RAJSHAHI UNIVERSITY OF ENGINEERING AND TECHNOLOGY

LAB REPORT

Dept: Electrical and Computer Engineering

SUBMITTED BY:

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Course name : Digital Signal Processing
Course no : ECE 4124

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Experiment no: 02

Experiment Name : Write a code for linear convolution and plot the signal using MATLAB
Objective : To learn a code for linear convolution and plot the signal using MATLAB

Theory : A convolution is an integral that expresses the amount of overlap of one function as it is shifted over another function . It therefore "blends" one function with another.Code :
Convolution is a mathematical way of combining two signals to form a third signal. It is the single most important technique in Digital Signal Processing. Using the strategy of impulse decomposition, systems are described by a signal called the impulse response.

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,

$x[n] * h[n] = \varepsilon\, x[k]\, h[n-k]$
Where k ranges between $-\infty$ and ∞

Code :

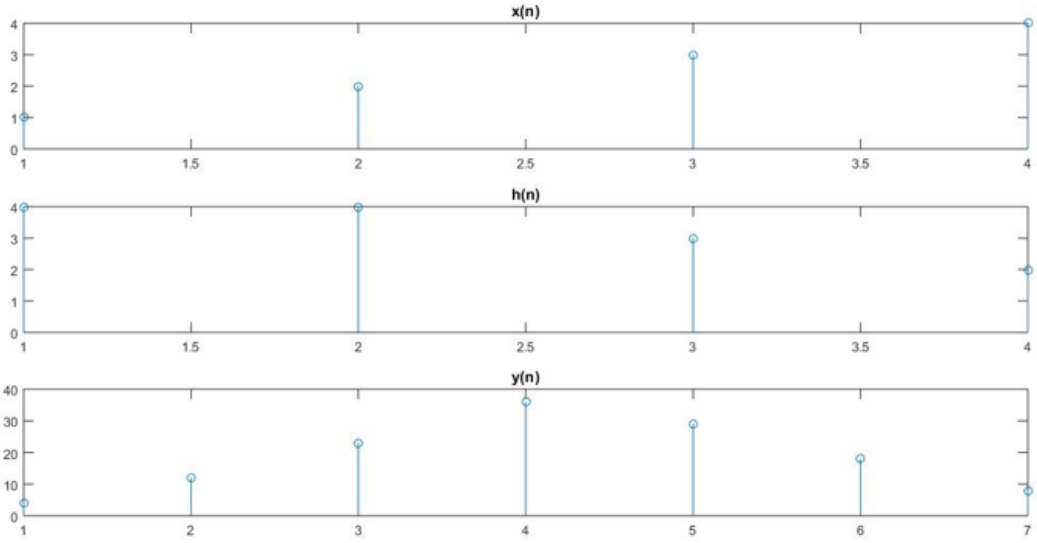
```
clc
clear all
close all
xn = [1 2 3 4];
hn = [4 4 3 2];
L = length(xn);
M = length(hn);
X = [xn, zeros(1,L)];
H = [hn, zeros(1,M)];
    for n = 1 : L+M-1
        y(n)=0;
        for i = 1 : L
            if(n-i+1>0)
            y(n) = y(n)+X(i)*H(n-i+1)
            %s (n) = H(n-i+1);
            end
        end
    end
    subplot(3,1,1)
    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 :

```
y =

     4    12    23    36    29    18     8
```



Discussion :

In the experiment utilizing MATLAB, linear convolution code was created. Two 1X4 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.