.6), (x_2, 0.7), (x_3, 0.8)\}$
- c. $\{(x_1, 0.3), (x_2, 0.3), (x_3, 0.2)\}$
- d. $\{(x_1, 0.3), (x_2, 0.5), (x_3, 0.6)\}$

Correct Answer:

QUESTION 6:

Let us consider two fuzzy sets as follows:

$$A(x) = \{(x_1, 0.3), (x_2, 0.4), (x_3, 0.5)\}$$

$$B(x) = \{(x_1, 0.5), (x_2, 0.6), (x_3, 0.7)\}.$$

Their algebraic product is determined as

- a. $\{(x_1, 0.5), (x_2, 0.6), (x_3, 0.7)\}.$
- b. $\{(x_1, 0.3), (x_2, 0.4), (x_3, 0.5)\}.$
- c. $\{(x_1, 0.15), (x_2, 0.24), (x_3, 0.35)\}.$
- d. $\{(x_1, 0.65), (x_2, 0.76), (x_3, 0.85)\}.$

Correct Answer:

QUESTION 7:

In Mamdani approach of fuzzy reasoning tool, let us assume that two rules are getting fired for a set of inputs. The combined fuzzified output considering these two fired rules is shown in Fig. B.

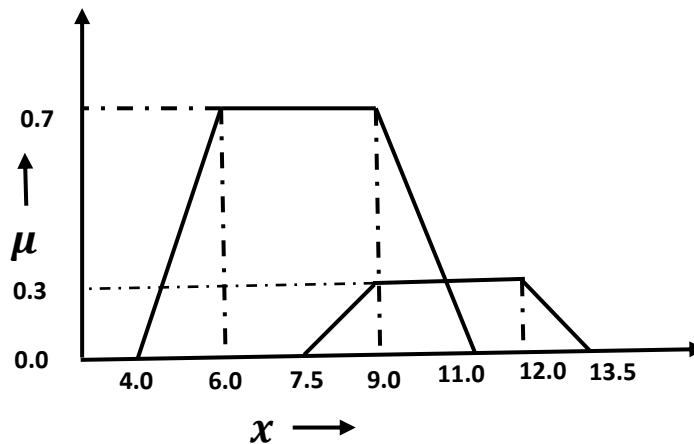


Fig. B. Combined fuzzified output.

By using the Mean of Maxima method, the crisp output is found to be equal to

- a. 9.5
- b. 8.5
- c. 6.5

d. 7.5

Correct Answer:

QUESTION 8:

In order to establish input-output relationships of a process having 3 inputs, a fuzzy reasoning tool is to be designed. The first, second and third inputs are represented using 4, 5 and 6 linguistic terms, respectively. The total number of rules becomes equal to

- a. $4 + 5 + 6 = 15$
- b. $4 \times 5 \times 6 = 120$
- c. 4^3
- d. 5^3

Correct Answer:

QUESTION 9:

Let us consider the coordinates of two data points: M and N as (2.0,3.0) and (8.0,7.0) , respectively. Let us also assume that similarity (S) between these two data points is inversely proportional to their Euclidean distance (d) with the constant of proportionality $k = 0.8$. Their similarity (S) is determined approximately as

- a. 0.347
- b. 0.350
- c. 0.111
- d. 0.412

Correct Answer:

QUESTION 10:

The value of Log-sigmoid transfer function used in neural network (NN) varies in the range of

- a. (-1.0, +1.0)
- b. (-5.0, +5.0)
- c. (0.0, +1.0)

d. $(-2.0, +2.0)$

Correct Answer:

*******END*******

ANSWER KEYS

Q. 1:

Q. 2:

Q. 3:

Q. 4:

Q. 5:

Q. 6:

Q. 7:

Q. 8:

Q. 9:

Q. 10:

Name:

Roll No.