QUESTION BANK OF SOFT COMPUTING FOR AEIE BRANCH, 7TH SEMESTER

FUZZY LOGIC

1. Distinguish between fuzzy and probability with example.
2. Specify the components of Soft Computing techniques.
3. Distinguish between Fuzzy and Probability theory.

2006

1) Two fuzzy relations are given as:

\[ R_1 = \begin{bmatrix} 0.3 & 0.0 & 0.7 & 0.3 \\ 0.0 & 1.0 & 0.2 & 0.6 \\ \end{bmatrix} \]

a) Find Max-Min composition 
\[ R_1 \otimes R_1 = \begin{bmatrix} 0.0 & 0.0 & 0.0 & 0.3 \\ 0.0 & 0.0 & 0.0 & 0.6 \\ \end{bmatrix} \]
b) Find Max-Prod composition 
\[ R_1 \otimes R_1 = \begin{bmatrix} 0.0 & 0.0 & 0.0 & 0.6 \\ 0.0 & 0.0 & 0.0 & 0.3 \\ \end{bmatrix} \]
c) Max-Average composition of two relations.

10 marks.

2) Two fuzzy sets are given as: 
\[ A = \{0.4/2, 0.6/3, 0.8/4, 1/5, 0.6/7, 0.4/8 \} \]
\[ B = \{0.4/2, 0.8/4, 1/5, 0.6/7 \} \]
a) Find intersection of A and B by applying three different T-norms.
b) Union 
c) Difference.

2008

1) Explain the structure and characteristics of rule base expert systems. Also explain the conflict resolution mechanism. 10 marks.

1. How does soft computing differ from hard computing?
2. If \( \mu_{\text{young}}(x) = \frac{1}{1+|x-10|} \) determine the membership function for the set 'young but not so young'.

1) Let the universe \( x = \{1, 2, 3, 4, 5\} \) and 'small integers' be defined as 
\[ A = \{(1, 1), (2, 0.5), (3, 0.4), (4, 0.2)\} \]. Let the fuzzy relation \( R: \text{almost equal} \) be defined as follows: what is the membership function of the fuzzy set \( B = \text{rather small integers} \), if it is interpreted as the composition \( A \circ R \)? 7 marks.

2) Explain the term 'Generalised Modus Ponens' with the help of suitable example. 3 marks.

3) A fuzzy reasoning system is provided with the following facts and rules:
   a) Premise 1 (fact) \( x \) is \( A' \) and \( y \) is \( B' \)
   b) Premise 2 (Rule 1): if \( x \) is \( A_1 \) and \( y \) is \( B_1 \), then \( z \) is \( C_1 \).
   c) Premise 3 (Rule 2): if \( x \) is \( A_2 \) and \( y \) is \( B_2 \), then \( z \) is \( C_2 \).

Then explain in detail the inference procedure to find out the conclusion \( z \) is \( C' \), i.e., given \( \mu_A(x), \mu_{A_1}(x), \mu_{A_2}(x), \mu_B(y), \mu_{B_1}(y), \mu_{B_2}(y), \mu_{C_1}(z), \mu_{C_2}(z) \), determine \( \mu_C(z) \). 7 marks.

4) Which fuzzy inference system is used more widely and why? 3 marks.

4) Define soft computing.
2. State different de fuzzification techniques.
3. What do you mean by a Hybrid System?
4. What is the main difference between probability and fuzzy logic?

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NEURAL NETWORKS

1. How does an ANN differ from a biological neuron?
2. What are the different activation functions used in ANN?
3. State different learning methods of ANN.
4. Sketch a 3-4-5-2 neural network.
5. Distinguish between ADALINE and MADALINE.
6. Write the weight updated equation of a back propagation algorithm.

