

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CS467

Course Name: MACHINE LEARNING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

- | | | Marks |
|----|---|-------|
| 1 | Identify the suitable learning method in each case and Explain it. (a) Grouping people in a social network (b) Training a robotic arm | (4) |
| 2 | Explain the concept of Overfitting and Underfitting model with suitable diagrams. | (4) |
| 3 | Define VC dimension. Show that VC dimension of a line hypothesis is three. | (4) |
| 4 | Compare Gain ratio with Information gain for attribute selection. Explain the advantage of using Gain ratio over Information gain for finding best split for constructing a decision tree. | (4) |
| 5 | Compute the Maximum Likelihood estimate for the parameter λ in the Poisson distribution whose probability function is $f(x) = \frac{e^{-\lambda} \lambda^x}{x!} \quad x = 0,1,2 \dots n$ | (4) |
| 6 | Why does a single perceptron cannot simulate simple XOR function ? Explain how this limitation is overcome? | (4) |
| 7 | Describe any two techniques used for Ensemble Learning. | (4) |
| 8 | Explain Kernel Trick in the context of support vector machine. List any two kernel function used in SVM. | (4) |
| 9 | Describe the basic concepts of Expectation Maximization Algorithm. | (4) |
| 10 | Calculate the dissimilarity between two data points $x_1(2,3,4)$ and $x_2(4,3,5)$ using (a) Euclidian distance (b) Manhattan Distance | (4) |

PART B

Answer any two full questions, each carries 9 marks.

- 11 a) Is regression a supervised learning technique? Justify your answer. Compare regression with classification with examples. (5)

- b) Explain (a) Hypothesis space (b) Version space (c) Most General hypothesis (d) Most specific hypothesis in the context of a classification problem. (4)
- 12 a) Explain the concept of PAC learning . Derive an expression for PAC learning in such a way that the selected function will have low generalized error. (5)
- b) Briefly Explain the procedure for the computation of the principal components of a given data.. (4)
- 13 a) Describe the forward selection and backward selection algorithm for implementing the subset selection procedure for dimensionality reduction (6)
- b) Explain the concept of association rule analysis with its application (3)

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) The following table shows the midterm and final exam grades obtained for students in a database course. (6)

| X Midterm exam | Y Final exam |
|-------------------|-----------------|
| 72 | 84 |
| 50 | 63 |
| 81 | 77 |
| 74 | 78 |
| 94 | 90 |
| 86 | 75 |
| 59 | 49 |
| 83 | 79 |
| 65 | 77 |
| 33 | 52 |
| 88 | 74 |
| 81 | 90 |

- (i) Use the method of least squares to find an equation for the prediction of a student's final exam grade based on the student's midterm grade in the course.
- (ii) Predict the final exam grade of a student who received an 86 on the midterm exam.
- b) Explain Bootstrapping method for evaluating accuracy of a classifier. (3)
- 15 Identify the first splitting attribute for decision tree by using ID3 algorithm with the following dataset. (9)

| Age | Competition | Type | Class (profit) |
|-----|-------------|----------|----------------|
| Old | Yes | Software | Down |
| Old | No | Software | Down |
| Old | No | Hardware | Down |
| Mid | Yes | Software | Down |
| Mid | Yes | Hardware | Down |
| Mid | No | Hardware | Up |
| Mid | No | Software | Up |
| New | Yes | Software | Up |
| New | No | Hardware | Up |
| New | No | Software | Up |

- 16 a) Explain back propagation algorithm for a multilayer Perceptron. (5)
 b) Explain the concept of Reduced Error pruning (4)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) Explain Learning problem in Hidden Markov model and how it can be solved. (6)
 b) Describe the significance of soft margin hyperplane and explain how they are computed. (6)
- 18 a) Find the three clusters after one epoch for the following eight examples using the k-means algorithm and Euclidean distance (6)
 $A_1=(2,10)$, $A_2=(2,5)$, $A_3=(8,4)$, $A_4=(5,8)$, $A_5=(7,5)$, $A_6=(6,4)$, $A_7=(1,2)$, $A_8=(4,9)$. Suppose that the initial seeds (centers of each cluster) are A_1 , A_4 and A_7 .
 b) Show the final result of hierarchical clustering with single link by drawing a dendrogram. (6)

| | A | B | C | D | E | F |
|---|------|------|------|------|------|---|
| A | 0 | | | | | |
| B | 0.12 | 0 | | | | |
| C | 0.51 | 0.25 | 0 | | | |
| D | 0.84 | 0.16 | 0.14 | 0 | | |
| E | 0.28 | 0.77 | 0.70 | 0.45 | 0 | |
| F | 0.34 | 0.61 | 0.93 | 0.20 | 0.67 | 0 |

- 19 a) Explain DBSCAN algorithm for density based clustering. List out its advantages compared to K-means. (6)
 b) State the mathematical formulation of the SVM problem. Give an outline of the method for solving the problem. (6)
