Machine Learning Quiz - Set 1

Total Marks: 18

Instructions:

- Answer all questions clearly and completely.
- Show work for subjective questions.
- Circle the correct option for multiple choice questions.
- MCQ: 7 marks, Subjective: 11 marks

MULTIPLE CHOICE QUESTIONS

1. 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? **[3 marks]**

(A) 0.875

(B) 0.95

(C) 0.825

(D) 0.857

(E) 0.90

(F) 0.85

2. Which of the following best describes the bias-variance tradeoff in machine learning? **[2 marks]**

(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

3. In a decision tree, which impurity measure is most commonly used for classification tasks? **[2 marks]**

(A) Gini Impurity

(B) Mean Absolute Error (MAE)

(C) R-squared

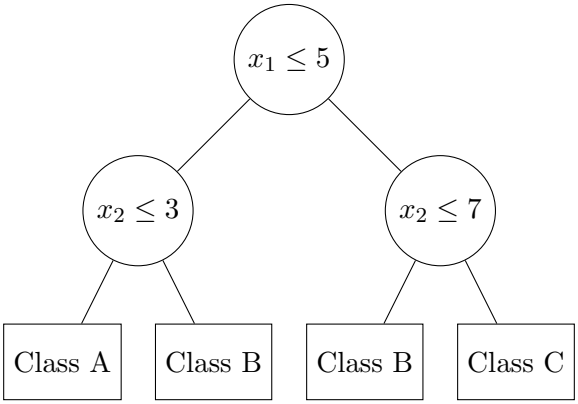
(D) Cross-entropy

(E) Pearson correlation

(F) Mean Squared Error (MSE)

SUBJECTIVE QUESTIONS

4. 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]** **[6 marks]**

5. 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]** [**5 marks**]