

# Indian Institute of Technology, Jammu

Department of Computer Science and Engineering

Examination, Date: OCT 26, 2024

Subject: Pattern Recognition

Time: 120 minutes

Subject : MTECH

Full Marks: 15

[**Note:** Answer all the questions. If assuming any data take as minimum values as required. For example, assuming a positive variable should be 1. **No discussion during the exam.**]

1. (4 marks)

- A dataset consists of two features  $X$  and  $Y$ . If the mean of  $X$  is 5 and the mean of  $Y$  is 10, calculate the covariance between  $X$  and  $Y$  given the following paired data:  $(2, 8), (4, 9), (6, 11), (8, 12)$ . (2 marks)
- Explain how variance can influence the decision boundary in a classification problem. (2 marks)

2. (4 marks)

- If a 4-directional chain code is given as  $[1, 2, 2, 1, 0, 3]$ , describe the potential shape it represents. What assumptions can you make about the object? (2 marks)
- Create a chain code for a simple "L" shape and justify your coding choices. (2 marks)

3. (4 marks)

- Consider two classes  $C_1$  and  $C_2$  with the following prior probabilities:

$$P(C_1) = 0.6$$

$$P(C_2) = 0.4$$

You know the likelihoods for a feature  $F$ :

$$P(F|C_1) = 0.85$$

$$P(F|C_2) = 0.15$$

Compute  $P(C_1|F)$  and  $P(C_2|F)$  using Bayes' theorem.

Additionally, if you were to modify the likelihoods such that  $P(F|C_1)$  is decreased by 0.1 and  $P(F|C_2)$  is increased by 0.1, what would the new values of  $P(C_1|F)$  and  $P(C_2|F)$  be?

**Note:** Ensure the modified likelihoods still sum to 1.

4. (3 marks)

- A binary classifier predicts class  $C_1$  with probability 0.75 and  $C_2$  with 0.25. Given that the misclassification costs are different, with  $C_1$  misclassifying as  $C_2$  costing 3 and  $C_2$  misclassifying as  $C_1$  costing 1, calculate the expected loss. (3 marks)