भारतीय प्रौद्योगिकी संस्थान तिरुपति
TIRUPATI

DIGITAL SIGNAL PROCESSING LAB
Lab sheet. No: 02

NAME: NIKHIL KILARI **Roll.No: EE16B017**

QUESTION 1

Aim:

To find convolution of two finite sequences:

X1 = [4 2 6 3 8 1 5]

X2 = [3 8 6 9 6 7]

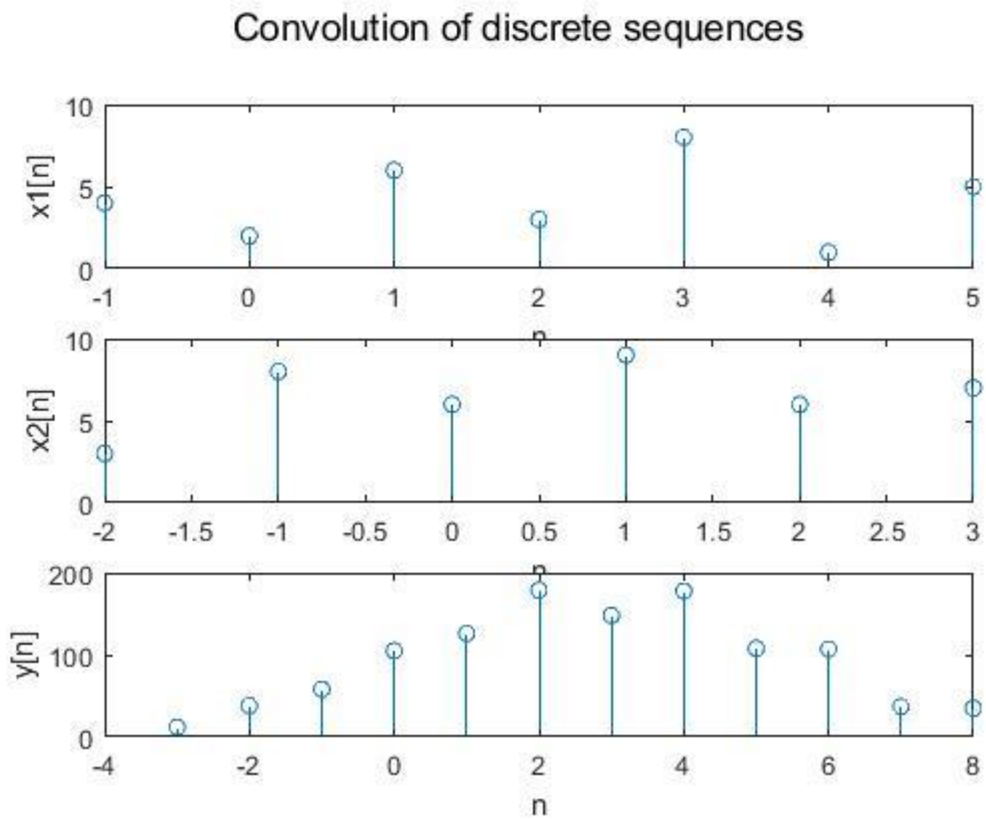
Short Theory:

Here we need to find and plot the discrete time convolution of X1 and X2 using conv() in MATLAB.

Key Commands:

- conv()
- subplot()
- stem
- xlabel()
- ylabel()
- suptitle()

Result:



Inferences/comments:

- Therefore convolution of two discrete sequences can be easily found using conv() in MATLAB.
- Even though conv gives the desired output the range of time for convoluted signal must be provided by the user.

