Enrollment No......................................

Faculty of Engineering

End Sem (Odd) Examination Dec-2019
OE00002 Neural Networks & Fuzzy Systems

Programme: B.Tech.   Branch/Specialisation: All

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1   i.   Artificial neural network used for: **1**
            (a) Pattern recognition   (b) Classification
            (c) Clustering   (d) All of these

    ii.   A Neural Network can answer: **1**
            (a) For loop questions
            (b) What-if questions
            (c) If-then-else analysis questions
            (d) None of these

    iii.   What is the sequence of the following tasks in a perceptron?   **1**
            I.   Initialize weights of perceptron randomly
            II.   Go to the next batch of dataset
            III. If the prediction does not match the output, change the weights
            IV. For a sample input, compute an output
            (a) I, II, III, IV   (b) IV, III, II, I
            (c) III, I, II, IV   (d) I, IV, III, II

    iv.   Suppose that you have to minimize the cost function by changing the parameters. Which of the following technique could be used for this?   **1**
            (a) Exhaustive Search   (b) Random Search
            (c) Bayesian Optimization   (d) Any of these

    v.   In which neural net architecture, does weight sharing occur?   **1**
            (a) Convolutional neural Network
            (b) Recurrent Neural Network
            (c) Fully Connected Neural Network
            (d) Both (a) and (b)

vi. What is a dead unit in a neural network? **1**
   (a) A unit which doesn't update during training by any of its neighbour
   (b) A unit which does not respond completely to any of the training patterns
   (c) The unit which produces the biggest sum-squared error
   (d) None of these

vii. Fuzzy logic is usually represented as **1**
   (a) IF-THEN-ELSE rules   (b) IF-THEN rules
   (c) Both (a) and (b)   (d) None of these

viii. _____ is/are the way/s to represent uncertainty. **1**
   (a) Fuzzy Logic   (b) Probability
   (c) Entropy   (d) All of these

ix. What are the following sequence of steps taken in designing a fuzzy logic machine? **1**
   (a) Fuzzification $\rightarrow$ Rule evaluation $\rightarrow$ Defuzzification
   (b) Fuzzification $\rightarrow$ Defuzzification $\rightarrow$ Rule evaluation
   (c) Rule evaluation $\rightarrow$ Fuzzification $\rightarrow$ Defuzzification
   (d) Rule evaluation $\rightarrow$ Defuzzification $\rightarrow$ Fuzzification

x. The values of the set membership is represented by **1**
   (a) Discrete set   (b) Degree of truth
   (c) Probabilities   (d) Both (b) and (c)

Q.2 i. Explain the Mc Culloch-Pitts neuron model with neat sketch and derivations? **2**

  ii. Describe the learning strategies for artificial neural networks? What are the advantages and disadvantages of ANN? **3**

  iii. Explain the classification taxonomy of artificial neural networks? Derive the formulas used? **5**

OR iv. Explain different types of Perceptron training algorithms using neat sketches and derivations? **5**

Q.3 i. Explain what is Perceptron and what are the limitations of "Perceptron" model? **2**

  ii. Describe the multilayer feed forward neural network? Derive output equations and weight update equations for a multilayer feed forward neural network using back propagation algorithm? **8**

OR iii. Explain the Kolmogorov theorem with the help of necessary derivations and diagrams? What are the applications, advantages, and disadvantages of it? **8**

Q.4 i. A 4-input neuron has weights 1, 2, 3 and 4. The transfer function is linear with the constant of proportionality being equal to 2. The inputs are 4, 10, 5 and 20 respectively. Find the output? **2**

  ii. Explain the different types of the training algorithms for pattern association? **8**

OR iii. Briefly explain the Hopfield network and Hetero-associate network? What are the applications, advantages and disadvantages of these networks? **8**

Q.5 i. Explain the cardinalities in fuzzy sets with the help of examples? **2**

  ii. What is meant by membership function? Describe in detail various membership functions of fuzzy logic systems with the help of necessary sketches and derivations? **8**

OR iii. Describe the fuzzy composition operations? Explain decision making using fuzzy composition operations with the help of neat sketches and derivations? **8**

Q.6 Attempt any two:

  i. Explain air conditioner control using fuzzy logic with the help of derivations? **5**

  ii. Describe the different methods of defuzzification with the help of neat sketches and derivations? **5**

  iii. What is the Greg-Viot fuzzy cruise controller? Describe the same using necessary equations and sketches? **5**

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Marking Scheme
OE00002 Neural Networks & Fuzzy Systems

Q.1   i.   Artificial neural network used for: **1**
(d) All of these

     ii.   A Neural Network can answer: **1**
(b) What-if questions

     iii.   What is the sequence of the following tasks in a perceptron?   **1**
(d) I, IV, III, II

     iv.   Suppose that you have to minimize the cost function by changing the parameters. Which of the following technique could be used for this?   **1**
(d) Any of these

     v.   In which neural net architecture, does weight sharing occur?   **1**
(d) Both (a) and (b)

     vi.   What is a dead unit in a neural network?   **1**
(a) A unit which doesn't update during training by any of its neighbour

     vii.   Fuzzy logic is usually represented as   **1**
(b) IF-THEN rules

     viii.   _____ is/are the way/s to represent uncertainty.   **1**
(d) All of these

     ix.   What are the following sequence of steps taken in designing a fuzzy logic machine?   **1**
(a) Fuzzification → Rule evaluation → Defuzzification

     x.   The values of the set membership is represented by   **1**
(d) Both (b) and (c)

Q.2   i.   Mc Culloch-Pitts neuron model   1 mark   **2**
         Sketch and derivations   1 mark

     ii.   Learning strategies for artificial neural networks   1 mark   **3**
         Advantages   1 mark
         Disadvantages of ANN   1 mark

     iii.   Classification taxonomy   3 marks   **5**
         Derivation   2 marks

OR   iv.   Types of Perceptron training algorithms   **5**
         Any two 2.5 marks for each   (2.5 marks *2)

Q.3   i.   Perceptron   1 mark   **2**
         Limitations of "Perceptron" model   1 mark

     ii.   Multilayer feed forward neural network   4 marks   **8**
         Derivation   4 marks

OR   iii.   Kolmogorov theorem with derivations and diagrams   **8**
            4 marks
         Applications   2 marks
         Advantages and disadvantages   2 marks

Q.4   i.   Find the output   **2**
         Stepwise marking

     ii.   Types of the training algorithms for pattern association   **8**
         Any two 4 marks for each   (4 marks * 2)

OR   iii.   Hopfield network   3 marks   **8**
         Hetero-associate network   3 marks
         Applications   1 mark
         Advantages and disadvantages   1 mark

Q.5   i.   Cardinalities in fuzzy sets   1 mark   **2**
         Examples   1 mark

     ii.   Membership function   4 marks   **8**
         Various membership functions   4 marks

OR   iii.   Fuzzy composition operations   4 marks   **8**
         Decision making using fuzzy composition operations
            4 marks

Q.6   Attempt any two:

     i.   Air conditioner control using fuzzy logic   3 marks   **5**
         Derivations   2 marks

     ii.   Any two methods of defuzzification   **5**
         2.5 marks for each   (2.5 marks * 2)

     iii.   Greg-Viot fuzzy cruise controller   3 marks   **5**
         Equations and sketches   2 marks

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