LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE 514 (CS 535) Machine Learning – Spring 2025
Quiz 2 Solutions

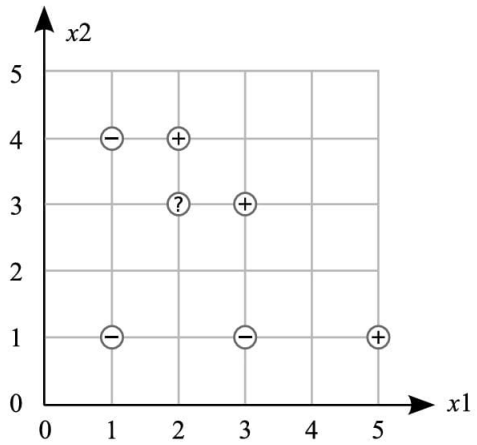
Name: _____

Campus ID: _____

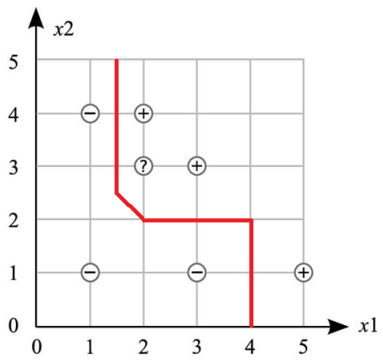
Total Marks: 10
Time Duration: 10 minutes

Question 1 (5 marks)

The graph below shows the training data points for a binary classification task using K-Nearest Neighbors. Data points are negative [(1,1) (3,1) (1,4)] or positive [(2,4) (3,3) (5,1)]. A test point with unknown label is located at (2,3).



(a) [3 marks] Draw the 1-NN decision boundary on the plot using the labeled points only.



Solution:

- 1 mark for somewhat correct boundary (some notion of perpendicular bisectors)
- 2 marks for mostly correct boundary
- 3 marks for exactly correct boundary

(b) [2 marks] How would 1-NN classify the unknown point (2,3).

Solution: A simple observation from a) shows that (2,3) will be classified as positive, since it lies on the positive half of the decision boundary.

- 1 mark for incorrect but consistent answer with a)
- 2 marks for correct answer

Question 2 (2 marks)

Your TA Ahmad claims that kNN performance (in terms of accuracy or RMSE for example) scales (improves) with the input dimensionality. Do you agree with his claim? Why or why not?

Solution: I disagree. As the number of dimensions increases, the volume of the feature space grows exponentially, causing data points to become more sparse (**curse of dimensionality**). Additionally, the distance between points tends to become more uniform, making it difficult for kNN to distinguish between close and far neighbors effectively. All points tend to be nearly equidistant from each other, hence the notion of "nearest" becomes less meaningful, leading to poor performance.

- 1 mark for correct answer
- 1 mark for correct explanation

Question 3 (3 marks)

For R^2 (i.e., 2D plane), plot three different graphs showing the locus of all points with Manhattan, Euclidean, and Chebyshev distance = 2 from **the point (1,1).**

Solution:

- 1 mark for each correct graph