SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

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Soft Computing (CSP 3035) Lab Exam Quiz **BX Answer Key**

Q. 1 Which of the following statements is true about the McCulloch-Pitts (MP) neuron model?

- ○ a) It can implement non-linear functions without activation functions
- ○ b) It uses analog inputs and outputs
- ● c) It can only implement logical functions like AND, OR, and NOT
- ○ d) It incorporates learning through weight adjustments

Q. 2 What is the key contribution of Hebb's learning rule to neural networks?

- ○ a) It introduced the concept of recurrent connections
- ● b) It established that "neurons that fire together, wire together"
- ○ c) It introduced the concept of hidden layers
- ○ d) It incorporated error-based weight adjustment

Q. 3 A perceptron with weights $w = [0.4, -0.2]$ and threshold $\theta = 0.3$ receives input $x = [0.5, 1]$. If the learning rate $\eta = 0.1$ and the target output is 1, the updated weights after ONE iteration will be:

- ○ a) $w = [0.4, -0.2]$
- ○ b) $w = [0.45, -0.15]$
- ○ c) $w = [0.35, -0.25]$
- ● d) $w = [0.45, -0.1]$

Q. 4 What is the primary difference between ADALINE and the perceptron?

- ● a) ADALINE uses continuous output values before thresholding
- ○ b) ADALINE can only implement linear functions
- ○ c) ADALINE uses a different activation function
- ○ d) ADALINE has multiple layers while perceptron has only one

Q. 5 In the original MADALINE with Rule I learning, which of the following statements is TRUE?

- ○ a) MRI adjusts weights in all layers of the network
- ○ b) MRI adjusts only the weights connecting hidden ADALINE units to the output unit
- ● c) MRI adjusts only the weights connecting inputs to hidden ADALINE units
- ○ d) MRI applies different learning rates to different layers

Q. 6 What is the purpose of the activation function in a neural network?

- ○ a) To initialize the weights properly
- ● b) To introduce non-linearity into the network's output
- ○ c) To normalize the input data
- ○ d) To reduce computational complexity

Q. 7 What is the primary difference between crisp sets and fuzzy sets?

- ○ a) Crisp sets can handle continuous data while fuzzy sets cannot
- ● b) Crisp sets are based on binary logic while fuzzy sets allow partial membership
- ○ c) Crisp sets require more computational resources than fuzzy sets
- ○ d) Crisp sets are used only in supervised learning while fuzzy sets are used in unsupervised learning

Q. 8 Given a fuzzy set A with membership function $\mu A(x) = x/10$ for $0 \leq x \leq 10$ and a fuzzy set B with membership function $\mu B(x) = (10 - x)/10$ for $0 \leq x \leq 10$, what is the membership value of element $x = 4$ in the intersection of A and B using the minimum operator?

- ● a) 0.4
- ○ b) 0.6
- ○ c) 0.5
- ○ d) 1.0

Q. 9 A genetic algorithm is initialized with a population where all chromosomes have the same fitness value. Which of the following mechanisms would be MOST critical to ensure the algorithm doesn't stagnate in the first generation?

- ○ a) Elitism
- ● b) Mutation
- ○ c) Roulette wheel selection
- ○ d) Crossover

Q. 10 If C is the complement of the union of fuzzy sets A and B, which of the following expressions correctly represents C according to fuzzy set theory and De Morgan's laws?

- ● a) $\tilde{A} \cap \tilde{B}$
- ○ b) $\tilde{A} \cup \tilde{B}$
- ○ c) $(A \tilde{\cap} B)$
- ○ d) $A \cap \tilde{B}$

Q. 11 What is the primary inspiration for genetic algorithms?

- ○ a) Human problem-solving strategies
- ● b) Biological evolution and natural selection
- ○ c) Physics optimization principles
- ○ d) Economic market dynamics

Q. 12 The ADALINE weight update rule is given by

- ○ a) $w_{new} = w_{old} + \alpha(t - y)x$
- ● b) $w_{new} = w_{old} + \alpha(t - net)x$
- ○ c) $w_{new} = w_{old} + \alpha(y - t)x$
- ○ d) $w_{new} = w_{old} + \alpha x$

Q. 13 In backpropagation, the error term (δ) at the output neuron is:

- ○ a) $(t - y)$
- ● b) $(t - y)f^{'}(net)$
- ○ c) $f^{'}(net)$
- ○ d) $(t - y)x$

Q. 14 The MP neuron uses which type of activation function?

- ○ a) Linear
- ● b) Step (threshold)
- ○ c) Sigmoid
- ○ d) $Tanh$

Q. 15 Which of the following best describes the Cartesian product of two fuzzy sets $A(x)$ and $B(y)$?

- ○ a) The set of all pairs (x, y) with membership value 1
- ○ b) The set of all pairs (x, y) with membership value 0
- ● c) The set of all pairs (x, y) with membership value $min(\mu A(x), \mu B(y))$
- ○ d) The set of all pairs (x, y) with membership value $max(\mu A(x), \mu B(y))$