QUESTION 2

Aim:

To find auto correlations and cross correlation of the sequences

X1 = [4 2 6 3 8 1 5]

X2 = [3 8 6 9 6 7]

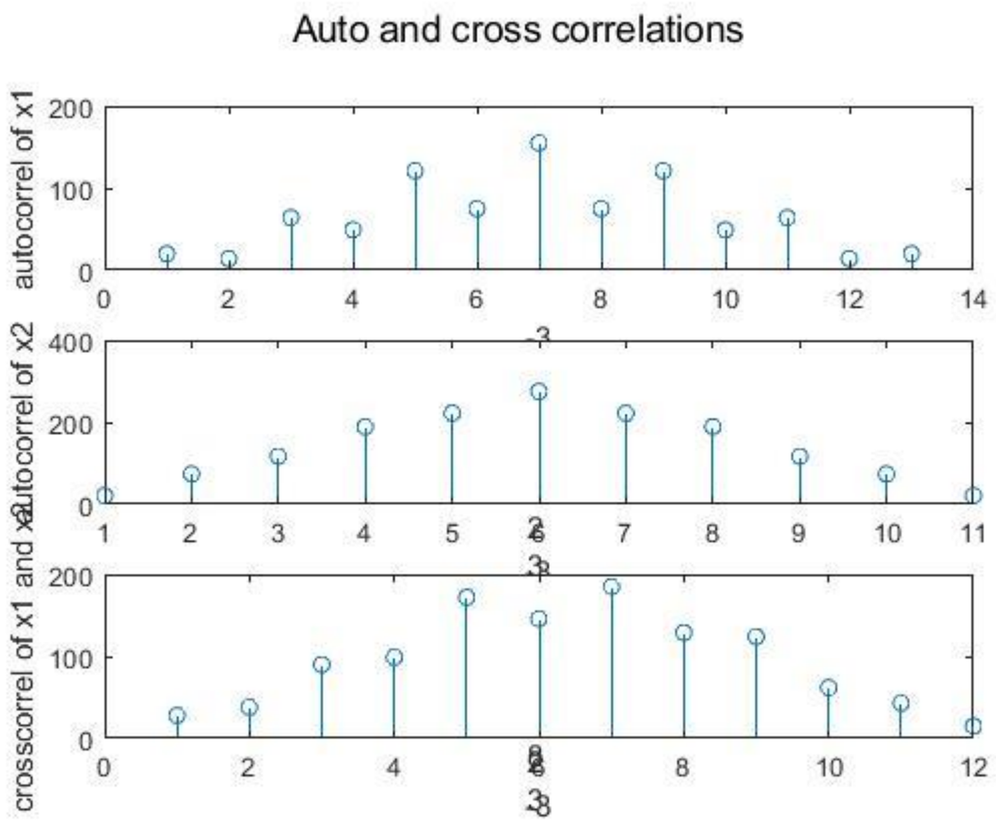
Short Theory:

Here we need to find the auto correlations and cross correlation of the signals X1 and X2 as mentioned in the question.

Key Commands:

- flip()
- conv()
- stem()
- title()
- xlabel()
- ylabel()
- suptitle()

Result:



Inferences/comments:

QUESTION 3

Aim:

To generate exponentially growing and decaying complex signal.

