



VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: A2+TA2

Vellore – 632014, Tamil Nadu, India
SCHOOL OF ELECTRONICS ENGINEERING
FALL SEMESTER 2024-2025
CAT-II

Programme: B.Tech	Branch: ECE	Course code: BECE309L
Course Name: Artificial Intelligence and Machine Learning	Date: 13/10/2024	
Class Nbr: VL2024250103611	Max Marks: 50	Duration: 90 mins
Faculty name(s): Dr. Pradeep Kumar Das and Dr. Suraj Prakash Sahoo		

General instruction(s): 1. Answer ALL

Q. No	Question	Max. Marks									
1.	A smart home system uses a Hidden Markov Model to predict whether a person is at home or not based on sensor data. The hidden states represent whether the person is Home (H) or Away (A). The observable events are Activity Detected (AD) or No Activity Detected (NAD). Given Information: Transition Probabilities: $P(H \rightarrow H) = 0.7$, $P(H \rightarrow A) = 0.3$, $P(A \rightarrow H) = 0.4$, $P(A \rightarrow A) = 0.6$ Emission Probabilities: $P(AD H) = 0.8$, $P(NAD H) = 0.2$, $P(AD A) = 0.3$, $P(NAD A) = 0.7$, $P(NAD A) = 0.7$ Initial Probabilities: $P(H) = 0.5$, $P(A) = 0.5$ Task: Calculate the probability of observing the sequence of events (AD, NAD, AD) over three time steps when the hidden states are (HHH).	10 M									
2.	A Bayesian decision network is shown in Figure 1, provided with chance nodes A, B, C, and D, a utility node U and a decision node D. The decision is of two types: d or $\bar{d}$. Find out the maximum expected utilities $MEU(b)$, $MEU(\bar{b})$. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>U</th><th>b</th><th>$\bar{b}$</th></tr> </thead> <tbody> <tr> <td>d</td><td>40</td><td>50</td></tr> <tr> <td>$\bar{d}$</td><td>30</td><td>10</td></tr> </tbody> </table> $P(b a) = 0.3$, $P(a c) = 0.4$, $P(c \bar{d}) = 0.5$ $P(b \bar{a}) = 0.1$, $P(a \bar{c}) = 0.3$, $P(c \bar{d}) = 0.3$ Figure 1	U	b	$\bar{b}$	d	40	50	$\bar{d}$	30	10	10 M
U	b	$\bar{b}$									
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$\bar{d}$	30	10									

3.	What are the applications of data reduction? Convert the 2D feature set given in Table 1 into an 1D feature set using PCA. Table 1 <table><tr><td></td><td>Sample 1</td><td>Sample 2</td><td>Sample 3</td><td>Sample 4</td><td>Sample 5</td></tr><tr><td>X1</td><td>4</td><td>3</td><td>1</td><td>0</td><td>-1</td></tr><tr><td>X2</td><td>4</td><td>2</td><td>1</td><td>-1</td><td>-2</td></tr></table>		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	X1	4	3	1	0	-1	X2	4	2	1	-1	-2	10 M																											
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4.	Find out the least square regression line for the following points presented in Table 2, where X is the independent variable and Y is the dependent variable. Estimate the value of Y when X=20. Table 2 <table><tr><td>X</td><td>10</td><td>12</td><td>15</td><td>18</td><td>20</td><td>22</td><td>25</td><td>30</td></tr><tr><td>Y</td><td>25</td><td>30</td><td>40</td><td>45</td><td>50</td><td>55</td><td>65</td><td>70</td></tr></table>	X	10	12	15	18	20	22	25	30	Y	25	30	40	45	50	55	65	70	10 M																											
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5.	As presented in Table 3, we have 8 students who have undergone three rounds of interviews: a written test, a technical round, and an HR round. Based on their scores, we want to predict whether they will be selected or rejected for the job. Determine whether the student with the Written Test Score=76, Technical Round Score= 72, and HR Round Score= 73, is selected or rejected using the KNN algorithm if K=3. Table 3 <table><tr><td>Students</td><td>Written Test Score</td><td>Technical Round Score</td><td>HR Round Score</td><td>Status</td></tr><tr><td>1</td><td>85</td><td>90</td><td>88</td><td>Selected</td></tr><tr><td>2</td><td>80</td><td>85</td><td>80</td><td>Selected</td></tr><tr><td>3</td><td>75</td><td>70</td><td>75</td><td>Rejected</td></tr><tr><td>4</td><td>90</td><td>95</td><td>90</td><td>Selected</td></tr><tr><td>5</td><td>70</td><td>60</td><td>65</td><td>Rejected</td></tr><tr><td>6</td><td>78</td><td>82</td><td>80</td><td>Selected</td></tr><tr><td>7</td><td>65</td><td>70</td><td>68</td><td>Rejected</td></tr><tr><td>8</td><td>92</td><td>88</td><td>85</td><td>Selected</td></tr></table>	Students	Written Test Score	Technical Round Score	HR Round Score	Status	1	85	90	88	Selected	2	80	85	80	Selected	3	75	70	75	Rejected	4	90	95	90	Selected	5	70	60	65	Rejected	6	78	82	80	Selected	7	65	70	68	Rejected	8	92	88	85	Selected	10 M
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