BENNETT UNIVERSITY
THE TIMES GROUP

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Department/ School: SCSET

END-TERM EXAMINATION, EVEN SEMESTER MAY 2024

COURSE CODE:	**CSET301**	**MAX. DURATION**	**2 HRS**
COURSE NAME:	**Artificial Intelligence and Machine Learning**		
PROGRAM:	**B. Tech**	**TOTAL MARKS**	**35**

Mapping of Questions to Course and Program Outcomes							
Q. No.	A1	A2	A3	A4	B1	B2	B3
CO	1	2	3	2	1	1	3
PO	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4,5	1,2,4,5	1,2,4
BTL*[1]	1	3	2,3	3,4	3,4	2	2,4

GENERAL INSTRUCTIONS: -

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**
2. Carrying mobile phones, smartwatches and any other non-permissible materials in the examination hall is an act of **UFM.**

COURSE INSTRUCTIONS:

a) All Questions are Compulsory.
b) If require any missing data; then choose suitably
c) Draw neat diagrams wherever necessary

SECTION A

Max Marks: 20

A1) Define short note on following: **4*2 = 8 Marks**

i) Bagging and Boosting
ii) Multilayer perceptron model
iii) Stochastic Gradient Descent
iv) Ant-Colony Optimization

A2) Apply agglomerative hierarchical clustering on below mentioned matrix that represents distance between every pair of units. Draw dendograms for- **2+2 = 4 Marks**

a. Complete linkage method
b. Average linkage method

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	1	2	3	4	5
1	0	0	0	0	0
2	9	0	0	0	0
3	7	3	0	0	0
4	5	6	9	0	0
5	9	7	8	2	0

A3) Explain the Gradient Descent algorithm and its significance in finding the minimum of a function. Illustrate your answer by describing the process of how the algorithm updates its parameters in each iteration to reach the minimum value. Also, discuss the impact of the learning rate on the convergence of the algorithm. Use a hypothetical function $f(x) = x^3$ as an example to demonstrate your points.

4 Marks

A4) Compute Singular Value Decomposition for the following matrix M:

$$M=\begin{bmatrix}1 & 2\\ 1 & 2\end{bmatrix}$$

Also show all intermediate steps.

4 Marks

SECTION B

3Q*5M = 15

B1) Consider a dataset where you have the following information: In a collection of 100 emails, 70 are classified as spam and 30 as non-spam. If an email contains the word 'offer,' there is a 40% chance it is classified as spam and a 20% chance it is non-spam. Using the Naïve Bayes classifier, calculate the probability that an email is spam given that it contains the word 'offer.' Explain each step of your calculation and interpret the result in the context of email filtering. **5 Marks**

B2) Suppose you have a linear regression model with two parameters w_1 and w_2, and the mean squared error (MSE) cost function is defined as: **2.5+2.5 = 5 Marks**

$$\text{MSE} = \frac{1}{2m}\sum_{i=1}^{m}(y_i - (w_1x_{i1} + w_2x_{i2} + b))^2$$

where m is the number of data points, (x_{i1}, x_{i2}, y_i) are the coordinates of the data points, and b is the bias term (for simplicity, let's assume $b = 0$ in this question).

Consider the following data points:

$(x_{1,1}, x_{2,1}, y_1) = (1, 2, 5),$
$(x_{1,2}, x_{2,2}, y_2) = (2, 3, 8),$
$(x_{1,3}, x_{2,3}, y_3) = (3, 4, 11)$

Using gradient descent, find the updated values of w_1 and w_2 after one iteration.
Assume initial values $w_1 = 1$, $w_2 = 2$, and a learning rate $\alpha = 0.01$.

B3) Briefly explain the concepts of fitness function, selection, crossover, and mutation within the context of a Genetic Algorithm. Examine how these components work together to find an optimal solution in a search space? **3+2 = 5 Marks**

-ALL THE BEST-