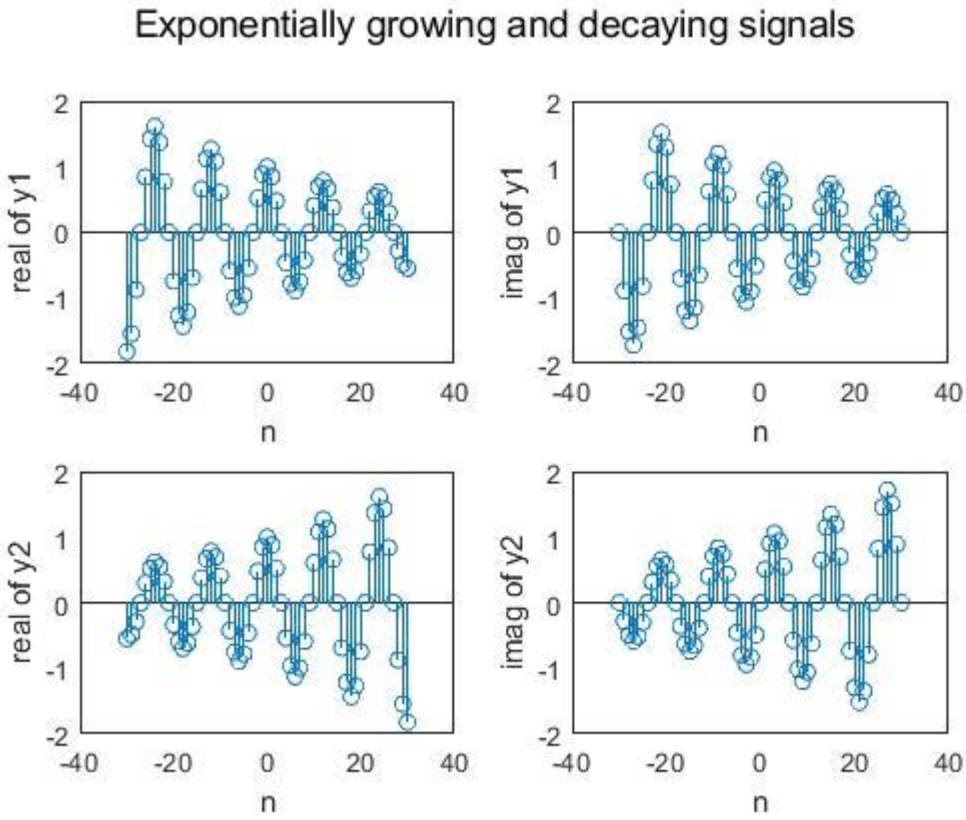
Short Theory:

a) To generate exponentially decaying signal we define real of z as a positive number
b) To generate exponentially decaying signal we define real of z as a negative number

Key Commands:

- exp()
- stem()
- real()
- imag()
- subplot()
- xlabel()
- ylabel()
- suptitle()

Result:



Inferences/comments:

- Real part of z as a positive number generates exponentially growing sequence
- Real part of z as a negative number generates exponentially decaying sequence

QUESTION 4

Aim:

To find the impulse response of the differential equation

y[n] = ay[n-1]+x[n]

Short Theory:

y = filter(b,a,X)

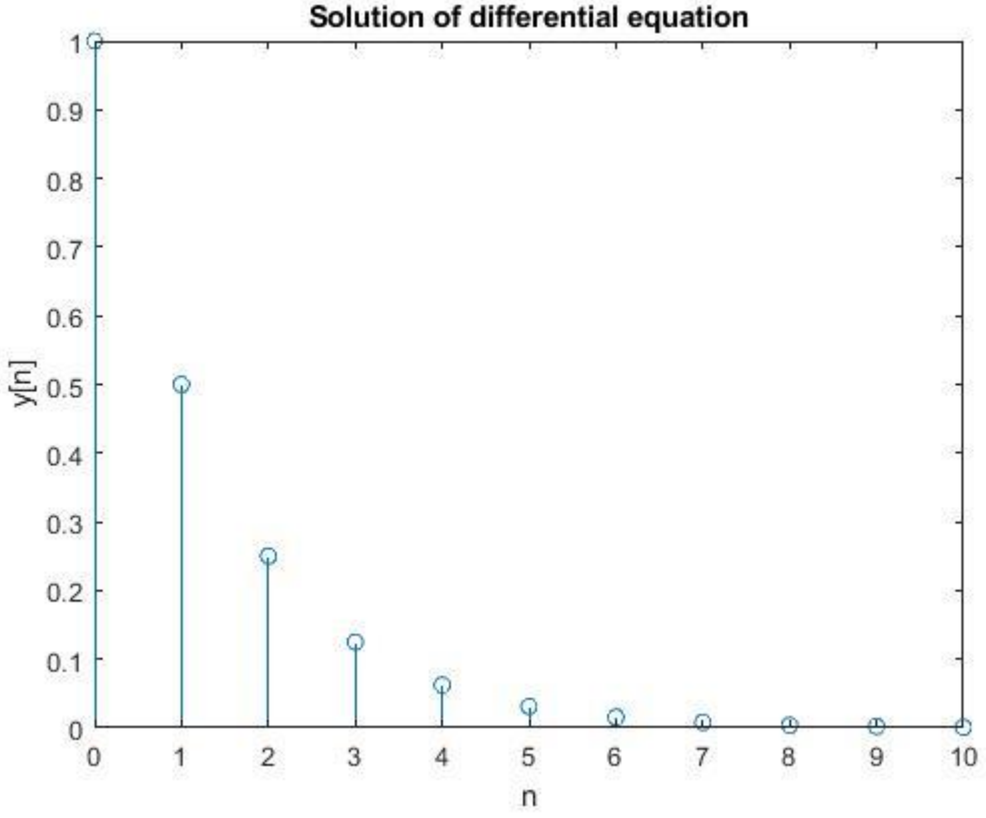
$$Y(z) = \frac{b(1) + b(2)z^{-1} + \ldots + b(nb+1)z^{-nb}}{1 + a(2)z^{-1} + \ldots + a(na+1)z^{-na}} X(z)$$

