Module 2

1. Define linear regression. Write the equation for a simple linear regression model and explain each term.
2. Explain simple linear regression and multiple linear regression with suitable equations and examples.
3. Explain the concept of gradient descent. Why is the learning rate important?
4. Optimize the linear regression loss function to get the update values for both the parameters (i.e slope and intercept) using gradient descent. Also mention when we should stop updating parameter values.
5. Explain underfitting and overfitting. When do they occur and if they occur how will you address them?
6. Explain the bias-variance tradeoff and how it relates to overfitting and underfitting.
7. What is regularization in machine learning? Compare L1 (Lasso) and L2 (Ridge) regularization with examples.
8. Explain how regularization helps prevent overfitting in supervised learning.
9. Write the mathematical form of the logistic regression hypothesis function and explain the role of the sigmoid function.
10. Discuss the differences between linear regression and logistic regression in terms of purpose, output, and loss functions.
11. How will you tackle multiclass classification problems using logistic regression?
12. Explain the working principle of the K Nearest Neighbor algorithm. Explain step by step approach for solving both classification and regression problems using KNN (for K=5). (use your own example)
13. How will you calculate distance between data points in KNN? Which distance metrics will you use if the data points are categorical and numerical?
14. Describe logistic regression in detail.
15. You are given a dataset with the following 6 training points, each having two features (X1, X2) and a class label (Y): A new test point T = (4, 3) is to be classified using KNN with Euclidean distance.

Point	X1	X2	Y
A	1	2	0
B	2	3	1
C	3	1	1
D	6	5	0
E	7	7	1
F	8	6	0

(i) Compute the Minkowiski distance (p=2.6) from point T to all six training points.

(ii) Using k = 3, predict the class of point T.

In case of a tie, use distance-weighted voting, where the vote of each neighbor is inversely proportional to the square of the distance.

(iii) Repeat the classification with k = 5. Again, apply distance-weighted voting if there's a tie.

16. Given the following dataset of customer information, use the Naive Bayes classifier to predict if a new customer will buy a product: **New Customer[**Age: Middle-aged, Income: Medium, Student Status: Yes]

Customer ID	Age	Income	Student Status	Bought Product
1	Young	High	Yes	No
2	Young	Medium	Yes	Yes
3	Middle-aged	High	No	Yes
4	Senior	Medium	Yes	No
5	Senior	Low	No	No
6	Middle-aged	Low	Yes	Yes
7	Young	Low	No	No
8	Young	Medium	No	Yes
9	Senior	High	Yes	Yes
10	Middle-aged	Medium	No	No

17. Explain decision tree.

Construct a decision tree for the following dataset

Day	Outlook	Temperature	Humidity	Wind	Play
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes

D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

18. What is Support vector machine? Explain the different types of SVM.