PAPER ID-310163

Subject Code: KOE073

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VII) THEORY EXAMINATION 2023-24
MACHINE LEARNING

TIME: 3 HRS **M.MARKS: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	Marks
a.	What is machine learning?	2
b.	What are the steps involved in designing learning system in machine learning?	2
c.	Explain Artificial Neural Network.	2
d.	What do you understand by gradient descent	2
e.	Explain Bayes Classifier.	2
f.	What are the basics of sampling theory?	2
g.	What is mistake bound model of learning?	2
h.	Explain Case based Learning.	2
i.	How do you evaluate the performance of a model based on first-order rules?	2
j.	What is Reinforcement Learning?	2

SECTION B

2. Attempt any *three* of the following: **10x 3 = 30**

a.	Explain the Differentiate between Supervised, Unsupervised and Reinforcement Learning.	10
b.	Define the following in decision tree algorithm: (i) Entropy, (ii) Information gain, (iii)Gini index, (iv) Gain Ratio, (iv)Chi-Square	10
c.	Explain Expectation Maximization algorithm.	10
d.	Explain Backpropagation algorithm in artificial neural network (ANN) with suitable example.	10
e.	Explain the concept of hypothesis space search in the context of machine learning. How does the choice of hypothesis space impact the learning process? Provide examples to illustrate the significance of hypothesis space search.	10

SECTION C

3. Attempt any *one* part of the following: **10x 1 = 10**

a.	Explain the concept of inductive bias in machine learning, and provide an example to illustrate how it influences the learning process.	10
b.	Explain the Candidate Elimination algorithm in machine learning and provide a step-by-step solution for a hypothetical scenario.	10

4. Attempt any *one* part of the following: **10x 1 = 10**

a.	What is the difference between forward propagation and backward propagation in neural networks explain weight calculation for forward pass network?	10
b.	Consider a single-layer neural network with one input neuron, one hidden neuron, and one output neuron. The activation function used is the sigmoid function. The network is trained to learn the XOR function. • Input layer: One neuron • Hidden layer: One neuron with a sigmoid activation function	10

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- Output layer: One neuron with a sigmoid activation function

Input	Output
0	0
1	1
0	1
1	0

Weights and Biases (Initial Values):

- Weight between input and hidden layer: *wih* 0.5
- Bias at the hidden layer: *bh*=0
- Weight between hidden and output layer: *who*=−0.5
- Bias at the output layer: *bo*=0

Learning Rate: 0.1

Perform one iteration of training using the given data and update the weights and biases.

5. Attempt any *one* part of the following: 10x 1 = 10

a. Suppose we have a dataset of weather conditions and corresponding play decisions (play or not play) as follows: — 10

Day	Weather	Temperature	Humidity	Windy	Play
Day 1	Sunny	Hot	High	False	No
Day 2	Sunny	Hot	High	True	No
Day 3	Overcast	Hot	High	False	Yes
Day 4	Rain	Mild	High	False	Yes
Day 5	Rain	Cool	Normal	False	Yes
Day 6	Rain	Cool	Normal	True	No
Day 7	Overcast	Cool	Normal	True	Yes
Day 8	Sunny	Mild	High	False	No

(i) If the weather is sunny, then the Player should play or not?
(ii) If the level of humidity is Normal & it is windy then the player should play or not?

b. Suppose there is a rare disease that affects 1 in 10,000 people. A diagnostic test for this disease has a 99% accuracy rate for both true positives (correctly identifying a person with the disease) and true negatives (correctly identifying a person without the disease). If a randomly selected person takes the test and it comes back positive, what is the probability using bayes theorem that they actually have the disease? — 10

6. Attempt any *one* part of the following: 10x 1 = 10

a. What is mistake bound model of learning? Explain the concept, algorithm evaluation, its benefit and limitation. — 10

b. Suppose you have a dataset with the following points in a 2-dimensional space:
Data points: (2, 3), (5, 4), (9, 6), (8, 1), (7, 2)
and their corresponding labels are: — 10

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	A, A, B, B, B. Now, we want to classify a new point **(6, 5)** using k-nearest neighbors with k = 3.	

7. Attempt any *one* part of the following: 10x 1 = 10

a.	Consider a binary string optimization problem where the goal is to evolve a binary string of length 8 to maximize the number of ones. You decide to use a simple genetic algorithm for this task. (i) Define the representation of an individual in the population. (ii) Specify the initialization step for the genetic algorithm. (iii) Outline the different operations used in genetic algorithm.	10
b.	What are the different types of reinforcement? Explain.	10