Machine Learning Quiz - Set 1
Total Marks: 18

Instructions:

- Answer all questions. Show work for subjective questions.
- MCQ: Circle correct option. Subjective: Provide detailed solutions.
- MCQ (7 marks) + Subjective (11 marks) = 18 marks

Multiple Choice Questions

Q1 [3 marks]

Given the confusion matrix below for a binary classification problem:

	Predicted 0	Predicted 1
Actual 0	85	15
Actual 1	10	90

What is the precision of the classifier?

(A) 0.875 (D) 0.857
(B) 0.95 (E) 0.90
(C) 0.825 (F) 0.85

Q2 [2 marks]

Which of the following best describes the bias-variance tradeoff in machine learning?

(A) Variance only matters in unsupervised learning
(B) Bias and variance are independent and don't affect each other
(C) Reducing bias typically increases variance, and vice versa
(D) Bias and variance can both be minimized simultaneously without any tradeoff
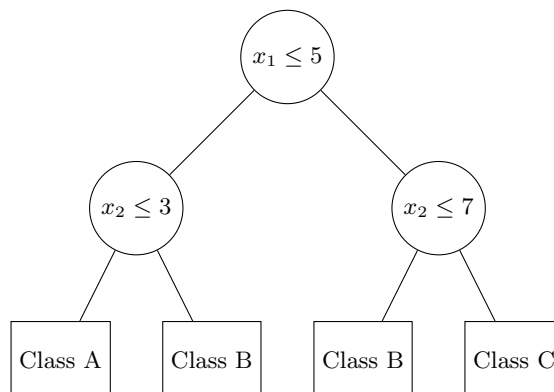(E) High bias models always perform better than high variance models

Q3 [2 marks]

In a decision tree, which impurity measure is most commonly used for classification tasks?

(A) Gini Impurity (D) Cross-entropy
(B) Mean Absolute Error (MAE) (E) Pearson correlation
(C) R-squared (F) Mean Squared Error (MSE)

Subjective Questions

Q4 [6 marks]

Analyze the decision tree structure below:

a) What is the maximum depth of this tree? [**1 mark**]
b) Calculate the Gini impurity for a node with class distribution: Class A: 40 samples, Class B: 30 samples, Class C: 10 samples. [**3 marks**]
c) Explain why pruning might be beneficial for this tree. [**2 marks**]

_____
_____
_____

Q5 [5 marks]

Consider the following dataset for linear regression:

Sample	Feature 1	Feature 2	Target
1	1	2	6
2	3	1	7
3	2	3	9
4	4	2	10

a) Calculate the mean squared error (MSE) if the model predicts $\hat{y} = 5.9, 7.1, 8.8, 9.9$ respectively. [**3 marks**]
b) If we use L2 regularization with $\lambda = 0.05$, write the complete loss function. [**2 marks**]

_____
_____
_____