Graphic Era

End Term (Odd) Semester Examination December 2024

Name of the Course: BCA

Semester: V

Name of the Paper: Soft Computing

Paper Code: TBC-505(3)

Time: 3 Hours

Maximum Marks: 100

Note:

(i) All Questions are compulsory.
(ii) Answer any two sub-questions among a, b, and c in each main question.
(iii) Total marks in each main question are twenty.
(iv) Each question carries 10 marks.

Q1	(10*2=20 marks)	**CO1**
(a)	What is soft computing? Explain its necessity and how it differs from hard computing with suitable examples. Identify and explain two real-world applications of soft computing, detailing how they address challenges that hard computing cannot solve.	
(b)	Explain the McCulloch-Pitts Neuron Model. Implement XOR function using McCulloch-Pitts Neuron (consider binary data)	
(c)	Write a short note on: (i) Perceptron Learning Rule vs Delta Learning Rule (ii) BNN vs ANN	
Q2	(10*2=20 marks)	**CO2/ CO3**
(a)	Explain the working of the Back Propagation Network (BPN) in detail. Discuss the following aspects: (i) Architecture of BPN. (ii) Steps involved in the forward pass and backward pass. (iii) The role of the learning rate in weight adjustments (iv) Applications of BPN in real-world scenarios. Support your explanation with suitable mathematical expressions and a diagram.	
(b)	Consider a Kohonen self-organizing net with two cluster units and five input units. The weight vectors for the cluster units are w1 = [1.0, 0.8, 0.6 , 0.4, 0,2] & w2 = [0.2, 0.4, 0.6, 0.8, 1.0] Use the square of the Euclidean distance to find winning cluster unit for the input pattern x = [0.5, 1.0, 0.5, 0.0 0.0] Using a learning rate of 0.2, find the new weights for the winning unit.	
(c)	What is Bidirectional Associative Memory (BAM)? Explain its architecture and how it differs from Hopfield Networks.	
Q3	(10*2=20 marks)	**CO4**
(a)	Define fuzzy logic and fuzzy set. State the importance of fuzzy sets. Discuss in detail the properties of fuzzy sets.	
(b)	Write a short note on the following. (i) Justify the following statement: Partial membership is allowed in fuzzy sets.	

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	(ii) Classical and Fuzzy relations (iii) Fuzzy variable	
(c)	Discuss the operations of fuzzy sets. Given the two fuzzy sets. $A = \left\{\frac{1}{2.0} + \frac{0.65}{4.0} + \frac{0.5}{6.0} + \frac{0.35}{8.0} + \frac{0}{10.0}\right\}$ $B = \left\{\frac{0}{2.0} + \frac{0.35}{4.0} + \frac{0.5}{6.0} + \frac{0.65}{8.0} + \frac{1}{10.0}\right\}$ Find the following: (i) $A \cup B$ (ii) $A \cap B$ (iii) $A\|B$ (iv) $\overline{AUB}$ (v) $A \cap \bar{A}$ (v) Algebraic sum (vi) Algebraic product (vii) Bounded sum (viii) Bounded difference	
Q4	**(10*2=20 marks)**	**CO4**
(a)	Explain the architecture and workings of a fuzzy inference system (FIS) using a block diagram. Explain the methods of FIS in brief.	
(b)	Explain – (i) The methods used to decompose compound linguistic rules into canonical ones. (ii) Operations on fuzzy relations	
(c)	Explain the different types of membership functions used in fuzzy logic systems. For each type, provide a mathematical representation. Discuss the features of membership functions.	
Q5	**(10*2=20 marks)**	**CO1/ CO5**
(a)	Compare and contrast traditional algorithm and genetic algorithm. With a neat flowchart, explain the operations of a simple genetic algorithm.	
(b)	Explain the biological inspiration of Genetic Algorithms (GA). Discuss how the following concepts are modeled after biological processes. (i) Selection (ii) mutation	
(c)	Discuss the Applications of GA. A Genetic Algorithm is applied to maximize the function $f(x)=(x^2)$ over the range x=0 to x=7 Perform: (i) Binary encoding for the range (ii) Calculate the fitness for P= {011,101,001,111}	