JHARKHAND Rai University
RANCHI

PRACTICE SET

End Semester (V Sem.) Examination, December 2025

Program: BCA
Semester: V
Subject: Machine Learning
Subject Code: 3CCC301

Course Outcomes	Description
CO1	Understand the basics of machine learning, including statistical foundations and apply linear regression for prediction tasks
CO2	Apply supervised learning techniques like decision trees, logistic regression, nd SVM, and evaluate models considering bias-variance trade-off
CO3	Design and train neural networks using backpropagation and analyze issues related to overfitting and network architecture.
CO4	Implement clustering techniques such as K-means, hierarchical clustering, and EM algorithm for unsupervised and semi-supervised learning problems
CO5	Analyze and apply ensemble methods like bagging, boosting, and active learning to enhance model accuracy and robustness

Section A **(25 x 5= 125 Total Marks)**

1. Describe any five applications of machine learning. [CO1] [Unit 1] [Understand LOT]
2. Compare and contrast Supervised, Unsupervised and Reinforcement learning with suitable example. [CO1] [Unit 1] [Understand LOT]
3. Outline the differences between Training data and Testing data. [CO1] [Unit 1] [Understand LOT]
4. Define Linear regression. [CO1] [Unit 1] [Remember LOT]

5. If A is a 5× 5 matrix with Det A = −1, compute Det(−2A). [CO1] [Unit 1] [Apply LOT]
6. Describe a decision tree. List its main components. [CO2] [Unit 2] [Remember LOT]
7. Illustrate with an example how pruning helps in decision trees. [CO2] [Unit 2] [Apply LOT]
8. Describe overfitting and underfitting with examples. [CO2] [Unit 2] [Understand LOT]
9. Differentiate between logistic regression and linear regression in terms of output and use cases. [CO2] [Unit 2] [Understand LOT]
10. Describe the various strategies that can be implemented to minimize the overfitting problems in decision tree. [CO2] [Unit 2] [Understand LOT]
11. Explain the concept of bias-variance trade-off. [CO2] [Unit 2] [Understand LOT]
12. Explain the role of kernels in SVM. [CO2] [Unit 2] [Understand LOT]
13. Compare and contrast biological neural network neuron and artificial neural network. [CO3] [Unit 3] [Understand LOT]
14. Describe perceptron learning rule. [CO3] [Unit 3] [Understand LOT]
15. Explain the concept of gradient descent in the context of neural network training. [CO3] [Unit 3] [Understand LOT]
16. Explain the mathematical model of Artificial Neural Network. [CO3] [Unit 3] [Understand LOT]
17. Mention the limitations of k-means clustering algorithms. [CO4] [Unit 4] [Understand LOT]
18. Define clustering in machine learning. State any five applications of clustering. [CO4] [Unit 4] [Understand LOT]
19. Define Expectation maximization algorithm. Describe any two advantages and disadvantages of EM algorithm. [CO4] [Unit 4] [Understand LOT]
20. Explain the differences between classification and regression. [CO1] [Unit 4] [Understand] [LOT]
21. Describe different types of neural network architecture. [CO4] [Unit 3] [Understand LOT]
22. Explain ensemble learning models. [CO5] [Unit 5] [Understand LOT]
23. Describe cross validation. [CO5] [Unit 5] [Understand LOT]
24. Give examples of any three types of data used in clustering analysis. [CO4] [Unit 4] [Understand LOT]

