

1. PROGRAM TO GENERATE RANDOM SEQUENCES AND PERFORM CORRELATION OF 2 SEQUENCES

AIM:

To generate a random sequence and perform cross correlation between two sequences.

APPARATUS:

PC with MATLAB

THEORY:

(a) Generation of Random Sequences

Matlab has two functions for generating random numbers, which can be added to signals to model noise.

- $A = \text{rand}(m,n)$ -generates an $m \times n$ array of random numbers from the uniform distribution on the interval $[0,1]$.
- $r = \text{randi}(\text{imax},n)$ returns an n -by- n matrix containing pseudorandom integers drawn from the discrete uniform distribution on the interval $[1,\text{imax}]$.
- $R = \text{randn}(\text{sz,arraytype})$ creates a matrix with underlying class of double, with random values in all elements both positive and negative.
- $p = \text{randperm}(n,k)$ returns a row vector containing k unique integers selected randomly from 1 to n numbers.

(b) Correlation of 2 sequences

Correlation:

It is a mathematical tool used to compare 2 signals. It has a significant role in signal processing. We have 2 types of correlations.

Auto Correlation:

Autocorrelation, also known as serial correlation, is the correlation of a signal with itself at different points in time. Informally, it is the similarity between observations as a function of the time lag between them. It is a mathematical tool for finding repeating patterns, such as the presence of a periodic signal obscured by noise, or identifying the missing fundamental frequency in a signal implied by its harmonic frequencies.

It is given by
$$R_{xx}(l) = \sum x(n) * x(n-l)$$

Cross Correlation:

In signal processing, cross-correlation is a measure of similarity of two series as a function of the displacement of one relative to the other. Cross correlation between a pair of signals $x(n)$ and $y(n)$ is given by,

- $R_{xy}(l) = \sum x(n) * y(n-l)$

The index l is called lag parameter and the subscript xy indicates that $x(n)$ is reference sequence that remains unshifted in time and $y(n)$ is shifted l units in time with respect to $x(n)$.

PROCEDURE:-

- Open MATLAB
- Open new M-file
- Type the program
- Save in current directory

- Compile and Run the program
- For the output see command window\ Figure window

PROGRAM:**(b) Generation of Random Sequences**

```
% Generate the random sequences and determine the correlation.
```

```
clc;
close all;
clear all;
% two input sequences
l=input('enter input sequence length')
x = randi(10,1,1);
y = randi(10,1,1);
subplot(2,2,1);
stem(x);
xlabel('n');
ylabel('x(n)');
title('input sequence');

subplot(2,2,2);
stem(y);
xlabel('n');
ylabel('y(n)');
title('input sequence');
% cross correlation of input sequence
z=xcorr(x,y);
disp('The values of z are = '); disp(z);
subplot(2,1,2);
stem(z);
xlabel('n');
ylabel('z(n)');
title('Cross correlation of input sequence');

z1=xcorr(x,x);
disp('The values of z are = '); disp(z1);
figure(2)
subplot(2,2,1);
stem(x);
xlabel('n');
ylabel('x(n)');
title('input sequence');

subplot(2,2,2);
stem(y);
xlabel('n');
ylabel('y(n)');
```

