

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Calculator is allowed.

Q. No.	Question	CO	Marks																												
Q1.	<p>An online retail company maintains a data warehouse to analyze its business performance. The warehouse stores information related to sales transactions, product details, customer information, time of purchase, and store location hierarchy (city, state, country). The company also wants to organize the location and product information into multiple related tables to reduce data redundancy while supporting analytical queries such as sales by region and product category performance.</p> <p>a) Identify the most appropriate data warehouse schema for this scenario and justify your answer with valid reason.</p> <p>b) Design the schema structure by identifying the fact table and the related dimension tables.</p> <p>c) Explain one advantage and one disadvantage of using this schema in the given scenario.</p>	2	[2] [2] [1]																												
Q2.	<p>Consider the following Artificial Neural Network trained using the backpropagation algorithm. The learning rate is 0.1. The initial weights, biases and the target output are given in the table below. Using the sigmoid activation function, find the updated values of w_{35}, w_{45}, θ_3, and θ_4 after one iteration of backpropagation.</p> <table border="1"> <thead> <tr> <th>Weight/bias</th> <th>Values</th> <th>Weight/bias</th> <th>Values</th> </tr> </thead> <tbody> <tr> <td>x_1</td> <td>1</td> <td>w_{35}</td> <td>0.1</td> </tr> <tr> <td>x_2</td> <td>1</td> <td>w_{45}</td> <td>0.3</td> </tr> <tr> <td>w_{13}</td> <td>0.5</td> <td>θ_3</td> <td>0.6</td> </tr> <tr> <td>w_{14}</td> <td>0.2</td> <td>θ_4</td> <td>-0.4</td> </tr> <tr> <td>w_{23}</td> <td>-0.3</td> <td>θ_5</td> <td>0.8</td> </tr> <tr> <td>w_{24}</td> <td>0.5</td> <td>T</td> <td>0</td> </tr> </tbody> </table>	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_3	0.6	w_{14}	0.2	θ_4	-0.4	w_{23}	-0.3	θ_5	0.8	w_{24}	0.5	T	0	4	[5]
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Q3.	<p>A supermarket chain records daily billing, product purchases, and payment details in a database where thousands of transactions occur every minute. The system must process each transaction quickly and accurately.</p> <p>a) Identify the type of system used to process these transactions. Justify your answer.</p> <p>b) Write any four key differences between Online Transaction Processing and Online Analytical Processing systems.</p>	2	[1] [2]																												
Q4.	<p>Given the following training dataset, which predicts whether a patient has a disease (Yes/No) based on their Exercise Level (High, Medium, Low) and Junk Food Habit (Yes/No), apply the C4.5 algorithm to determine the root node of the decision tree.</p> <table border="1" data-bbox="312 600 1193 779"> <tr> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>Exercise Level</td> <td>Low</td> <td>Low</td> <td>Medium</td> <td>Medium</td> <td>High</td> <td>High</td> </tr> <tr> <td>Junk Food Habit</td> <td>Yes</td> <td>No</td> <td>Yes</td> <td>No</td> <td>Yes</td> <td>No</td> </tr> <tr> <td>Disease</td> <td>Yes</td> <td>Yes</td> <td>Yes</td> <td>No</td> <td>No</td> <td>No</td> </tr> </table>		1	2	3	4	5	6	Exercise Level	Low	Low	Medium	Medium	High	High	Junk Food Habit	Yes	No	Yes	No	Yes	No	Disease	Yes	Yes	Yes	No	No	No	4	[5]
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Q5.	<p>Consider the following dataset. Apply the K-Nearest Neighbors algorithm with $K = 3$ to predict the price of a car having engine power of 130 HP and age of 3 years. Use L-1 norm as the distance metric. Perform any necessary preparation of the features before computing distances.</p> <table border="1" data-bbox="408 1003 1088 1272"> <thead> <tr> <th>Engine Power (HP)</th> <th>Age (years)</th> <th>Price (₹ lakh)</th> </tr> </thead> <tbody> <tr> <td>80</td> <td>1</td> <td>4</td> </tr> <tr> <td>100</td> <td>2</td> <td>5</td> </tr> <tr> <td>120</td> <td>3</td> <td>6</td> </tr> <tr> <td>140</td> <td>4</td> <td>7</td> </tr> <tr> <td>160</td> <td>5</td> <td>8</td> </tr> </tbody> </table>	Engine Power (HP)	Age (years)	Price (₹ lakh)	80	1	4	100	2	5	120	3	6	140	4	7	160	5	8	4	[5]										
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