National University of Computer & Emerging Sciences

Homework # 16

1. Let

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$$

   (a) Find the Singular Value Decomposition(SVD) of the matrix A.

   (b) Compute the Spectral decomposition of the matrix A or write A as sum of rank 1 matrices.

   (c) Determine the orthogonal basis for the four fundamental subspaces of A.

   (d) Compute the left inverse of the matrix A using its SVD.

   (e) Find the least square solution of $Ax = b$

   (f) Determine the projection matrix that projects onto $col(A)$

2. Let the matrix A lists the two features of three observation.

   (a) Compute the standardized matrix.

   (b) Compute the covariance matrix.

   (c) Find the eigenvalues and eigenvectors of the covariance matrix.

   (d) Determine how much variance is preserved when projecting the data onto the first principal component.

   (e) Transform the data along the first principal component.

   (f) Project the data onto the first principal component.