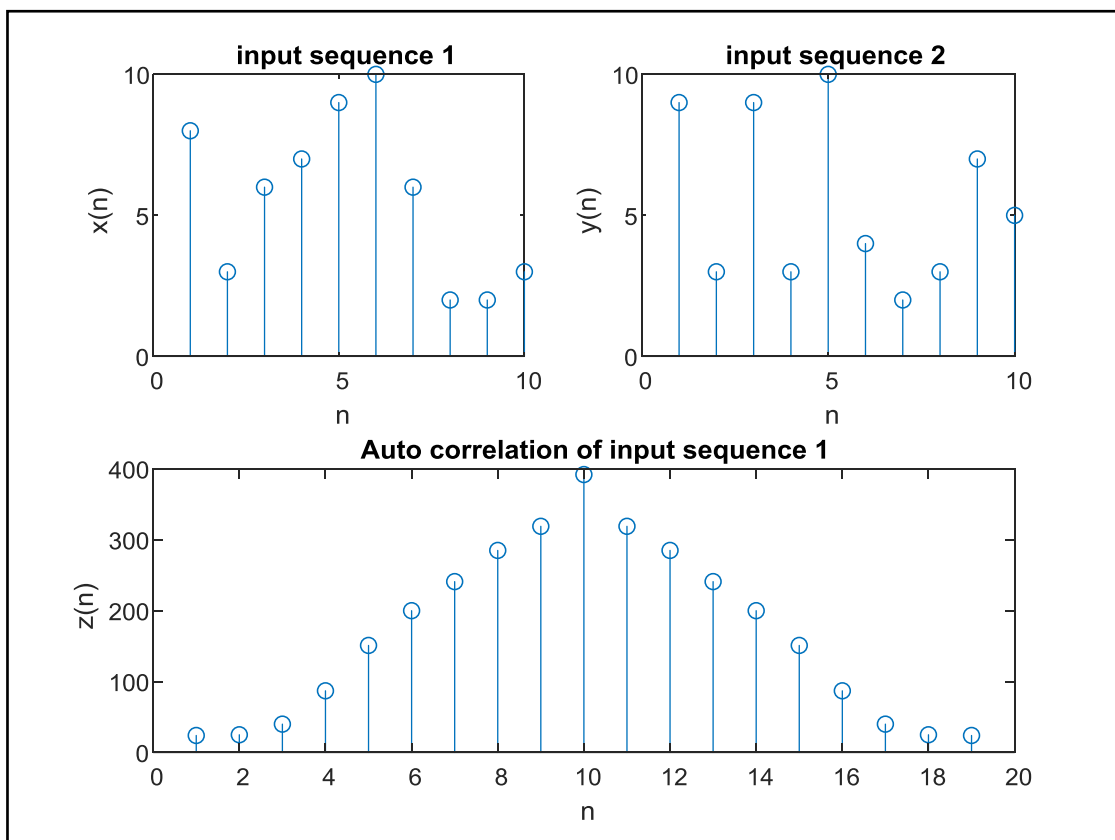
DIGITAL SIGNAL PROCESSING LAB

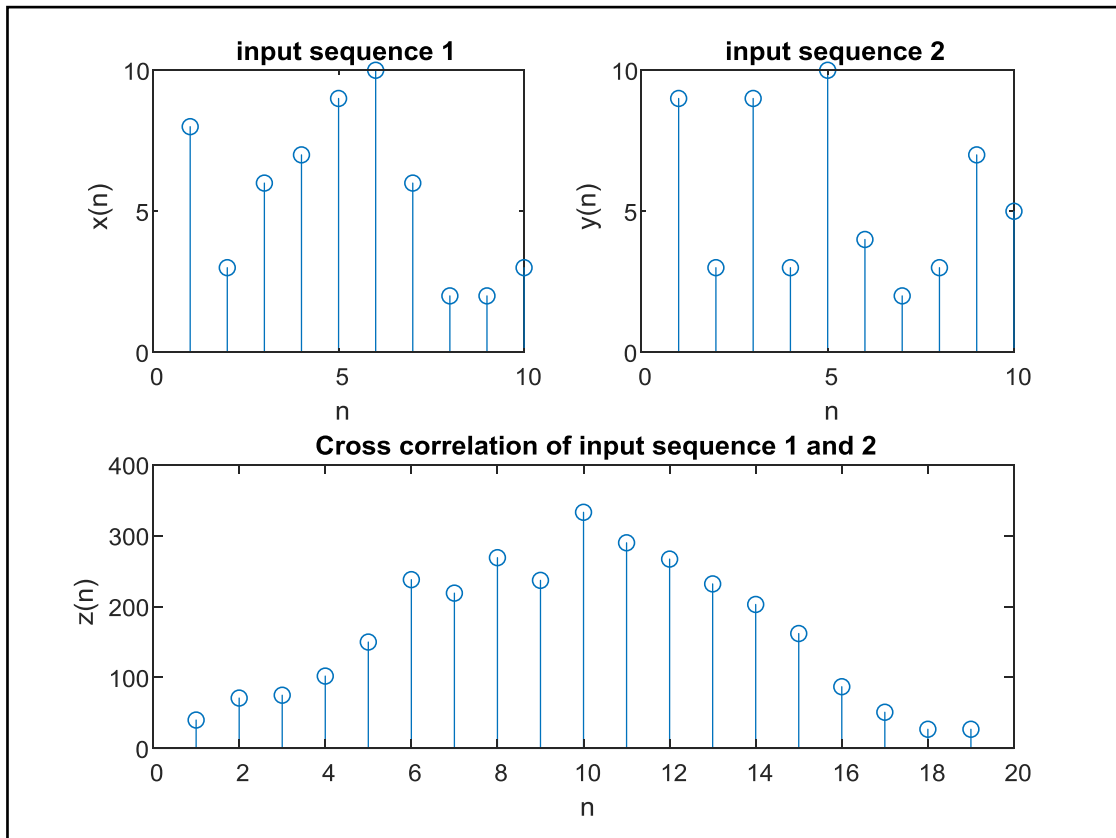
```
title('input sequence');  
  
subplot(2,1,2);  
stem(z1);  
xlabel('n');  
ylabel('z(n)');  
title('Auto correlation of input sequence');
```

INPUT:

Enter the sequence length: 10.

OUTPUT:





RESULT:

Two Random sequence, and its auto correlation, cross correlation is generated in MATLAB and figures are plotted showing all the specifications.