JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST – 2 EXAMINATION - 2025

B.Tech. - VI Semester (CSE/IT)

COURSE CODE (CREDITS): 18B1WCI634 (2) MAX. MARKS: 25

COURSE NAME: Machine Learning

COURSE INSTRUCTORS: D. Gupta, G. Negi, M. Dhalaria, V. Sehgal MAX. TIME: 90 Min.

Note: *(a) All questions are compulsory. (b) The candidate can make suitable numeric assumptions wherever required to solve problems. (c)* ***Be concise****. (d) Use of a calculator is permitted.*

<table>
<tr><th>Q. No.</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>Q1 (a)</td><td>In the C4.5 algorithm, how are missing attribute values managed during the construction of the decision tree, and why is this method considered more effective than removing records with missing data?</td><td>4</td><td>3</td></tr>
<tr><td>(b)</td><td>Using the dataset provided, first calculate the entropy of the target attribute Buy Computer. Then, compute the information gain for each feature (Age, Income, and Credit Rating) to identify the most suitable attribute for the root node of a decision tree.
<table>
<tr><th>Age</th><th>Income</th><th>Credit Rating</th><th>Buy Computer</th></tr>
<tr><td>Youth</td><td>High</td><td>Fair</td><td>No</td></tr>
<tr><td>Youth</td><td>High</td><td>Excellent</td><td>No</td></tr>
<tr><td>Middle Aged</td><td>High</td><td>Fair</td><td>Yes</td></tr>
<tr><td>Senior</td><td>Medium</td><td>Fair</td><td>Yes</td></tr>
<tr><td>Senior</td><td>Low</td><td>Fair</td><td>Yes</td></tr>
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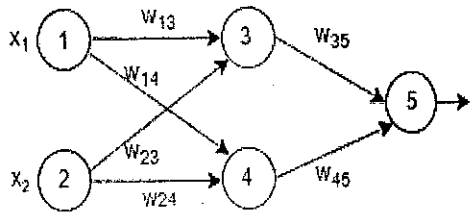
</table></td><td>4</td><td>5</td></tr>
<tr><td>Q2 (a)</td><td>Discuss the main strengths and limitations of logistic regression. Identify one scenario where it performs well (best-case scenario) and one where it fails (worst-case scenario), providing a brief justification for each.</td><td>3</td><td>3</td></tr>
</table>

(b)	Consider a dataset containing academic performance details of 7 students. Each record includes attributes such as Study Hours, Attendance, and a target class Academic Result. Identify the attribute that results in the lowest Gini Index.	4	5

Record	Study Hours	Attendance	Academic Result
1.	High	Regular	Pass
2.	Low	Irregular	Fail
3.	Moderate	Regular	Pass
4.	Low	Regular	Fail
5.	High	Irregular	Pass
6.	Moderate	Irregular	Fail
7.	High	Regular	Pass

Q3 (a)	For each of the optimization methods: Batch Gradient Descent, Mini-Batch Gradient Descent, and Stochastic Gradient Descent, consider factors like dataset size, memory availability, data type (static/streaming), and real-time requirements to briefly discuss: • One best-case scenario where the method is most effective • One worst-case scenario where the method performs poorly	3	3
(b)	Consider the following ANN model with backpropagation algorithm. Weights and biases ($\theta_1, \theta_2, \theta_3$) are given in the table. The network uses the sigmoid as an activation function and the error function Err = O(1-O)(T-O) where O is the output of the neuron and T is the target output. Use the given information to compute the output of each neuron during the forward pass, and then calculate the error term for each neuron using the backpropagation algorithm.	3	6



Weight/Bias	Values	Weight/Bias	Values
x_1	1	w_{35}	0.1
x_2	1	w_{45}	0.3
w_{13}	0.5	θ_1	0.6
w_{14}	0.2	θ_2	-0.4
w_{23}	-0.3	θ_3	0.8
w_{24}	0.5	T	0