



# Rajshahi University of Engineering and Technology

Department of Electrical and Computer Engineering(ECE)

Course Title: Digital Signal Processing Sessional

Course No: ECE 4124

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**Experiment Date:** 30 April, 2023

**Experiment No:** 02

**Name of the Experiment:** Write a code for linear convolution and plot the signal using MATLAB.

**Theory:** A mathematical technique for mixing two signals to create a third signal is called convolution. The most crucial method in digital signal processing is this one. Systems are described by a signal known as the impulse response, which employs the impulse decomposition technique.

In linear systems, convolution is used to describe the relationship between three signals of interest: the input signal, the impulse response, and the output signal. If,  $x(n)$  is a  $M$ - point sequence  $h(n)$  is a  $N$  – point sequence then,  $y(n)$  is a  $(M+N-1)$  – point sequence.

If the input and impulse response of a system are  $x[n]$  and  $h[n]$  respectively, the convolution is given by the expression,

$$x[n] * h[n] = \sum_k x[k] h[n-k]$$

Where  $k$  ranges between  $-\infty$  and  $\infty$

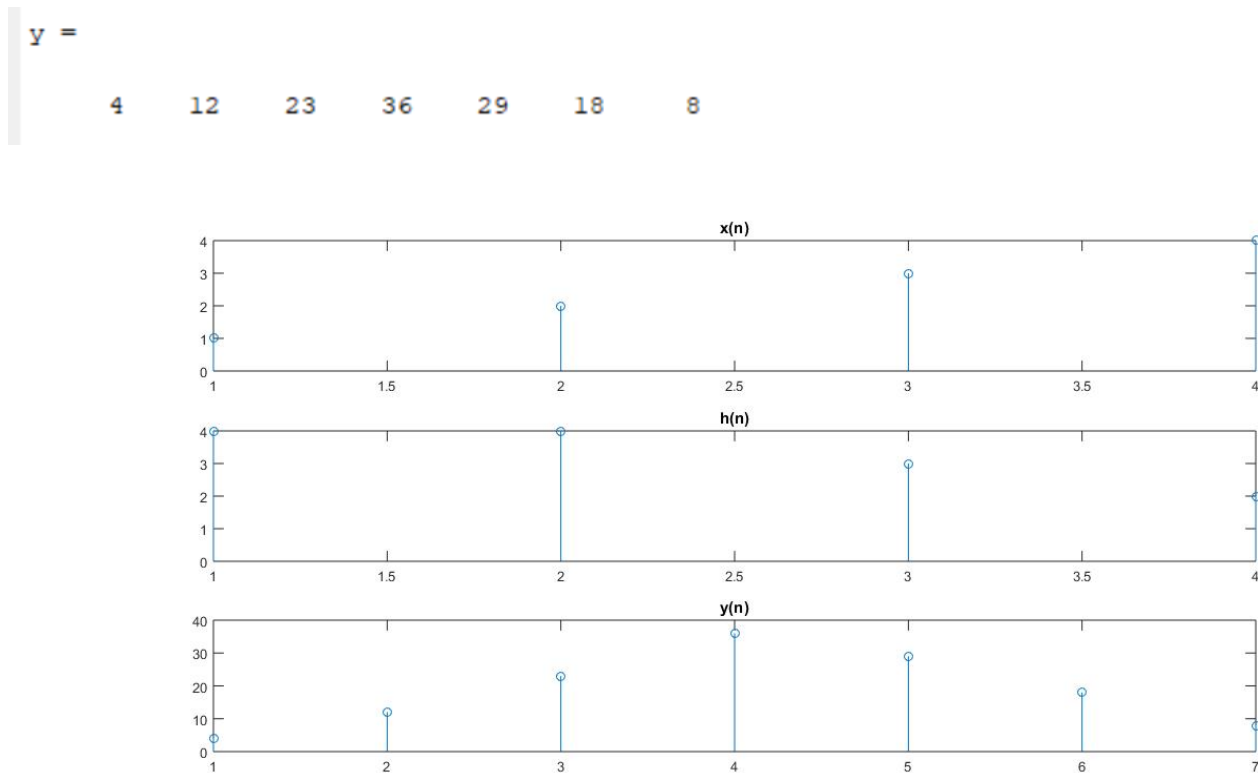
**Code:**

**Code for linear convolution:**

```
1. clc
2. clear all
3. close all
4. xn = [1 2 3 4];
5. hn = [4 4 3 2];
6. L = length(xn);
7. M = length(hn);
8. X = [xn, zeros(1,L)];
9. H = [hn, zeros(1,M)];
10.     for n = 1 : L+M-1
11.         y(n)=0;
12.         for i = 1 : L
13.             if(n-i+1>0)
14.                 y(n) = y(n)+X(i)*H(n-i+1)
15.                 %s (n) = H(n-i+1);
16.             end
17.         end
18.     end
19.     subplot(3,1,1)
20.     stem (xn)
21.     title('x(n)')
22.     subplot(3,1,2)
23.     stem (hn)
24.     title('h(n)')
25.     subplot(3,1,3)
26.     stem (y)
27.     title('y(n)')
```

## Output:

### Output for linear convolution:



**Discussion:** Utilizing MATLAB, linear convolution code was constructed. Two 14 matrix were defined to carry out the code. The length of the matrix was then calculated using the length function. A nested for loop was then applied. The first for loop in this example was executed from 1 to  $L+M-1$ . A condition was applied using an if condition in the second for loop. A formula for the output was created using the if condition. I created a code to plot these signals following the for loop. Subplot was employed here. Since the signal was discrete, I plotted it using the stem function.

**Conclusion:** The code was successfully run, and no mistakes were discovered. We gained knowledge of linear convolution and MATALB signal plotting through this project.

## References:

- [1]"Convolution – Wikipedia", Wikipedia, 2023. [Online].  
Available: <https://en.wikipedia.org/wiki/Convolution>  
[Accessed: 06 - May - 2023]
- [2]"Linear Convolution – PantechSolutions", PantechSolutions, 2023. [Online].  
Available: <https://www.pantechsolutions.net/linear-convolution-using-tms320c6745>