Section B **(13 x 10= 120 Total Marks)**

25. Critically analyse the performance of Linear Regression with other basic Machine Learning algorithms. When would you prefer Linear Regression? [CO1] [Unit 1] [Analyse HOT]
26. Illustrate Machine Learning. Explain the activities involved in Machine Learning. [CO1] [Unit 1] [Understand LOT]
27. Describe the process of principal component analysis and its applicability towards feature reduction. [CO4] [Unit 4] [Understand LOT]
28. Explain bagging and boosting in detail. Describe the necessity of Bagging method for classification process. [CO5] [Unit 5] [Understand LOT]
29. Give a detailed discussion on the significance of diversity in ensemble learning. [CO5] [Unit 5] [Analyse HOT]
30. Using an appropriate illustration, demonstrate how a support vector machine can be used to classify linear data. Enumerate the advantages and disadvantages of support vector machine. [CO2] [Unit 2] [Understand LOT]
31. Illustrate the need of activation function in artificial neurons network. Explain different types of activation functions. [CO3] [Unit 3] [Understand LOT]
32. Explain back-propagation algorithm for learning model parameters in a neural network [CO3] [Unit 3] [Understand LOT]
33. Differentiate between Divisive and Agglomerative hierarchical clustering algorithm. Also illustrate the methods using example and dendrogram. [CO4] [Unit 4] [Analyse HOT]
34. Classify different distance measures methods used in K-mean algorithm. Explain why Euclidean distance is preferred over Manhattan distance in K mean algorithm? [CO4] [Unit 4] [Analyze HOT]
35. Design a neural network model with two input neurons with bias and two output neurons. The initial weight vectors are [v11, v21, v01] = [0.2, 0.1, 0.3] and [v12, v22, v02] = [-0.1, 0,4, 0.5]. Calculate the outputs of both the neurons for input vector [1, 1]. Use Binary sigmoidal function as activation function. [CO3] [Unit 3] [Apply LOT]
36. Explain any 2 machine learning algorithms and their performance factors. [CO2] [Unit 2] [Analyze HOT]

37. Analyze the different types of Machine Learning and examine how their features influence the learning process and model performance. [CO1] [Unit 2] [Analyze HOT]

Section C **(4x 20= 100 Total Marks)**

38. Construct a Backpropagation NN with the following parameters and single hidden layer: X1= 0.05, X2 = 0.10; W11= 0.15, W12= 0.2, W21=0.25, W22=0.3, B1=0.35; W13= 0.4, W23=0.45. Target output = 0.8; Learning parameter = 0.05. Depict one complete iteration of a forward pass and backward estimation using binary sigmoidal function. [CO3] [Unit 3] [Evaluate HOT] `

39. Calculate, based on information gain, which feature is chosen as the root node of the Decision Tree for classifying the following data. All intermediate computations must be shown. [CO2] [Unit 2] [Evaluate HOT]

ID	Outlook	Temperature	Humidity	Wind	Play?
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Overcast	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes

40. Solve the following classification problem with the perceptron learning rule. Apply each input vector in order, for as many repetitions as it takes to ensure that the problem is solved. Assume initial weight and bias as zero. [CO3] [Unit 3] [Evaluate HOT]

$$\left\{\mathbf{p}_1 = \begin{bmatrix}2\\2\end{bmatrix}, t_1 = 0\right\}\left\{\mathbf{p}_2 = \begin{bmatrix}1\\-2\end{bmatrix}, t_2 = 1\right\}\left\{\mathbf{p}_3 = \begin{bmatrix}-2\\2\end{bmatrix}, t_3 = 0\right\}\left\{\mathbf{p}_4 = \begin{bmatrix}-1\\1\end{bmatrix}, t_4 = 1\right\}$$

41.a) Utilize the k-means algorithm and Euclidean distance to cluster the following points into three clusters and determine their centres after two iterations. A1= (2,10), A2= (2,5), A3= (8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9) [C04] [Unit 4][Evaluate, HOT]

(b) Given the following distance matrix, generate a dendrogram using the hierarchical agglomerative single and complete linkage algorithm.

Item	A	B	C	D	E
A	0				
B	8	0			
C	2	6	0		
D	5	4	8	0	
E	10	9	1	7	0

----------End----------

Summary Sheet:

CO Wise

CO	Q. No	Marks
CO1	1,2,3,4,5,20,25,26,37	60
CO2	6,7,8,9,10,11,12,30,36,39	75
CO3	13,14,15,16,31,32,35,38,40	100
CO4	17,18,19,21,27,34,41	60
CO5	22,23,24,28,29	53
Total		**330**

Unit Wise

Unit	Q. No	Marks
Unit 1	1,2,3,4,5,25,26	45
Unit 2	6,7,8,9,10,11,12,17,30,36,37	70
Unit 3	13,14,15,16,21,31,32,35,38,39,40	115
Unit 4	18,19,20,24,27,33,34,41	60
Unit 5	22,23,28,29,30	40
Total		**330**

Blooms Taxonomy Level (BTL) Wise

BTL	Q. No	Marks
LOT	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19, 20,21,22,23,24,26,27,28,30,31,32,35	190
HOT	28,29,33,34,36,37,38,39,40,41	140
Total		**330**

Prepared by: Anuradha Sharma

Disclaimer: - This is a Practice Set. The Question in End term examination will differ from the Practice set. This Practice set is meant for practice only.