Machine Learning
Supervised Learning Fundamentals Quiz

Instructions:

- Answer all questions.
- For Questions 1–5, choose the best option.
- For Questions 6–8, mark True or False.
- For Questions 9–10, write detailed answers with mathematical formulations where appropriate.

1. Which of the following is NOT a symptom of overfitting?

(A) High training accuracy but low test accuracy

(B) Model captures noise in the training data

(C) High bias and high training error

(D) Complex model with too many parameters

2. In gradient descent, the learning rate determines:

(A) The direction of parameter updates

(B) The size of steps taken toward the minimum

(C) The number of iterations required

(D) The final accuracy of the model

3. Which regularization technique adds the sum of squared weights to the loss function?

(A) L1 regularization (Lasso)

(B) L2 regularization (Ridge)

(C) Dropout

(D) Batch normalization

4. The precision metric measures:

(A) True positives divided by all actual positives

(B) True positives divided by all predicted positives

(C) True negatives divided by all actual negatives

(D) Correct predictions divided by total predictions

5. K-fold cross-validation helps to:

(A) Increase training data size

(B) Reduce model complexity

(C) Provide more reliable performance estimates

(D) Speed up training time

6. A decision tree with unlimited depth will always overfit the training data. (True/False)

7. The softmax function is typically used in the output layer for binary classification. (True/False)

8. Feature scaling is essential for all machine learning algorithms. (True/False)

9. Explain the bias-variance tradeoff in machine learning. How do model complexity, training data size, and regularization affect this tradeoff? Provide examples.

10. Describe how logistic regression works for binary classification. Explain the sigmoid function, the loss function used, and how gradient descent optimizes the model parameters.