1) Find the inputs u to the perception activation function for the following input vectors x and weight vectors w:
   a) x=[-1, 0, 2]^T   w=[-1, -3, 2, -5]^T
   b) x=[-1, 0, 2, 4]^T   w=[-1, -3, 2, -5]^T

2) Find the output using the activation function as defined for the 3-3 neural network with given input x=[3, 0, 1] and
   \[ w = \begin{bmatrix} 3 & -1 & 1 \\ -2 & -1 & -2 \\ 0 & 1 & 0 \end{bmatrix}, \text{output} = \begin{cases} 1, & x < 0 \\ 1, & x > 0 \end{cases} \]

3) Derive the back propagation algorithm for 2-3-1 neural network with the activation function \( \frac{1}{1 + e^{-x}} \).

4) Find the output of u from the network with input x=[-1, 2] and weight function in hidden layer as:
   a) Unipolar activation function
   b) Bipolar sigmoidal function.

1. Specify the components of Soft Computing techniques.
2. What are the different learning methods of NN?
3. State different models of NN.
4. Why learning is essential for a NN with nonlinear units?
5. What is the significance of momentum term in BP learning?
6. Why LMS algorithm is called as stochastic gradient descent method?
7. Why BP algorithm is called generalized Δ rules?
8. Explain the limitations of BP learning.

1. Describe the Back Propagation algorithm for a FLANN structure with 2-inputs and 1-output, where the inputs are expanded to x, cos(\pi*x), sin(\pi*x).

2. Distinguish between MLP and RBF NN with their relative merits and demerits. Specify different Properties of NN.
3. If the activation function of all hidden unit is linear, show that a MLP is equivalent to a single layer Perceptron.
4. What are the advantages of a sigmoid function as the activation function over a hard limiting function?
5. What are different learning paradigms?
1) A neuron receives inputs from other neurons whose activity levels are 10, -20, 4 and -2. The respective synaptic weights of the neurons are 0.8, 0.2, -1.0 and -0.9. Calculate the output of neuron j for the following situations.
   a) The neuron is linear.
   b) The neuron is represented by McCulloch-Pitts model, define as follows:
      \[ Y = \sum_{k} w_k x_k \]
      where \( V_k \) is the induced local field.

2) Consider the pseudo linear function \( \phi(v) \) as shown in figure. Formulate \( \phi(v) \) as a function of \( v \).

3) The figure given below shows the signal flow graph of a 2-2-2-1 feedforward network. The function \( \phi() \) denotes a logistic function. Write the input output mapping defined by this network.

4) Compare and contrast between MLP and RBFN. State ‘Cover’s Theorem on Separability of Patterns’. 5 marks.

5) Derive the backpropagation through time (BPTT) algorithm used to train the recurrent neural networks. 10 marks.

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**GENETIC ALGORITHM**

1. Differentiate between mutation and crossover operator.
2. When GAs are preferred? 2006
3. What are the benefits of GA?
4) Write the algorithm for a simple Genetic algorithm. 5 marks.
5) Following non linear problems needs to be solved by GA. It is decided to give three and two decimal places of accuracy to variable \( x_1 \) and \( x_2 \) respectively.
   a) How many bits are required for coding the variables?
   b) What will be the fitness function? Minimize \((x_1-2.5)^2+(x_2-5)^2\) such that \(5.5x_1+2x_2^2-18 \leq 0\), \(0 \leq x_1, x_2 \leq 5\).

1. Distinguish between fixed and adaptive crossover operator.
2. What are GAs? Specify the steps followed in GAs. Illustrate the steps with a suitable example. 10 marks.

1. What are genetic algorithms? 2007
2) Name the different crossover operators used in GA.
3) List different selection mechanisms in GA. 2008

1) Enumerate the steps followed in Genetic Algorithm. 5 marks.
2) What do you understand by ‘Tournament Selection’ with reference to GA? How does it overcome the demerit of ‘Roulette Wheel selection’?
3) For finding out the value of \( x \) form the range \([-1, 2]\) which maximized the function \( f(x) = xsin(10\pi x) + 1.0 \), determine the minimum length of the ninary string used to encode \( x \). The required precision is up to 4 decimal places. 5 marks.