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 : $R1 = \begin{matrix} 0.3 & 0.0 & 0.7 & 0.3 \\ 0.0 & 1.0 & 0.2 & 0.0 \end{matrix}$

$R2 = \begin{matrix} 1.0 & 0.0 & 1.0 \\ 0.0 & 0.5 & 0.4 \\ 0.7 & 0.9 & 0.6 \\ 0.0 & 0.0 & 0.0 \end{matrix}$

   a) Find Max-Min composition
   b) Find Max-Prod composition
   c) Max-Average composition of two relations. **10 marks.**
2) Two fuzzy sets are given as : A={o.4/2. 0.6/3, 0.8/4, 1/5, 0.8/6, 0.6/7, 0.4/8} and B={0.4/2, 0.8/4, 1/5, 0.6/7} **10 marks.**
   a) Find intersection of A and B by applying three different T-norms.
   b) Union
   c) Difference.
3) What is a fuzzy inference system? This define the followings with examples:
   a) Generalized modus ponens.
   b) Generalized modus tollens. **5 marks.**
4) What do you mean by de fuzzyfication? Discuss different methods of defuzzification. **5 marks.**
5) Given A={1/2+0.5/3+0.3/4+0.2/5}, B={0.5/2+0.7/3+0.2/4+0.4/5} find A', B', AVB, AB, A|B, A'A, B'B. **10 marks.**
6) What are the fuzzy inference system (FIS)? Formulate a problem that you know to derive inference through fuzzy systems. **10 marks.**
7) $R=\begin{matrix} & y1 & y2 \\ x1 & 0.7 & 0.5 \\ x2 & 0.8 & 0.4 \end{matrix}$ and $S=\begin{matrix} & z1 & z2 & z3 \\ y1 & 0.7 & 0.5 & 0.2 \\ y2 & 0.8 & 0.4 & 0.5 \end{matrix}$ find T=R x S using max-product decompositions. **10 marks.**

1. 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?
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 $\mu_{young}(x)=\frac{1}{1+\left(\frac{x}{35}\right)^4}$, determine the membership function for the set 'young but not so young'. **2008**
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: 'almost equal' be defined as follows:what is the membership function of the fuzzy set B='rather small integers', if it is interpreted as the composition A_0R? **7marks.**

	1	2	3	4
1	1	0.8	0	0
2	0.8	1	0.8	0
3	0	0.8	1	0.8
4	0	0	0.8	1

2) Explain the term 'Generalised Modus Ponens' with the help of suitable example. **3marks.**
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 $\mu_{A'}(x)$, $\mu_{A1}(x)$, $\mu_{A2}(x)$, $\mu_{B'}(y)$, $\mu_{B1}(y)$, $\mu_{B2}(y)$, $\mu_{C1}(z)$, $\mu_{C2}(z)$, determine , $\mu_{C'}(z)$. **7marks.**
4) Which fuzzy inference system is used more widely and why? **3marks.**

NEURAL NETWORKS

1. How does an ANN doffers from 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. **2006**
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) $x=[-1, 0, 2, 4]^T$ $w=[-1, -3, 2, -5]^T$ **5 marks.**
2) find the output using the activation function as defined for the 3-3 neural network with given input x=[3, 0, 1] and

$$w = \begin{bmatrix} 3 & -1 & 1 \\ 1 & -2 & -2 \\ -1 & 0 & -3 \end{bmatrix}, output = \begin{cases} 1, u < 0 \\ 1, u > 0 \end{cases}$$ **5 marks.**

3) Derive the back propagation algorithm for 2-3-1 neural network with the activation function $1/(1+e^{-x})$. **10 marks.**
4) Find the output of u form the network with input $x=[-1,2]^T$ $w=[-1, 2]$ with activation function in hidden layer as :
   a) Unipolar activation function
   b) Bipolar sigmoidal function. **10 marks.**

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. **2007**

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). **10 marks.**
2. Distinguish between MLP and RBF NN with their relative merits and demerits. Specify different Properties of NN. **10 marks.**
3. If the activation function of all hidden unit is linear, show that a MLP is equivalent to a single layer Perception. **5 marks.**
4. What are the advantages of a sigmoid function as the activation function over a hard limiting function? **5 marks.**
5. What are different learning paradigms?

