

Lab 3: Realization of Arrays and Matrices

Experiment:

1. Write a program to realize one dimensional array [1, 4, 16, 32], obtain the continuous and discrete plots of the above array and upload the results.

2.  $x = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$  realize the matrix in python and obtain its visualization. Upload the results.

3.  $x = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$  write a python program to find the inverse of matrix x ?

4.  $2x + y + z = 4$ ,  $x + 3y + 2z = 5$ ,  $x = 6$  Write a python program to solve this system of linear equations using matrix?

5. Consider two matrices  $x = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$   $y = \begin{bmatrix} -4 & -3 & 2 \\ 1 & 2 & 1 \\ 2 & 4 & 2 \end{bmatrix}$  write a python program

to find

- a) Rank of x
- b) Eigen values of x
- c) Eigen vectors of x
- d) Rank of y
- e) Eigen values of y
- f) Eigen vectors of y

6. Consider a matrix  $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  perform the singular value decomposition of the

matrix A , print the left singular matrix, right singular matrix , eigen value matrix and reconstruct the matrix using all singular vectors obtained from svd?

7. Consider a matrix  $A = \begin{bmatrix} 2 & 0 & 8 & 6 & 0 \\ 1 & 6 & 0 & 1 & 7 \\ 5 & 0 & 7 & 4 & 0 \\ 7 & 0 & 8 & 5 & 0 \\ 0 & 10 & 0 & 0 & 7 \end{bmatrix}$  perform the singular value decomposition of

the matrix A , print the left singular matrix, right singular matrix , eigen value matrix.

i) Reconstruct the matrix using first 2 singular vectors obtained from svd, Obtain the absolute error

ii) Reconstruct the matrix using first 3 singular vectors obtained from svd, Obtain the absolute error

- iii) Reconstruct the matrix using first 4 singular vectors obtained from svd, Obtain the absolute error
- iv) Reconstruct the matrix using all singular vectors obtained from svd.
- v) Plot the absolute error against  $r$ , where  $r$  is the number of singular vectors used for matrix reconstruction

### Reports:

#### Preliminary Lab report:

1. Explain singular value decomposition of a matrix. List out some of its applications
2. Write the algorithm/ flowchart for the experiments listed in preceding section

#### Final Lab Report:

In addition to the Pre-lab report, document the code, comment each line and clearly report the results of each program (wherever applicable).