

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2020

Course: Fuzzy Logic & Neural Network
Program: B.Tech. Electronics Engineering (IoT)
Course Code: ICEG 441

Semester: VIII
Time 03 hrs.
Max. Marks: 100

Section A (30 marks – 5 marks each) – Choose the correct answer

Q 1. Which of the following figure represent a symmetrical hard limit activation function?



A.



B.

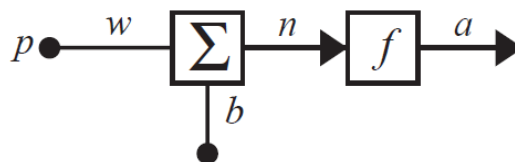


C.



D.

Q 2. Which of the following equation correctly represents the *output* (a) obtained from the neuron model below?



A. $w = f(an + b)$

- B. $a = f(wb + p)$
- C. $a = f(wp + b+n)$
- D. $a = f(pw + b)$

Q 3. For the fuzzy sets A and B given below, select the Cartesian product $A \times B$

$$\tilde{A} = \frac{0.2}{x_1} + \frac{0.5}{x_2} + \frac{1}{x_3} \quad \text{and} \quad \tilde{B} = \frac{0.3}{y_1} + \frac{0.9}{y_2}.$$

A. $\tilde{A} \times \tilde{B} = \tilde{R} = \begin{matrix} & y_1 & y_2 \\ x_1 & 0.2 & 0.2 \\ x_2 & 0.3 & 0.5 \\ x_3 & 0.3 & 0.9 \end{matrix}$

A.

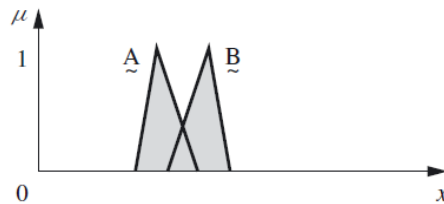
B. $\tilde{R} = \begin{matrix} & y_1 & y_2 \\ x_1 & 0.7 & 0.5 \\ x_2 & 0.8 & 0.4 \end{matrix}$

B.

C. Both a and b are correct

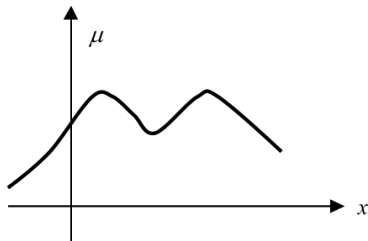
D. None of the above

Q 4. From the fuzzy sets given below identify the mathematical operation.

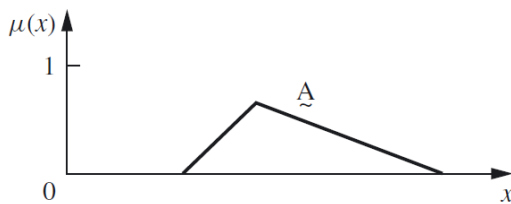


- A. Intersection of fuzzy sets A and B
- B. Union of fuzzy sets A and B
- C. Complement of fuzzy sets A and B
- D. All of the above

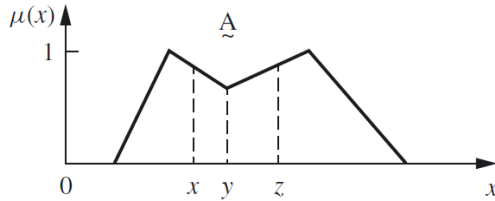
Q 5. Which among the following fuzzy sets is a convex set?



A.



B.



- C.
D. All of the above

Q 6. Which of the following represents *centroid* defuzzification method?

A.
$$z^* = \frac{\sum \mu_{\tilde{C}}(\bar{z}) \cdot \bar{z}}{\sum \mu_{\tilde{C}}(\bar{z})}$$

B.
$$z^* = \frac{a + b}{2}$$

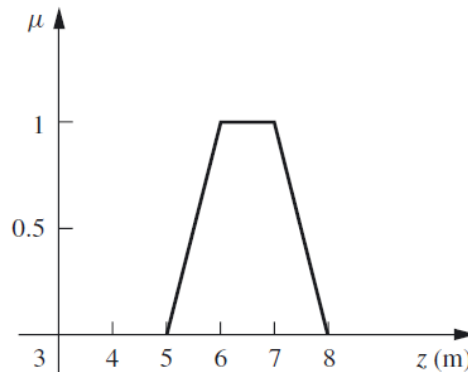
C.
$$z^* = \frac{\int \mu_{\tilde{C}}(z) \cdot z \, dz}{\int \mu_{\tilde{C}}(z) \, dz}$$

- D. None of the above

Section B (50 marks – 10 marks each) – Answer in around 5 lines (150 words)

Q 7. Discuss the importance of bias input in an artificial neuron model.

Q 8. Using mean max membership defuzzification method, calculate the crisp value form the fuzzy set given below.



Q 9. The input to a single-input neuron is 2.0, its weight is 3 and its bias is -1.5. (a) Calculate the net input to the transfer function, (b) What is the neuron output if the neuron has a hardlimit transfer function.

Q 10. Consider a single-input neuron with a bias. We would like the output to be -1 for inputs less than 3 and +1 for inputs greater than or equal to 3.

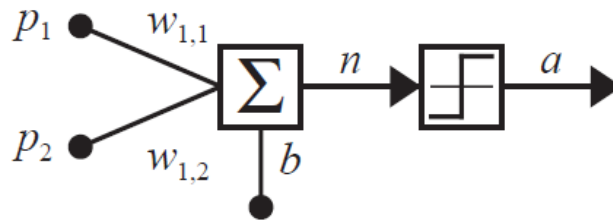
- What kind of a transfer function is required?
- What bias would you suggest? Is your bias in any way related to the input weight? If yes, how?

Q 11. For the following sets A and B. calculate the (a) union, (b) intersection, for the sets. Also find. Consider the universe of discourse as $\{0,1,2,3,4\}$

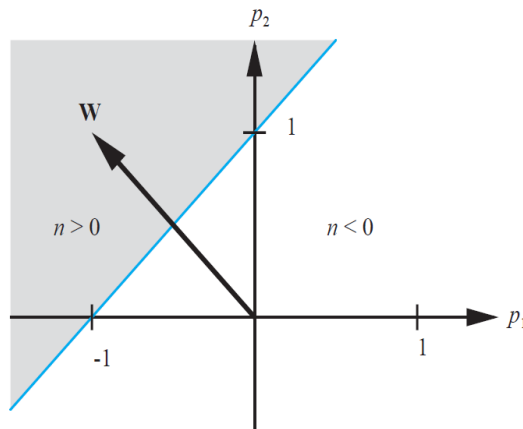
Fuzzy Set A = $\{1/1 + 0.3/2 + 0.1/3 + 0.3/4\}$, Fuzzy Set B = $\{0.3/1 + 0.5/2 + 0.3/3 + 0.7/4\}$

Section C (20 marks) – Answer in around 700 words

Q 12. Explain the concept of decision boundary. How a perceptron network acts as a classifier? Describe with help of an example.



2-input Perceptron Model



Required decision boundary