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## B.Tech DEGREE EXAMINATION, MAY 2024

Fifth & Seventh Semester

### 18ECE242J - PATTERN RECOGNITION AND NEURAL NETWORKS

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

**Note:**

- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40<sup>th</sup> minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

**Time: 3 Hours**

**Max. Marks: 100**

#### PART - A (20 × 1 = 20 Marks)

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Answer all Questions

- |   |  |                        |
|---|--|------------------------|
| <p>1. Which defines type-II error in the classification of healthy and patient?<br/>           (A) The person is healthy but identified as a patient<br/>           (C) The person is a patient but identified as a patient</p> | <p>(B) The person is healthy and identified as healthy<br/>           (D) The person is patient but identified as healthy.</p>   | <p>1      1      1</p> |
| <p>2. Identify the optimal classifier.<br/>           (A) Bayes classifier<br/>           (C) discriminant classifier</p>   | <p>(B) Nearest neighbor classifier<br/>           (D) Neural network</p>   | <p>1      2      1</p> |
| <p>3. Find the approach in which rules and grammar are used a recognition function.<br/>           (A) Template matching<br/>           (C) Syntactic</p>   | <p>(B) Statistical<br/>           (D) Neural network</p>   | <p>1      2      1</p> |
| <p>4. The biometric identification is having ____ number of classes.<br/>           (A) 10<br/>           (C) 26</p>  | <p>(B) 2<br/>           (D) 4</p>  | <p>1      2      1</p> |
| <p>5. Identify the drawback of the parametric method.<br/>           (A) Incapable of proving a good representation of true conditional density<br/>           (C) The density to be determined entirely by the data.</p>       | <p>(B) The number of parameters in the model grows with the size of the data set<br/>           (D) Assuming a specific functional form for density model is difficulty.</p> | <p>1      2      2</p> |
| <p>6. Find why the cluster's radius and standard deviation are computed?<br/>           (A) To find centroid<br/>           (C) To make the cluster more accurate</p>   | <p>(B) To determine its spread in each dimension<br/>           (D) To merge the clusters</p>  | <p>1      2      2</p> |
| <p>7. Calculate Euclidean distance of the data points <math>x_i=(3,4,5)</math> and <math>x_j=(5,8,9)</math><br/>           (A) 2<br/>           (C) 8</p>   | <p>(B) 4<br/>           (D) 6</p>  | <p>1      3      2</p> |
| <p>8. Choose the method, where the distance between 2 clusters is the distance between 2 closest data points of 2 clusters.<br/>           (A) Centroid<br/>           (C) Complete link</p>                                    | <p>(B) Average link<br/>           (D) Single link</p>   | <p>1      2      2</p> |
| <p>9. Find the value of the output of the threshold activation function, if the input to the threshold active function is less than 0.<br/>           (A) 0<br/>           (C) 0.5</p>  | <p>(B) 1<br/>           (D) -1</p>   | <p>1      3      3</p> |

- |   |   |   |   |
|---|---|---|---|
| 10. Identify the learning method, also known as learning with a teacher.  | 1 |   |   |
| (A) supervised learning   |   |   |   |
| (B) unsupervised learning   |   |   |   |
| (C) reinforcement learning  |   |   |   |
| (D) both unsupervised and reinforcement learning  |   |   |   |
| 11. Choose the learning method in which the output neurons of a neural network compete among themselves to become active. | 1 | 2 |   |
| (A) Error-correction learning   |   |   |   |
| (B) Memory-based learning   |   |   |   |
| (C) Hebbian learning  |   |   |   |
| (D) Competitive learning  |   |   |   |
| 12. Pick the threshold value for the McCulloch OR logic   | 1 | 3 | 3 |
| (A) 0   |   |   |   |
| (B) 1   |   |   |   |
| (C) 2   |   |   |   |
| (D) -1  |   |   |   |
| 13. Identify the architecture in which input training vector and output target vector are same.                           | 1 | 2 | 4 |
| (A) Auto-associative memory network only  |   |   |   |
| (B) Hetero associative memory network only  |   |   |   |
| (C) Hopfield network only   |   |   |   |
| (D) Both the auto-associative memory network and Hopfield network   |   |   |   |
| 14. Find the correct statement for the Boltzmann machine.   | 1 | 2 | 4 |
| (A) It is the application of simulated annealing on a discrete Hetero associative network.                                |   |   |   |
| (B) It is the application of a genetic algorithm on a discrete Hopfield network.  |   |   |   |
| (C) It is the application of simulated annealing on a discrete Hopfield network.  |   |   |   |
| (D) It is the application of simulated annealing on auto-associative networks.  |   |   |   |
| 15. Identify which architecture has the connection between the hidden layers.   | 1 | 2 | 4 |
| (A) Single layer neural network   |   |   |   |
| (B) Adaptive linear neural network  |   |   |   |
| (C) Recurrent neural network  |   |   |   |
| (D) Multilayer neural network   |   |   |   |
| 16. Identify the number of layers present in the forward-only counter-propagation network.                                | 1 | 2 | 4 |
| (A) 2   |   |   |   |
| (B) 3   |   |   |   |
| (C) 4   |   |   |   |
| (D) 5   |   |   |   |
| 17. Identify the learning neural network for a Self-organizing map.   | 1 | 2 | 5 |
| (A) Supervised  |   |   |   |
| (B) Unsupervised  |   |   |   |
| (C) Reinforcement   |   |   |   |
| (D) Both unsupervised and reinforcement   |   |   |   |
| 18. Find the number of nodes in the distance-2 grid of hexagonal grid topology.   | 1 | 2 | 5 |
| (A) 24  |   |   |   |
| (B) 6   |   |   |   |
| (C) 12  |   |   |   |
| (D) 18  |   |   |   |
| 19. Find, which is not possible for low value of vigilance threshold in ART1.   | 1 | 2 | 5 |
| (A) Large mismatch accepted   |   |   |   |
| (B) Few large clusters  |   |   |   |
| (C) Misclassifications are more likely.   |   |   |   |
| (D) Higher precision  |   |   |   |
| 20. Identify which is not the application of the feature map classifier.  | 1 | 2 | 5 |
| (A) Classification of disease   |   |   |   |
| (B) Pattern recognition   |   |   |   |
| (C) Separation  |   |   |   |
| (D) Feature extraction  |   |   |   |

