Register Number | | | | | | | | | |

Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Computer Science and Engineering

Continuous Assessment Test – I

Question Paper

Degree & Branch	B.E. & CSE				**Semester**	VI
Subject Code & Name	UCS1603 & INTRODUCTION TO MACHINE LEARNING				**Regulation:**	**2018**
Academic Year	2021-2022	**Batch**	2019-2023	**Date**	**01.04.2022**	**FN**
Time: 90 minutes (8.30-10.00 AM)	**Answer All Questions**				**Maximum: 50 Marks**	

Part – A (6×2 = 12 Marks)

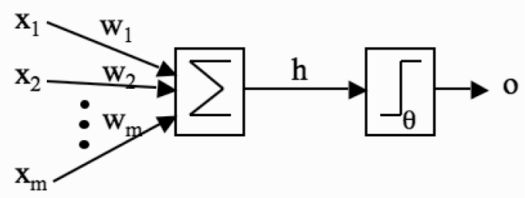
<K1>	1. List any four sub domains of Artificial Intelligence. Ans: Machine Reasoning, Robotics, Machine Learning, Deep Learning	<CO1>
<K2>	2. Compare the characteristics of Human brain with ANN? **Biological Neuron** / **Artificial Neuron** Dendrites / Input Cell Nucleus(Soma) / Node Axon / Output Synapse / Interconnections	<CO2>
<K3>	3. A ROC curve is plotted for a heart disease prediction problem. It is observed that on the plot area, we get a point instead of a curve. How will you solve this problem to get a curve? Ans: Divide the dataset into 3 sets: training , testing and validation. Perform multi fold cross validation to get the curve.	<CO1>
<K3>	**4.** "Demand for a commodity goes down when its price rises". Identify the nature of the covariance value with proper justification. **Ans:** If two variables are independent, then the covariance is 0 (the variables are then known as uncorrelated), while if they both increase and decrease at the same time, then the covariance is positive, and if one goes up while the other goes down, then the covariance is negative. In the given case where "Demand for a commodity goes down when its price rises" , the variables are demand and price, both of them are dependent variable out of which one goes up and other down. Hence the co variance value will be negative.	<CO1>

<K1>	5. Define Hebb's rule. Hebb's rule says that the changes in the strength of synaptic connections are proportional to the correlation in the firing of the two connecting neurons.	<CO2>
<K3>	6. Write the formula for MCC and compute it for the given inputs: Actual = [1,1,1,1,1,1,1,1,1,1,0,0,0,0,0] Predicted = [1,1,1,1,1,1,1,1,1,0,0,1,1,1,0,0] Ans: 0.2311	<CO1>

Part – B (3×6 = 18 Marks)

<K3>	7. Consider the given case study to decide whether to buy a computer or not based on their age, income, student and credit rating. Apply the Baye's rule to find the outcome for the given X. Explain the basics of turning data into probabilities. X = (age > 40, Income = low, Student = no, Credit_rating = excellent) Note: Refer to the following table. Ans: Basics of turning data into probabilities explanation : 2 mark Problem: 4 mark	<CO1>

age	income	student	credit_rating	buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
30…40	high	no	fair	yes
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
31…40	low	yes	excellent	yes
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
>40	medium	yes	fair	yes
<=30	medium	yes	excellent	yes
31…40	medium	no	excellent	yes
31…40	high	yes	fair	yes
>40	medium	no	excellent	no

