Nirma University

Institute of Technology

Semester End Examination (RPR), July 2022

B. Tech. CSE Semester- V

2CS501, MACHINE LEARNING

Roll / Exam No.		Supervisor's initial with date	

Time: 3 Hours | Max. Marks: 100

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Make suitable assumptions wherever necessary.

SECTION I

Q.1 Answer the following questions: **[16]**

A. CO2 Explain the following machine learning methods with suitable examples: [10]

a. Deep Learning
b. Linear Discriminant Analysis
c. Principle Component Analysis
d. Recurrent Neural Network

B. CO3 Given the set of values $X = (3, 7, 12, 5, 2)^T$ and $Y = (2, 9, 11, 4, 3)^T$. Evaluate the linear regression coefficients. [06]

Q.2 Answer the following questions: **[16]**

A. CO3 Consider a cricket game between two rival teams: Team A and Team B. Suppose Team A wins 90% of the time and Team B wins the remaining matches. Among the games won by Team A, only 20% of them come from playing on Team B's cricket field. On the other hand, 70% of the victories for Team B are obtained while playing at home. If Team B is to host the next match between the two teams, which team will most likely emerge as the winner? [10]

B. CO1,2 Define Competitive Neural Network. Explain the working of self-organizing map-based learning with a suitable example. [06]

Q.3 Answer the following questions: **[18]**

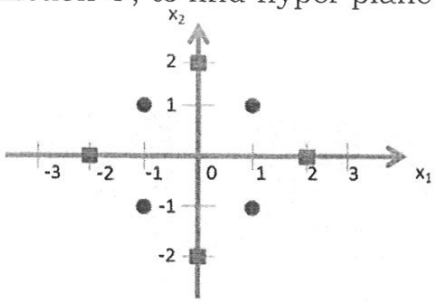
A. CO3 Consider the given data for the sales (in million dollars) of Car of an Automobile Company for 6 consecutive years. [12]

Year	2013	2014	2015	2016	2017	2018
Sales	120	100	250	275	230	300

a. Determine a linear regression model equation to represent this data.
b. Plot the equation.
c. Based on the above data, predict the sales for next four consecutive years.

OR

A. CO3 Consider the two groups of data points (circles and squares) as shown in Figure below. Use non-linear SVM, using the transformation function Φ, to find hyper plane equation. [12]



$$\phi\begin{pmatrix}x_1\\x_2\end{pmatrix}=\begin{cases}\begin{pmatrix}6-x_1+(x_1-x_2)^2\\6-x_2+(x_1-x_2)^2\end{pmatrix} & \text{if } \sqrt{x_1^2+x_2^2}\geq 2\\ \begin{pmatrix}x_1\\x_2\end{pmatrix} & \text{otherwise}\end{cases}$$

Classify the point $(x_1, x_2)= (2, 3)$, based on the above model.

B. CO2 What do you understand by reinforcement learning? Explain the working of Q-learning. [06]

SECTION II

Q.4 Answer the following questions: **[18]**

A. CO3 Consider the following set of training examples: [12]

Instance	A1	A2	Classification
1	1	1	1
2	1	1	1
3	1	0	0
4	0	0	1
5	0	1	0
6	0	1	0

i. What is the entropy of this collection of training examples with respect to the target function classification?

ii. What is the information gain of A2 relative to these training examples?

OR

A. CO3 Show the final result of hierarchical clustering with single linkage by drawing a dendrogram. The value in the matrix represents the Euclidean distance between the points. **[12]**

	A	B	C	D	E	F
A	0					
B	.12	0				
C	.51	.25	0			
D	.84	.16	.14	0		
E	.28	.77	.70	.45	0	
F	.34	.61	.93	.20	.67	0

B. CO3 For the following data tuples compute the values for the True Positive Rate (TPR) and False Positive Rate (FPR) for different cut off values. [06]

Tuple No.	Class	Probability
1	P	0.995
2	P	0.980
3	P	0.847

4	N	0.763
5	N	0.622
6	P	0.506
7	N	0.471
8	N	0.337
9	P	0.218
10	N	0.048

Q.5 **Answer the following questions:** **[16]**

A. CO2 Discuss various factors on which classification/prediction methods can be compared. [06]

B. CO3 Consider the training data in the following table where Play is a class attribute. [06]

Day	Outlook	Humidity	Wind	Play
1	Sunny	High	Weak	No
2	Sunny	High	Strong	No
3	Overcast	High	Weak	Yes
4	Rain	High	Weak	Yes
5	Rain	Normal	Weak	Yes
6	Rain	Normal	Strong	No
7	Overcast	Normal	Strong	Yes
8	Sunny	High	Weak	No
9	Sunny	Normal	Weak	Yes
10	Rain	Normal	Weak	Yes
11	Sunny	Normal	Strong	Yes
12	Overcast	High	Strong	Yes
13	Overcast	Normal	Weak	Yes
14	Rain	High	Strong	No

What is class label for the following day (Outlook= Rain, Humidity= High, Wind= Weak), according to naïve Bayesian classification?

C. CO2 Differentiate between bagging, boosting and voting in ensemble methods. [04]

Q.6 **Answer the following questions:** **[16]**

A. CO2 Distinguish between overfitting and underfitting. How it can affect model generalization? [06]

B. CO3 A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population has this disease. [06]

1. What is the probability that this patient has cancer?
2. What is the probability that he does not have cancer?
3. What is the diagnosis?

C. CO2 With suitable equations, explain any two types of activation functions used in neural networks. [04]