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Unique Paper Code: 2513010017
Name of the Paper: Advanced Machine Learning
Name of the Course: B.Sc.(H) Electronics (DSE)
Semester: Semester VII (Under NEP UGCF Mode)
Duration: 03 Hour
Maximum Marks: 90

Instruction for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question 1 is compulsory.
3. Attempt any 5 questions including question 1.

- Q1 (a) What does a train-test split mean? Why should we divide the dataset into training and testing parts? 3
- (b) Explain bias-variance trade off in supervised learning. 3
- (c) Explain how PCA helps in reducing the number of features. 3
- (d) Explain the elements of a Markov Decision Process (MDP). 3
- (e) Explain the concept of PAC (Probably Approximately Correct) learning. 3
- (f) Given the following decision tree votes for the target class "*Fraud*": 3
 Tree 1: Yes
 Tree 2: Yes
 Tree 3: No
 Explain the concept behind the prediction.
- Q2 (a) Describe unsupervised learning. Why is it useful when labels are not available? 6
- (b) Given the dataset: 6
 $X = [1, 2, 3, 4]$,
 $Y = [2, 5, 7, 10]$,
 perform simple linear regression to estimate the slope and intercept values.
- (c) What are the major differences between classification and regression, and how does the nature of target variable influence the choice? 6
- Q3 (a) What is Agglomerative Clustering? Describe how clusters are formed step by step. 6
- (b) Describe how the K-Means algorithm forms clusters. What happens after the initial random centroids are selected? 6
- (c) Describe how the K-NN algorithm makes a prediction when a new data point is given. Mention the role of distance. 6
- Q4 (a) What is the main idea behind Bayesian learning? Explain how it uses prior and new information. 6
- (b) Explain the concept of Hidden Markov Models and the role of transition probabilities. 6

- (c) Differentiate between passive and active reinforcement learning with examples 6
- Q5 (a) What is Instance Based Learning? Explain its advantages and limitations. 6
- (b) Define sample complexity. How does it differ for finite and infinite hypothesis spaces? 6
- (c) Give main differences between KNN and Distance Weighted KNN 6
- Q6 (a) Explain the concept of underfitting. How does it affect a model's accuracy? 6
- (b) What is the purpose of using a Random Forest classifier? Explain how combining many trees improves the model 6
- (c) Explain the main idea of DBSCAN. How does it group points using the concept of density? 6
- Q7 (a) What is Multiple Linear Regression? How is it different from simple linear regression? 6
- (b) What is Kernel Function? What are benefits of using Kernel Function? 6
- (c) Explain construction of a Bayesian Network with an example. 6