	Bayes Rule – (1) → class conditional P $P(C_i|X_j) = \frac{P(X_j|C_i)P(C_i)}{P(X_j)}$ → Prior P Posterior P $P(C_P)\prod_k P(X_j^k = a_k|C_i)$. Given: X = (age>40, income = low, student = no, credit_rating = excellent) (i) P(buys computer = yes|X) = P(BC = yes) × P(>40|yes) × P(low|yes) × P(not student|yes) × P(excellent|yes) $= \frac{9}{14} \times \frac{3}{9} \times \frac{3}{9} \times \frac{3}{9} \times \frac{3}{9} = 0.008$ (ii) P(BC = no|X) = P(BC = no) × P(>40|no) × P(low|no) × P(not student|no) × P(excellent|no) $= \frac{5}{14} \times \frac{2}{5} \times \frac{1}{5} \times \frac{4}{5} \times \frac{3}{5} = 0.014$. Hence, the outcome for given X is He/She does not opt to buy computer since P(BC = No|X) > P(BC = Yes|X) [∵ 0.014 > 0.008]	
<K2>	8. Explain the McCulloch and Pitts Neural Network Model with its structure and limitations. Ans: Describe MPNNN **(1) a set of weighted inputs** w_i that correspond to the synapses **(2) an adder** that sums the input signals (equivalent to the membrane of the cell that collects electrical charge) **(3) an activation function** (initially a threshold function) that decides whether the neuron fires ('spikes') for the current inputs  Limitations: • Linear summation (non linear) • Synchronous with clock (asynch) • Single output (spike train of output response) • Neuron has to produce graded output in continuous way • Changing weights between 0 and 1 (excitatory or inhibitory connections) • Feedback loop is not available (exceptions)(available)	<CO2>
<K3>	9. Make use of the following confusion matrix to compute the accuracy, sensitivity and specificity for each class of the given multi class problem and find their overall percentage. <table><tr><td rowspan="2">Actual</td><td colspan="3">Predicted</td></tr><tr><td>C1</td><td>C2</td><td>C3</td></tr><tr><td>C1</td><td>10</td><td>5</td><td>5</td></tr><tr><td>C2</td><td>2</td><td>15</td><td>3</td></tr><tr><td>C3</td><td>1</td><td>1</td><td>18</td></tr></table>	<CO1>

Ans:

Class	Accuracy	Sensitivity	Specificity
1	78	0.5	0.93
2	82	0.75	0.85
3	83	0.9	0.8
Average	81%	72%	86%

Part – C (2×10 = 20 Marks)

<K2>

10. Explain five types of learning with appropriate diagram and state their uniqueness. List out any two applications in each type.

1. Supervised – sales forecasting, image classification
2. Unsupervised – recommendation system, anomaly detection
3. Semi supervised – speech analysis, internet content classification
4. Evolutionary – medical imaging, scheduling
5. Reinforcement - robot, game AI

<CO1>

(OR)

<K2>

11. Explain the importance of the curse of dimensionality and ROC curve.

Curse of dimensionality – 6 marks

ROC curve -4 marks

<CO1>

<K3>

12. Apply the perceptron learning algorithm for the given OR network and estimate the updated weights and output of each sample for two epochs.

Consider the following inputs X_1, X_2 and output T for the OR network with learning rate = 0.1, theta = 1.0, $W_0 = W_1 = W_2$ = bias= 0.5.

Output = 1 if $y_j >=$ theta

-1 if $y_j <$ theta

Note: $y_j =$ output of weighted liner function and output = $g(y_j)$

X_1	X_2	T	W_0	W_1	W_2
Epoch 1					
1	1	1	0.5	0.5	0.5
1	-1	1	0.6	0.7	0.3
-1	1	1	0.7	0.5	0.5
-1	-1	-1	0.7	0.5	0.5
Epoch 2					
1	1	1	0.7	0.5	0.5
1	-1	1	0.8	0.7	0.3
-1	1	1	0.9	0.5	0.5
-1	-1	-1	0.9	0.5	0.5

<CO2>

(OR)

<K3>

13. Explain the perceptron learning algorithm with structure and apply to model the OR network. Consider the following inputs X_1, X_2 and output T for the OR network.

Ans:

Explanation of perceptron with diagram – 4 marks

Problem – 6 marks

X_1	X_2	T	W_0	W_1	W_2
Epoch 1					
0	0	0	-0.03	-0.02	0.02
0	1	1	0.22	-0.02	0.02
1	0	1	-0.03	-0.02	0.27
1	1	1	-0.03	-0.02	0.27

Assume:W_0 = - 0.03, W_1 = -0.02, W_2 = 0.02, bias= -1, learning rate = 0.25, theta = 0

Estimate the updated weights and the error of each sample for one epoch.

<CO2>

Prepared By	Reviewed By	Approved By
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