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**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023****(2020 SCHEME)****Course Code : 20CST394****Course Name: Advanced Topics in Machine Learning****Max. Marks : 100****Duration: 3 Hours****PART A****(Answer all questions. Each question carries 3 marks)**

1. Define Supervised Learning.
2. Define Gaussian process.
3. How K-Means Algorithm is used in Unsupervised Learning.
4. List out the applications of clustering algorithm.
5. What is the tradeoff between Bias and Variance?
6. What are the advantages of the Adaboost algorithm?
7. What does probably refer to in Probably Approximately Correct(PAC) learning?
8. What is Vapnik-Chervonenkis dimension and how it is calculated?
9. Why are graphical models are used in machine learning?
10. What is a clique tree in graph theory?

**PART B****(Answer one full question from each module, each question carries 14 marks)****MODULE I**

11. a) Explain the different types of machine learning? (7)
- b) What are the different types of regression in machine learning techniques. (7)

**OR**

12. a) Describe how regularization is used in RIDGE regression in detail. (8)
- b) Discuss about the Gaussian discriminant analysis. (6)

**MODULE II**

13. a) How do you measure similarity and dissimilarity in clustering? (7)
- b) Explain the types of Agglomerative Clustering in machine learning? (7)

**OR**

14. a) Discuss about the key difference between K-Means and K-Medoids? (7)
- b) What are the E step and M step during implementation of expectation maximization algorithm? (7)

**MODULE III**

15. a) Explain the four-common metrics for evaluating classifier performance? (6)
- b) How is ROC score calculated manually? (8)

**OR**

16. a) Write about bias variance principle? (7)
- b) What are the applications of Random Forest algorithm? (7)

**MODULE IV**

17. a) Explain the learnability with reference to machine learning? (7)
- b) Describe in detail probably approximately correct PAC learning theory? (7)

**OR**

18. a) Prove that  $VC(H) \leq \log_2 |H|$ , where H is a hypothesis space. ( $|H|$  denotes the cardinality of the hypothesis space). (7)
- b) Explain how to measure the sample complexity for infinite hypothesis spaces. (7)

**MODULE V**

19. a) Describe in detail Bayesian Belief Networks. (6)
- b) Invent a simple Markov decision process (MDP) with the following properties: **a)** it has a goal state, **b)** its immediate action costs are all positive, **c)** all of its actions can result with some probability in the start state, and **d)** the optimal policy without discounting differs from the optimal policy with discounting and a discount factor of 0.9. Prove **d)** using value iteration. (8)

**OR**

20. a) What is the difference between the Monte Carlo (MC) and Monte Carlo Markov Chain (MCMC) method? (7)
- b) How Can Generative Adversarial Networks (GAN) Architecture be Used for Unsupervised Learning? (7)

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