Here b is the row vector of the numerator coefficients while a is that of denominator.

Key Commands:

- filter()
- stem()
- title()
- xlabel()
- ylabel()

Result:



Inferences/comments:

- We need to first find the impulse response in frequency domain to know the numerator and denominator coefficients
- We can directly apply the filter to the data through x vector.

QUESTION 5

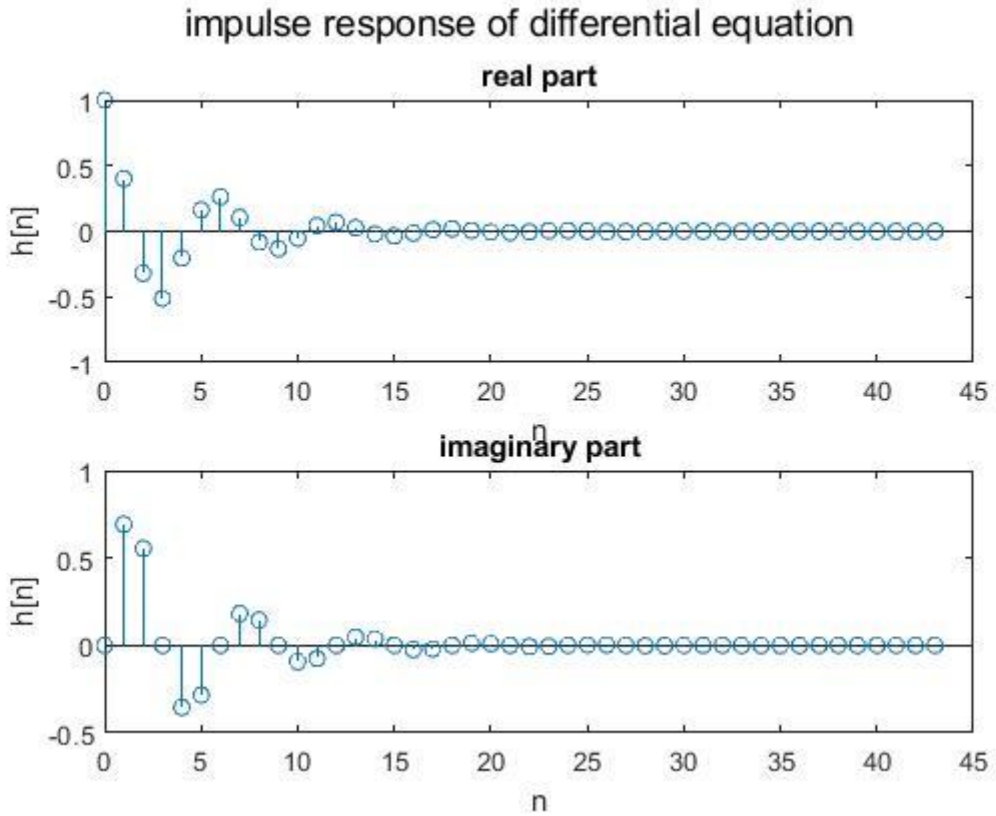
Aim:

