

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
(END SEMESTER EXAMINATION MO 2022)

CLASS: MCA  
BRANCH: MCA

SEMESTER: V  
SESSION: MO 2022

SUBJECT: CA640 MACHINE LEARNING

TIME: 03 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

- Q.1(a) Elaborate upon the definition of Machine Learning with suitable example. [2] CO1  
 Q.1(b) Differentiate supervised and unsupervised learning techniques. Discuss their limitations. [3] CO2  
 Q.1(c) Solve the system by reducing the augmented matrix to RREF. [5] CO1

$$\begin{aligned} 3x_1 + 7x_2 - x_3 &= -1 \\ x_1 + 3x_2 + x_3 &= 1 \\ -x_1 - 2x_2 + x_3 &= 1. \end{aligned}$$

- Q.2(a) Use the following dataset to construct a decision tree to predict whether a person is Happy (H) or Sad (S) based on the color of their shirt, whether they wear glasses and the number of SIM cards they have. [5] CO3

Shirt Color	Wear Glasses	Number of SIM Cards	Output
G	Y	2	S
G	N	2	S
G	N	2	S
B	N	2	S
B	N	2	H
R	N	2	H
R	N	2	H
R	N	2	H
R	Y	3	H

- Q.2(c) Consider the following training data points and apply SVM algorithm to classify the data points: [5] CO3  
 Class A samples:  $\{(-1,0), (0, -1), (1,0), (0,1)\}$   
 Class B samples:  $\{(6,1), (6, -1), (3,1), (3, -1)\}$   
 Take bias = 0.5. find the equation of hyperplane and show it on 2-D coordinate.

- Q.3(a) Design a perceptron to implement OR function. [2] CO4  
 Q.3(b) Explain the working of a recurrent network. [3] CO2  
 Q.3(c) Consider a neural network with the following details: [5] CO3

Number of inputs - 2 (labelled 1 and 2)  
 Number of inputs in hidden layer 1 - 2 (labelled 3 and 4)  
 Number of inputs in hidden layer 2 - 2 (labelled 5 and 6)  
 Hidden layers use the following activation function  
 $Y=f(y) = 1$  if  $y \geq 0$  otherwise 0

Calculate the output of the perceptron network if  
 Weights:  $w_{13}=-2, w_{35}=1, w_{23} = 3, w_{45} = -1, w_{14} = 4, w_{36} = -1, w_{24}=-1, w_{46}=1$   
 Input: 0,0

- Q.4(a) Describe the hierarchical clustering and its types. Explain any one algorithm for hierarchical clustering. [5] CO2

Q.4(b) Divide the given sample data in two clusters using K-Means algorithm based on Euclidean [5] CO3 distance.

Height	Weight
185	72
170	56
168	60
179	68
182	72
188	77
180	71
180	70
183	84
180	88
180	67
177	76

Q.5(a) Explain how bagging and boosting works in ML with suitable example(s). [5] CO2

Q.5(b) Write short notes on [5] CO2  
(i) Bias-variance tradeoff  
(ii) Ensemble

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