



PRESIDENCY UNIVERSITY

BENGALURU

Roll No.																			
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End - Term Examinations - December 2025

Date: 17 - 12- 2025

Time: 01:00pm - 04:00pm

School: SOCSE	Program: B.Tech. (Computer Engineering)		
Course Code: COM2504	Course Name: Applied Machine Learning		
Semester: V	Max Marks: 100	Weightage: 50%	

CO - Levels	C01	C02	C03	C04	C05
Marks	20	40	20	20	-

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

10Q x 2M=20M

1.	State the term used when sampling is performed with replacement.	2 Marks	L1	C01
2.	State 2 different types of machine learning.	2 Marks	L1	C01
3.	State true or false. The size of a feature vector for a bag-of-words text representation is smaller than the size of the vocabulary of the training dataset.	2 Marks	L1	C01
4.	State the statistical technique for filling in missing values in a dataset.	2 Marks	L1	C01
5.	One of the types of Naïve Bayes Classifiers used in scikit learn is the Gaussian Naïve Bayes classifier. State the names of 2 more types of Naïve Bayes Classifiers.	2 Marks	L1	C01
6.	State the names of any 2 activation functions whose upper bound of their output is 1.	2 Marks	L1	C01
7.	State true or false. An OR gate can be constructed via a single perceptron.	2 Marks	L1	C01
8.	State true or false. KNN (used for imputation) and KMeans both use a notion of distance. Hence, KNN and KMeans are both supervised learning techniques.	2 Marks	L1	C01

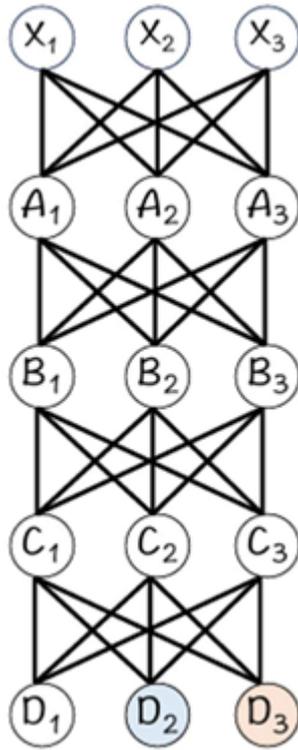
9.	State the 2 types of clustering.	2 Marks	L1	CO1
10.	Given that the expected output of a supervised learning problem is a set of binary classes (Eg. "Yes" or "No") like those mentioned in Question 17 , state the type of support vector machine which can be used to solve the problem. Either state the abbreviation or the full form of the abbreviation.	2 Marks	L1	CO1

Part B

Answer the Questions.

Total Marks 80M

11.	Let $Z_1 = [x_1, x_2, \dots, x_n]$ and $Z_2 = [a+x_1, a+x_2, \dots, a+x_n]$, where a is an integer. Explain (in NOT MORE THAN 1 PAGE) a proof that $\text{softmax}(Z_1) = \text{softmax}(Z_2)$.	20 Marks	L2	CO2
Or				
12.	<p>A dataset of student grades has the following features:</p> <ul style="list-style-type: none"> a) Faculty – name of the faculty (a string from a set of strings) b) Marks – can be a real number, not just an integer c) Subject Mean – Average marks in the subject d) Outcome (Pass / Fail) – whether the student passes or fails e) Grade Point – An integer between 0 to 10. <p>Classify each of the features into one of the following types of attributes – categorical, binary, ordinal, continuous, or interval. In each case, make the classification specific.</p>	20 Marks	L2	CO2
13.	<p>Recall the question which you had in your CA2 examination. However, there is going to be a <i>difference</i>. The output layer will be given as an input to the softmax layer for classification. The input $X = [1, 1, 1]$</p> <p>The weight matrices are as follows:</p> $W_A = \begin{bmatrix} 0 & 5 & 1 \\ 0 & 0 & 1 \\ 1 & 5 & 0 \end{bmatrix}, W_B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 5 & 0 \\ -1 & 0 & 1 \end{bmatrix}, W_C = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 5 & 0 \\ 1 & 0 & 1 \end{bmatrix}, \text{ and}$ $W_D = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 5 & 0 & 5 \end{bmatrix}.$ <p>Biases are given as $b_A = [0,3,0]$, $b_B = [0,-5,0]$, $b_C = [0,-5,0]$ & $b_D = [0,0,0]$</p> <p>Neural Network:</p>	20 Marks	L3	CO3



Predict the output of the classification. In other words, you should give the output of the **SoftMax Layer** (up to 4 decimal places).

Or

14.	For the Neural Network designed in Question 13 , calculate the output for an input $X = [4, -4, 4]$.	20 Marks	L3	CO3
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15.	Apply k-means clustering on the following data points: $[0, 1, 3, 4, 6, 10, 20, 30, 60]$. Do it for $k = 3$. The initial cluster centres are given as $C = [0, 6, 30]$. Stop after at most 5 iterations .	20 Marks	L3	CO4
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Or

16.	Apply k-means clustering for the data points $D = [(1, 2), (3, 4), (4, 10), (10, 12), (12,30), (30,20), (30,60)]$. Do it for $k = 3$. Initial cluster centres are given as $C = [(4,10), (10,12), (12,30)]$. Stop after at most 4 iterations .	20 Marks	L3	CO4
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17.	Use a Naïve Bayes classifier for the following data:	20 Marks	L3	CO2																									
	<table border="1"> <thead> <tr> <th>Outlook</th> <th>Temperature</th> <th>Humidity</th> <th>Windy</th> <th>Play?</th> </tr> </thead> <tbody> <tr> <td>Rainy</td> <td>Hot</td> <td>High</td> <td>False</td> <td>No</td> </tr> <tr> <td>Rainy</td> <td>Hot</td> <td>High</td> <td>True</td> <td>No</td> </tr> <tr> <td>Overcast</td> <td>Hot</td> <td>High</td> <td>False</td> <td>Yes</td> </tr> <tr> <td>Sunny</td> <td>Mild</td> <td>High</td> <td>False</td> <td>Yes</td> </tr> </tbody> </table>	Outlook	Temperature	Humidity	Windy	Play?	Rainy	Hot	High	False	No	Rainy	Hot	High	True	No	Overcast	Hot	High	False	Yes	Sunny	Mild	High	False	Yes			
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	Rainy	Mild	Normal	True	Yes			
	Overcast	Mild	High	True	Yes			
	Overcast	Hot	Normal	False	Yes			
	Sunny	Mild	High	True	No			
	For an input of $X = \{\text{Rainy, Hot, High, True}\}$, calculate the output predicted by the classifier.							
Or								
18.	Use a Decision Tree Classifier to solve the problem given in Question 17 (as opposed to a Naïve Bayes Classifier).					20 Marks	L3	CO2