

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.<br>(a) Grouping people in a social network<br>(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 $\lambda$ in the Poisson distribution whose probability function is<br>$f(x) = \frac{e^{-\lambda} \lambda^x}{x!} \quad x = 0,1,2 \dots n$ | (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<br>(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)

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