Total number of printed pages – 7

B. Tech

PECS 3401

Seventh Semester Examination – 2008

SOFT COMPUTING

Full Marks – 70

Time – 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (i) How does soft computing differ from hard computing ?

   (ii) If $\mu_{young}(x) = \frac{1}{1+\left(x/20\right)^4}$, determine the membership function for the set '*young but not so young*'.

P.T.O.

(iii) List the various activation functions used in ANN.

(iv) Enumerate the demerits of backpropagation algorithm.

(v) Name the different crossover operators used in GA.

(vi) Distinguish between sequential and batch-mode of backpropagation learning.

(vii) Enumerate different defuzzification techniques.

(viii) What do you understand by '*Annealing Schedule*' in simulated annealing ?

(ix) State the drawbacks of single layer perceptron. Name a problem which cannot be solved by the above neural model.

(x) List different selection mechanisms in GA.

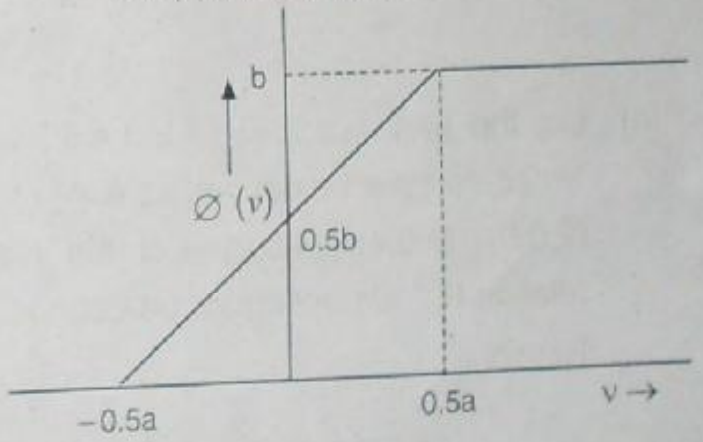
2. (a) A neuron j receives inputs from other neurons whose activity levels are 10, –20, 4 and –2. The respective synaptic weights of the neurons are 0.8, 0.2, –1.0 and – 0.9. Calculate the output of neuron j for the following situations. 6

(i) The neuron is linear.

(ii) The neuron is represented by Mc Culloch-Pitts model, defined as follows :

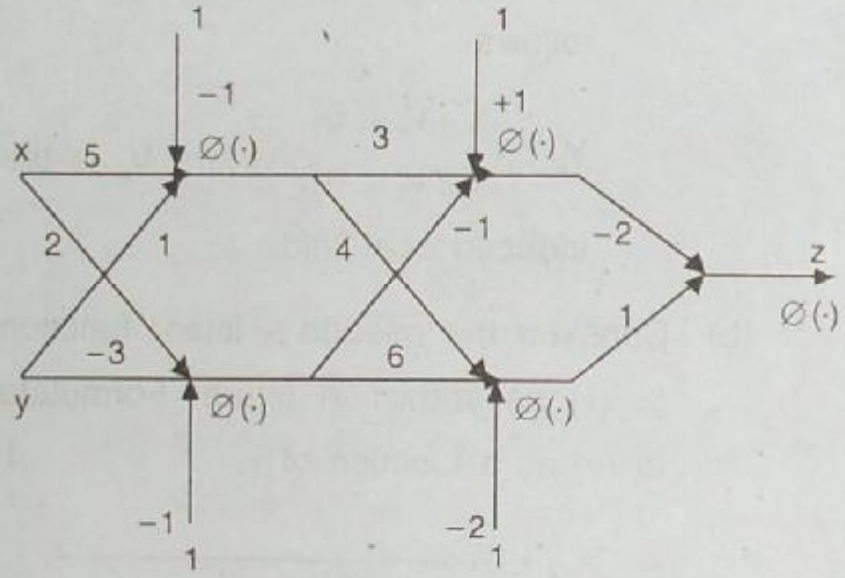
$$Y_k = \begin{cases} 1, \text{ if } V_k \geq 0 \\ 1, \text{ if } V_k < 0 \end{cases}$$, where V_k is the induced local field.

(b) Consider the pseudo – linear function $\varnothing(v)$ as shown in figure. Formulate $\varnothing(v)$ as a function of v. 4



3. The figure given below shows the signal flow graph of a 2-2-2-1 feedforward network. The

function $\varnothing$ (·) denotes a logistic function. Write the input-output mapping defined by this network. 10



4. (a) 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 :

	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

What is the membership function of the fuzzy set B = *'rather small integers'*, if it is interpreted as the composition A_0 R ? 7

(b) Explain the term *'Generalised Modus Ponens'* with the help of suitable example. 3

5. (a) Compare and contrast between MLP and RBFN. State 'Cover's Theorem on Separability of Patterns'. 5

(b) Enumerate the steps followed in Genetic Algorithm. 5

6. (a) What do you understand by *'Tournament Selection'* with reference to GA ? How does it overcome the demerit of *'Roulette Wheel selection'* ? 5

(b) For finding out the value of x from the range [–1, 2] which maximizes the function $f(x) = x \sin(10 \pi x) + 1.0$, determine the minimum length of the binary string used to encode x. The required precision is up to 4 decimal places. 5

7. (a) A fuzzy reasoning system is provided with the following facts and rules :

Premise 1 (fact): x is A′ and y is B′

Premise 2 (Rule 1): if x is A_1 and y is B_1, then z is C_1

Premise 3 (Rule 2): if x is A_2 and y is B_2, then z is C_2

Explain in detail the inference procedure to find out the conclusion z is C′, i.e., given $\mu_{A'}(x)$, $\mu_{A_1}(x)$, $\mu_{A_2}(x)$, $\mu_{B'}(y)$, $\mu_{B_1}(y)$, $\mu_{B_2}(y)$, $\mu_{C_1}(z)$, and $\mu_{C_2}(z)$, determine $\mu_{C'}(z)$. 7

(b) Which Fuzzy Inference System is used more widely and why ? 3

8. Derive the Backpropagation through time (BPTT) algorithm used to train the recurrent neural network. 10