Student ID:

Question 1 (12 marks)
(a) For the give data $\{(-3, 3); (-1, 1); (0, 0); (1, -1); (3, -3)\}$; please illustrate the steps to calculate the following (handwritten):
(b) The covariance matrix;
(c) Eigen values;
(d) Eigen vectors;
(e) Apply PCA on the dataset and represent the data after the dimension reduction. (Please illustrate the calculation steps one by one).

Question 2 (10 marks)
Based on the lecture slides, please do following LDA analysis;

Fro give data: Class 1, $\{(3,2);(2,3);(4,4);(3,1);(3,5);(3,3)\}$

Class 2, $\{(9,9);(10,9);(8,7);(8,10);(9,6);(8,8)\}$

(a) Plot the data in the image;
(b) Calculate the class mean and covariance matrix for these two classes;
(c) Calculate the Within-class scatter matrix and Between-class scatter matrix;
(d) Write the generalized eigen value problem for the LDA;
(e) Compute the projection vector.
(You can use matlab to do the calculation or do the exercise by hand except (a). If you use matlab, please copy the codes here and also list the results.)

Question 3 (12 marks)
For the given data; please calculate the Minkowski Distance with r=1, 2, infinite.

points	x	y
P1	0	3
P2	3	1
P3	5	1
P4	3	2
P5	2	4

Question 4 (16 marks)
For the given data, x=(2,3,4,3,1,1,1), y=(2,4,3,5,1,2,2), please calculate the following distances;
(a) Cosine distance
(b) Correlation distance
(c) L2 norm distance
(d) Please illustrate the property of scale invariant for correlation distance.