EE656A: Lab Assignment-2

Q1. Find and print the indices of pairs of elements in the following array "a" for which the value of their sum is a multiple of 7.

```
a = np.array([1, 7, 3, 10, 14, 76, 4])
```

Q2. Calculate the inverse of matrix A (save it as *A_inv*) and its dot product and element-wise multiplication with B using NumPy.

```
A = np.array([[1, 2, 0],[0, 5, 6],
[7, 0, 9]])
B = np.array([[5, 6, 7],[7, 8, 9],
  [1, 2, 3]])
```

Q3. A NumPy array "data" is given as follows

```
data = np.array([[1, 2, 3, 4, 5], [1, 8, 2, 10, 11], [4, 5, 6, 7, 8],
[7, 8, 9, 10, 11], [7, 18, 19, 10, 11]])
```

Do the following

a) Create a dataframe as df for the NumPy array "data" with column name {A,B,C,D,E}.

b) Sort the dataframe based on column C and save it as df2. Prints the first two and last two rows of the dataframe df2 using df2.head and df2.tail.

c) Print the df2 values only as NumPy array.

Q4. Compute the eigen values the matrix A using np.linalg.eig . Find the spectral radius of the matrix A.

```
A = np.array([[1, 2, 0],[0, 5, 6],
    [7, 0, 9]])
```

Q 5. Consider the matrix

```
B = np.array([[5, 6, 7],
              [7, 8, 9],
              [1, 2, 3]])
```

Using NumPy, answer the following:

(a) Compute the SVD. Use np.linalg.svd(B, full_matrices=False) to obtain the matrices U, S, and Vt. Convert the one-dimensional array S into a diagonal matrix Sigma = np.diag(S).

(b) Reconstruct the original matrix as B_recon = U @ Sigma @ Vt. Test the accuracy of the reconstruction with np.allclose(B, B_recon, atol=1e-10) and report the Boolean result.

(c) Using the singular values in S, compute the spectral (2-norm) condition number

$$\kappa_2(B) = \frac{\sigma_{\{max\}}}{\sigma_{\{min\}}}$$

Print the value of $\kappa_2(B)$