1. What is an activation function?
2. What is an auto associative network?
3. What are the advantages of neural networks over conventional computers?
4. Write down the energy function of discrete Hopifield net. **2007.**

1) Distinguish feedforward network and recurrent network.**5 marks.**
2) Draw the weight matrix for a feed forward network, showing the partitioning. You can assume that the weight matrix for connections from the input layer to the hidden layer is W_{ih}, and that the weight matrix for connections from the hidden layer to the output layer is W_{ho}. **5 marks.**
3) What is neural network? Elaborate on the features of neural network that help to solve complex problems. **5 marks.**
4) With the help of a suitable example show how a MLP can be used to provide non-linear decision boundary in Pattern Classification.**10M**.
5) List and analyze different training methods employed in RBF networks. **10 marks.**
6) short notes on: Learning Methods, MLP, RBF networks and ANFIS. **10.**

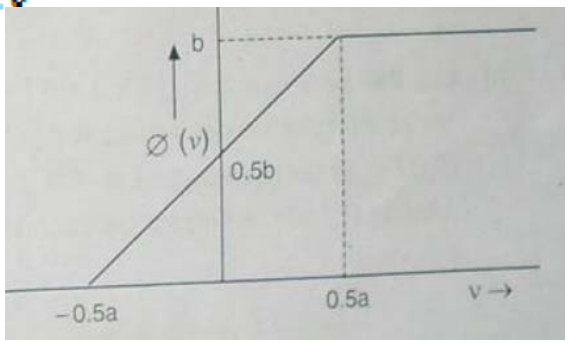
3. List various activation function used in ANN.

1. Enumerate the demerits of backpropagation algorithm.
2. Distinguish between sequential and batch mode of backpropagation learning.
3. What do you understand by 'Annealing Schedule' in simulated annealing?
4. State the drawbacks of single layer perceptron. Name a problem which cannot be solved by the above neural model.

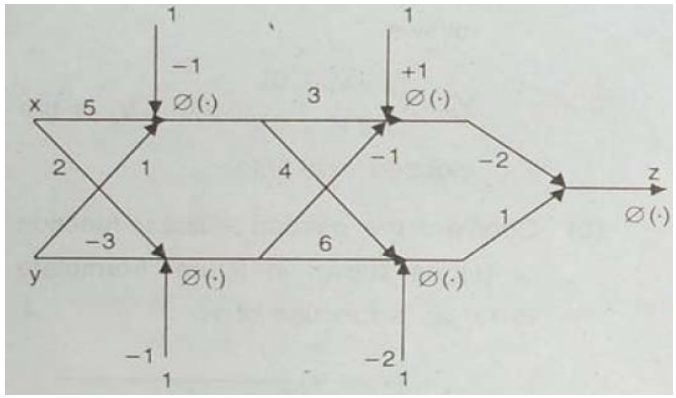
1) A neuron j receives inputs from other neurons whose activity levels are 10, -20, 4 and -2. The respective synaptic weights of the neurons are 0.8, 0.2, -1.0 and -0.9. Calculate the output of neuron j for the following situations. **6 marks.**
   a) The neuron is linear.
   b) The neuron is represented by Mc Culloch-Pitts model, define as follows:

$$Y_k = \begin{cases} 1, if\ V_k \geq 0 \\ 0, if\ V_k < \end{cases}$$

, where V_k is the induced local field.



2) Consider the pseudo linear function Ø(v) as shown in figure. Formulate Ø(v) as a function of v. **4marks.**
3) The figure given below shows the signal flow graph of a 2-2-2-1 feedforward network. The function Ø(.) denotes a logistic function. Write the input ouput mapping defined by this network. **10 marks.**



4) Compare and contrast between MLP and RBFN. State 'Cover's Theorem on Separability of Patterns'. **5marks.**
5) Derive the backpropagation through time (BPTT) algorithm used to train the recurrent neural networks. **10marks.**

GENETIC ALGORITHM

1. Differentiate between mutation and crossover operator.
2. When GAs are preferred? **2006**
3. What are the benefits of GA?

1) Write the algorithm for a simple Genetic algorithm. **5 marks.**
2) 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 $5.5x_1+2x_2^2-18<=0$, $0<=x_1, x_2<=5$.

1. Distinguish between fixed and adaptive crossover operator.
1. What are Gas? Specify the steps followed in GAs. Illustrate the steps with a suitable example. **10 marks.**
1. What are genetic algorithms? **2007**

1) Explain genetic operators and fitness function in respect of evolutionary computing. **10 marks.**

1. Name the different crossover operators used in GA.
2. 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(10Πx)+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.**