

Machine Learning

Supervised Learning Quiz

Set 1

Instructions:

- Answer all questions clearly and completely.
- Show your work for subjective questions.
- For multiple choice questions, **circle** the correct option.
- **Marks Distribution:** MCQ (7 marks) + Subjective (11 marks) = **18marks total**

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
- (B) 0.95
- (C) 0.825
- (D) 0.857
- (E) 0.90
- (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?

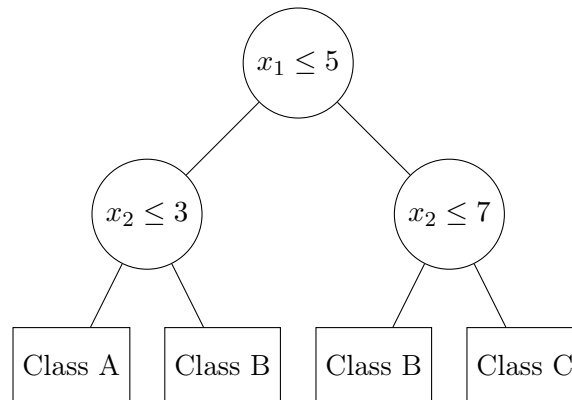
- (A) Gini Impurity
- (B) Mean Absolute Error (MAE)
- (C) R-squared
- (D) Cross-entropy
- (E) Pearson correlation
- (F) Mean Squared Error (MSE)

Subjective Questions

Q4

[Total: 6 marks]

Analyze the decision tree structure below:



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

Q5

[Total: 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

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