POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Machine Learning (New)

Semester: Spring

Year : 2025
Full Marks : 100
Pass Marks : 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define Machine Learning. Describe the typical Machine Learning workflow. 7

   b) How does regularization affect the bias-variance trade-off? Explain the Ridge and Lasso regression with its mathematical explanation. 8

2. a) What is SVM? How does the SVM classifier work? Also explain the importance of kernel functions in SVM. 7

   b) An analyst wants to build a multiple linear regression model to predict a car's price (in Rs. 100000) based on two factors: engine size (in liters) and car age (in years) 8

Car	Engine Size (X_1)	Age (X_2)	Price
1	2	5	20
2	2.2	4	22
3	1.8	6	18
4	2.5	3	24

   Fit a multiple linear regression model using matrix method.

3. a) What is market basket analysis? Using Apriori algorithm, find the frequent item sets and association rules (given minimum support count = 2, minimum confidence = 0.7) from below dataset: 7

TID	Items
100	1, 2
101	1, 3,4
102	1, 3, 4, 5
103	1, 2, 3,4

   b) *Use K(=2)-Means algorithm over the data (2, 3), (3, 3), (3, 4), (5, 4), (6, 4), (6, 5), (8, 5), (9, 6) up to two iterations and show the clusters. Choose Centroid 1: (3, 3) and Centroid 2: (8, 5) as initial centroids.* 8

OR

For the given data points, calculate the distance matrix and create a dendrogram using single linkage technique.

Points	X	Y
P1	1	4
P2	1	2
P3	0	4
P4	6	1
P5	7	0

4. a) What is dimensionality reduction? Explain what is PCA and the steps involved in PCA. 7

   b) Explain the Loss function in Artificial Neural Network with its mathematical equations and terminology used. 8

5. a) How multilayer perceptron uses the backpropagation and gradient descent in neural network training? Explain with an example. 7

   b) Describe the components of a Convolutional Neural Network (CNN) and explain their functions. 8

OR

Explain the architecture and functionality of Long Short-Term Memory (LSTM) networks. How do they overcome the vanishing gradient problem?

6. a) What are model validation techniques? Compare hold-out and k-fold cross-validation. 7

   b) Pokhara University recently developed a machine learning model to predict PASSED and FAILED students. While evaluating the model with a dataset of 1000 records, the system correctly predicted 480 students as PASSED and 380 students as FAILED students. However, 120 students were misclassified as FAILED students. 8

   i. Create a confusion matrix.
   ii. Compute accuracy, precision, recall, F1 score, sensitivity and specificity.

7. *Write short notes on:* **(Any two)** 2×5

   a) *Challenges of Machine Learning*
   b) Overfitting and Underfitting
   c) Hyperparameter Tuning