**PART - B (5 × 4 = 20 Marks)**

Answer **any 5** Questions

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- |   |   |   |   |
|---|---|---|---|
| 21. Elaborate pattern recognition process with block diagram. | 4 | 2 | 1 |
|---|---|---|---|

22.

4 3 2

$x_1$	1	1	1	0	1	0
$x_2$	0	0	1	1	0	1

- (i) Create a confusion matrix  
(ii) Calculate the distance of the given data if the priority for one and 0s are the same

23. Explain Outlier in K means clustering and 2 methods to deal with the outliers.  
24. Write short notes on error correction learning.  
25. Illustrate the Hebb rule with the target created by the AND logic function.  
26. Explain the architecture of the Hopfield network with a diagram  
27. Explain about rectangular grid topology.

4 2 2  
4 2 3  
4 3 3  
4 2 4  
4 2 5

### PART - C (5 × 12 = 60 Marks)

Answer all Questions

Marks BL CO

28. (a) Below is the frequency table for a sample weather dataset. Play Golf is the output variable and outlook is the input variable. Outlook has 3 attributes, namely sunny, overcast, and rainy. Play golf has 2 attributes, namely Yes and No. Find the Posterior probability (Yes | Sunny) =?

12 3 1

Frequency Table	Play Golf	
	Yes	No
Sunny	10	8
Overcast	6	14
Rainy	12	4

- (i) What is the Conditional probability  $P(\text{Overcast} | \text{Yes})$ ?  
(ii) Find the Posterior probability (Yes | Overcast).  
(iii) What is the Conditional probability  $P(\text{Rainy} | \text{No})$ ?  
(iv) Find the Posterior probability (No | Rainy).  
According to Bayes classifier, what will be the classifier output (class0-NO, class1-Yes) for playing on sunny, playing on overcast, playing on rainy?

(OR)

- (b) Illustrate the minimax criteria using an equation with probability that minimizes the maximum possible overall risk.

29. (a) Explain training and testing algorithm of auto associative memory.

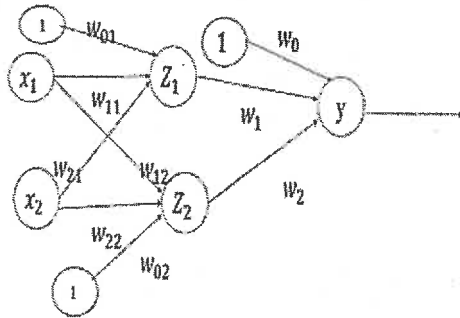
12 3 2

(OR)

- (b) (i) Explain 4 different techniques to measure the distance between 2 clusters.  
(ii) Explain common ways to represent clusters.

30. (a) Calculate the new weight of the multilayer perceptron neural network. If  $x_1 = 0$ ,  $x_2 = 1$ ,  $w_{01} = 0.3$ ,  $w_{02} = 0.6$ ,  $w_{11} = 0.4$ ,  $w_{21} = -0.3$ ,  $w_{12} = -0.4$ ,  $w_{22} = 0.5$ ,  $w_0 = -0.2$ ,  $w_1 = 0.4$ ,  $w_2 = 0.2$ . Target output=1, Learning rate=0.3, use binary sigmoid activation function.

12 3 3



(OR)

- (b) (i) Using the Hebb rule, find weights required to perform the following classification of the given input pattern: + symbol represents the value 1, and the empty sequence indicates -1. Consider 'I' belongs to a member of the class that has target value one and 'O' does not belong to member of class so has target value -1. Implement a manual method to calculate new weight and bias

+	+	
+	+	
+	+	

I

+	+	
+		+
	+	

O

- (ii) Explain the threshold activation function and sigmoid activation function.
31. (a) (i) Calculate the weight 'M' for bidirectional associative memory, if we wish to store 2 associations A1: B1 and A2: B2.  
 $A1 = (1, 1, 1, 0, 1, 0)$   $B1 = (1, 1, 0, 1)$   $A2 = (1, 1, 1, 0, 1, 0)$   $B2 = (1, 0, 1, 1)$
- (ii) Write the steps of the algorithm used for optimization inspired by the technique "If we heat a metal above its melting point and cool it down, then the structural properties will depend upon the cooling rate".

12 3 4

(OR)

- (b) Explain both types of counter-network with architecture.
32. (a) Explain Adaptive Resonance Theory - ART1 algorithm and illustrate its architecture.

12 3 5

(OR)

- (b) Demonstrate character recognition by using a neural network with neat diagrams also explain how digits '1' and '2' can be recognized using a neural network.

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