Nirma University

Institute of Technology

Semester End Examination (IR), November - 2024

Bachelor of Science (CSE), Semester-V

Int. B. Tech. (CSE) - MBA, Semester-V

B. Tech. in Computer Science and Engineering, Semester-V

3CS101CC24 Machine Learning

Roll / Exam No. _____ Supervisor's initial with date _____

Time: 3 Hours Max. Marks: 100

Instructions:
1. Attempt all questions.
2. Figures to the right indicate full marks.
3. Assume suitable assumptions and specify them.
4. Section-wise separate answer book to be used.

Section – I

Q-1. CO3,BL4 Using the Decision Tree classifier algorithm and the following training data, find the class label for a test record {Outlook=Sunny, Temp= Hot, Humidity=Normal, Windy=True, Play=?}. Build the entire Decision tree by using Information Gain. Show all the steps. **[18]**

Outlook	Temp	Humidity	Windy	Play
Sunny	Hot	High	False	No
Sunny	Hot	High	True	No
Overcast	Hot	High	False	Yes
Rainy	Mild	High	False	Yes
Rainy	Cool	Normal	False	Yes
Rainy	Cool	Normal	True	No
Overcast	Cool	Normal	True	Yes
Sunny	Mild	High	False	No
Sunny	Cool	Normal	False	Yes
Rainy	Mild	Normal	False	Yes
Sunny	Mild	Normal	True	Yes
Overcast	Mild	High	True	Yes
Overcast	Hot	Normal	False	Yes
Rainy	Mild	High	True	No

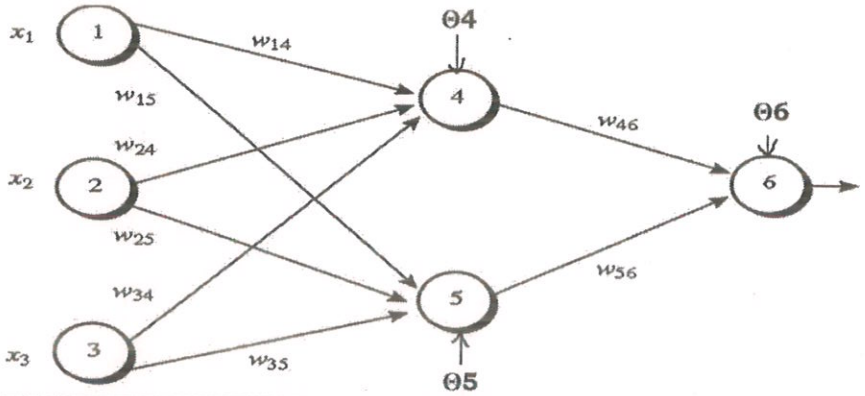
Q-2. Do as directed. **[16]**

A CO4,BL3 A healthcare diagnostic system is analyzing 800 patients. Among these, 500 cases are genuinely healthy, and 300 cases are diseased, while 100 are mistakenly classified as healthy. Out of the healthy cases, 400 are correctly identified as healthy, while 100 are incorrectly classified as diseased. Construct a confusion matrix for the given data and compute precision, recall, and F-measure. Clearly outline the formulas used for each metric and present your step-by-step calculations. [06]

B CO1,BL3 Consider the following negative data points {(1,1), (2,1), (1,-1), (2,-1), (4,0)} and positive data points {(5,1), (5,-1), (6,0)}. Use linear SVM function to find hyperplane equation. [06]

C CO2,BL1 Discuss the need of normalization. Explain min-max normalization with suitable example. [04]

Q-3. CO3,BL4 Consider the following feed-forward neural network. **[16]**



Input			Weight								Bias		
X1	X2	X3	W14	W15	W24	W25	W34	W35	W46	W56	Θ4	Θ5	Θ6
1	1	0	0.1	-0.2	0.3	0.2	-0.4	0.1	-0.4	-0.1	-0.3	0.1	0.2

Assume that the neurons have a sigmoid activation function, perform a forward pass and a backward pass on the network. Assume that the actual output y is 1 and the learning rate is 0.5.

Section – II

Q-4. Do as directed. **[18]**

A CO3,BL4 Answer the following question based on a simple competitive learning neural network. Let the training set T consist of six 3-dimensional vectors, i1 to i6. T={i1=(1.1,1.7,1.8),i2=(0,0,0),i3=(0,0.5,1.5),i4=(1,0,0),i5=(0.5,0.5,0.5),i6=(1,1,1). There are three Neurons in the output layer: A, B, and C in the topology (A-B-C). The Connection strengths (weights) are initially chosen randomly and are given by the weight matrix [12]

$$W(0) = \begin{pmatrix} w1: & 0.2 & 0.7 & 0.3 \\ w2: & 0.1 & 0.1 & 0.9 \\ w3: & 1 & 1 & 1 \end{pmatrix}$$

Learning rate η = 0.5. For each sample presented, show the winner node till t=6. Show which output node is repeatedly activated by which input samples. (Show all the calculations using squared Euclidean distance)

B CO2,BL2 Compare and contrast Deep Learning and Machine Learning. [06]

Q-5. Do as directed. **[12]**

A CO3,BL4 Consider the following 1-D data {12,15,18,22,30,35,40}. Apply Agglomerative Hierarchical Clustering to determine the number of clusters with their members. Draw the entire Dendrogram. [07]

B CO1,BL2 Discuss the reinforcement learning in detail. [05]

Q-6. CO3,BL4 Consider the data given in the following table. [20]

Advertising Budget (x) (in Lacs)	Sales (in Lacs) (y)
20	35
15.3	30
10.5	25
25	40
30	50

Fit a first-order regression model to the data ($y = \beta 0 + \beta 1x$). Estimate parameters of the model ($\beta 0$ and $\beta 1$) through one epoch (one complete pass through the training set) of batch gradient descent and stochastic gradient descent assuming learning rate = 0.01. Assume the initial value of $\beta 0$ and $\beta 1$ to be 2 and 3, respectively. The loss function is (1/2)*(mean squared error).