Short Theory:

Key Commands:

- exp()
- impz()
- stem()
- imag()
- real()
- subplot()
- title()
- xlabel()
- ylabel()
- suptitle()

Result:



Inferences/comments:

QUESTION 6

Aim:

To generate the impulse response of the difference equation

y[n] = 1.8 cos(π/16) y[n-1] + 0.81 y[n-2] = x[n] + 0.5 x[n-1]

Short Theory:

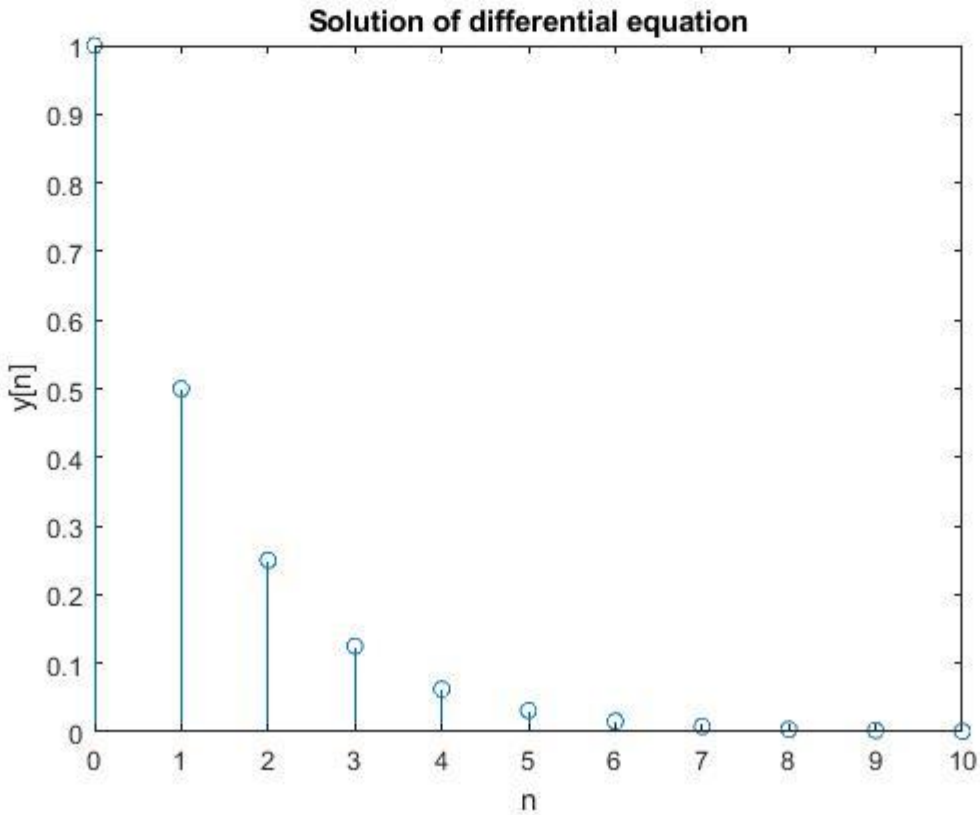
We need to use filter command to find the impulse response of the difference equation. But before doing that we need to find H(z) as we did in the above question.

Key Commands:

- cos()

- filter()
- stem()
- xlabel()
- ylabel()
- title()

Result:



Inferences/comments:

- The impulse response of the difference equation is a decaying signal, it is also causal and stable.