BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc **SEMESTER : VIII**
BRANCH: MATHEMATICS & COMPUTING **SESSION : SP/19**

SUBJECT: TSC1103 ARTIFICIAL NEURAL NETWORK AND FUZZY LOGIC
TIME: 3:00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What do you mean by ANN and write any two real life applications of it? [3]

Q.1(b) Draw the architecture of biological neuron and artificial neuron. Write any four differences between them. [4]

Q.1(c) What is the activation function? Explain with help of diagram. Describe the linear and non-linear activation functions and write down the models where they are used. [5]

Q.2(a) What is perceptron model? Explain with the help of diagram. Is XOR problem solved by perceptron model? If yes, solve it. [4]

Q.2(b) What do you mean by learning in ANN? Explain in detail about Boltzmann learning. [5]

Q.2(c) Write a short note on the following: [3]
(I) Unsupervised learning
(II) Feedback neural network

Q.3(a) Derive weight correction expression in Backpropagation principle when node j is an outer node. [3]

Q.3(b) Draw the architecture of BAM? Write its characteristics and drawbacks. [4]

Q.3(c) What are autocorrelators? Define correction matrix and recall equation for autocorrelator. Explain the working of autocorrelator for the following pattern: [5]
A_1=(-1,1,-1,1), A_2=(1,1,1,-1), A_3=(-1,-1,-1,1)

Q.4(a) What is the Radial basis function network? Explain the Pseudo inverse method to train the network. [4]

Q.4(b) Write a short note on the following: (I) Memory based learning (II) Associate memory network [4]

Q.4(c) What is ART 2 network? Explain the architecture and working of ART 2 network. [4]

Q.5(a) What is Hopfield neural network model? Explain the architecture and working of Hopfield neural network. [3]

Q.5(b) Explain the training algorithm for ART1 neural network. [5]

Q.5(c) Write a short note on the following: (I) Brain state in a Box model (II) Stability and Convergence in ANN. [4]

Q.6(a) Define the following in detail with examples: (I) Fuzzy connectives (II)Membership functions [5]

Q.6(b) If $\tilde{A}$ ={(x_1,0.4),(x_2,0.8),(x_3,0.6)}; $\tilde{I}$= {(x_1,0.2),(x_2,0.6),(x_3,0.9)}, compute the following: [3]
(I) $\tilde{A} \cap \tilde{I}$(II) $\tilde{A}$ - $\tilde{I}$(III) $\tilde{A} \oplus \tilde{I}$.

Q.6(c) What is a fuzzy relation? Define the four operations on fuzzy relations. For [4]
$\tilde{A}$={(x_1,0.2),(x_2,0.7),(x_3,0.4)} and
$\tilde{I}$= {(y_1,0.5),(y_2,0.6)} to be two fuzzy sets defined on X={ x_1, x_2, x_3} and Y={ y_1, y_2} respectively. Find the following:
(I) Fuzzy Cartesian product $\tilde{A}$ X $\tilde{I}$(II) Verify De Morgan's law

Q.7(a) Let X={x_1, x_2, x_3}, Y={y_1, y_2} and Z={z_1, z_2, z_3}. Let $\tilde{A}$ be fuzzy relation defined as $\begin{matrix} & y_1 & y_2 \\ x_1 \\ x_2 \\ x_3 \end{bmatrix} \begin{bmatrix} 0.5 & 0.1 \\ 0.2 & 0.9 \\ 0.8 & 0.6 \end{bmatrix}$ [3]

and $\tilde{I}$ be a fuzzy relation defined as $\begin{matrix} & z_1 & z_2 & z_3 \\ y_1 \\ y_2 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 & 0.7 \\ 0.5 & 0.8 & 0.9 \end{bmatrix}$ then find max-min composition $\tilde{A} \circ \tilde{I}$.

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Q.7(b) What is a fuzzy proposition? Consider $\tilde{A}$ to be fuzzy proposition; Karan is efficient with $T(\tilde{A})=0.5$ and $\tilde{N}$: Neena is efficient with $T(\tilde{N})=0.78$; Find the truth value of following fuzzy propositions: [3]
(I) Karan is not efficient.
(II) Karan is efficient and so is Neena.
(III) Either Karan or Neena is efficient.
(IV) Karan is efficient then so is Neena.

Q.7(c) Let $X=\{a, b, c, d\}$, $Y=\{1, 2, 3, 4\}$ and $\tilde{A} = \{(a,0)(b,0.8)(c,0.6)(d,1)\}$, $\tilde{N}=\{(1,0.2)(2,1)(3,0.8)(4,0)\}$, $\tilde{I}=\{(1,0)(2,0.4)(3,1)(4,0.8)\}$; determine the implication relations [6]
(I) IF x is $\tilde{A}$ THEN y is $\tilde{N}$.
(II) IF x is $\tilde{A}$ THEN y is $\tilde{N}$ ELSE y is $\tilde{I}$.

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