(Time: $2\frac{1}{2}$ hours)

[Total Marks: 60]

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculator is **allowed**.

1. Attempt *any two* of the following: **12**

a. Write and explain any six characteristics of Machine learning tasks.
b. Explain following terms:
Supervised Learning, unsupervised learning, predictive task, descriptive task, instance space, cross validation.
c. Define linear decision boundary with respect to Geometric models of Machine Learning. Also explain how geometric model is constructed with appropriate diagram.
d. What is the role of features in determining the success of a machine learning model? Discuss various domains of features. Also explain its uses.

2. Attempt *any two* of the following: **12**

a. What is classifier? Describe two-class classification in detail.
b. How can a class probability Estimation be assessed? Explain with example.
c. Write a short note on Vapnic-Chervonenkis Dimensions.
d. What is regularization? How does Regularization Work?

3. Attempt *any two* of the following: **12**

a. Write a short note on Multivariate Linear Regression.
b. Describe Support Vector Machine.
c. How to obtain probabilities from Linear classifiers? Explain in detail.
d. What are various Types of Kernel methods in Support Vector Machine?

4. Attempt *any two* of the following: **12**

a. Write and explain all steps of K-nearest neighbors (KNN) algorithm
b. How the K- Means Clustering Algorithm Works? Explain in detail.
c. How to measure association with respect to Association Rule Mining? Explain in detail.
d. Explain the following terms with respect to decision tree:
i) Splitting, ii) decision node, iii) pruning, iv) sub tree, v) Entropy, vi) information gain.

5. Attempt *any two* of the following: **12**

a. Explain in detail about Normal Distribution and Its Geometric Interpretations.
b. Explain Naïve Bayes classifier in detail.
c. What is active learning? How does it work?
d. What is Deep Learning? Explain the layers of Deep Learning.

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