LAFDS Sessions 4 & 5 Homework

Full Name: _____

Group No.: ____

Lecturer Name: _____

Submission date: _/_/__ **Grade: __**

Please write down all the steps not the final answer only

Questions:

1. (5 point)

Find the eigenvalues and eigenvectors of A and A^2 and A^{-1} and $A + 4I$:

$$A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} \quad \text{and} \quad A^2 = \begin{bmatrix} 5 & -4 \\ -4 & 5 \end{bmatrix}.$$

Check the trace $= \lambda_1 + \lambda_2$ and the determinant $= \lambda_1 \lambda_2$ for A and also A^2.

2. (5 point)

Let Π be the plane in R^3 spanned by vectors $x_1 = (2, 4, 4)$ and $x_2 = (-3, 0, 6)$.

(i) Find an orthonormal basis for Π.

(ii) Extend it to an orthonormal basis for R^3

3. (5 point)

Compute the principal component using PCA (solve manually using eigen decomposition and check using SVD in numpy)

$x_1 = (2, 1)$
$x_2 = (3, 5)$
$x_3 = (4, 3)$
$x_4 = (5, 6)$
$x_5 = (6, 7)$
$x_6 = (7, 8)$