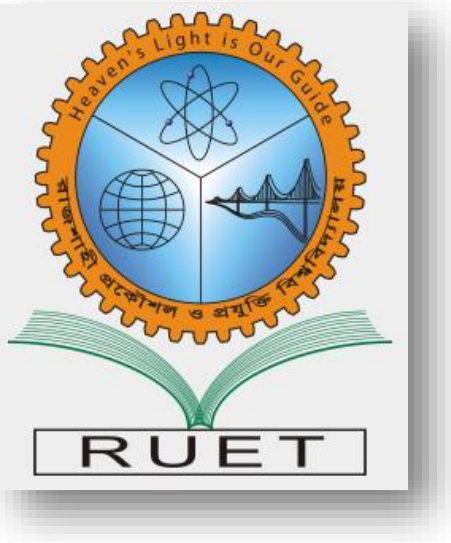

Department of Electrical & Computer Engineering

Course No: ECE 4124

Course Title: Digital Signal Processing Sessional

Experiment No. 02

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

Submitted by :

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Experiment No. 02

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

Theory: Linear convolution is a fundamental operation in signal processing and mathematics that is widely utilized in image processing, audio analysis, and other domains. It is a method of combining two functions or sequences to get a third function that depicts the overlap of the two original functions as they are shifted relative to each other.

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

$$x[n] * h[n] = \boldsymbol{\varepsilon}\, x[k]\, h[n-k]$$

In this equation, x(k), h(n-k), and y(n) represent the system's input and output at time n. We can observe that when one of the input signals is multiplied by the other, it shifts in time by a value. Linear Convolution is a popular method for building various types of filters.

Filtering, blurring, edge detection, and more applications use linear convolution. In practice, for discrete signals, the convolution process can be computed using a sliding window technique, in which the impulse response is shifted across the input signal and multiplication and summation are performed at each place to produce the output signal.

Linear convolution assumes a linear and time-invariant system. When working with real-world data, factors such as boundary effects may need to be addressed in order to produce correct results.

Required Software: MATLAB

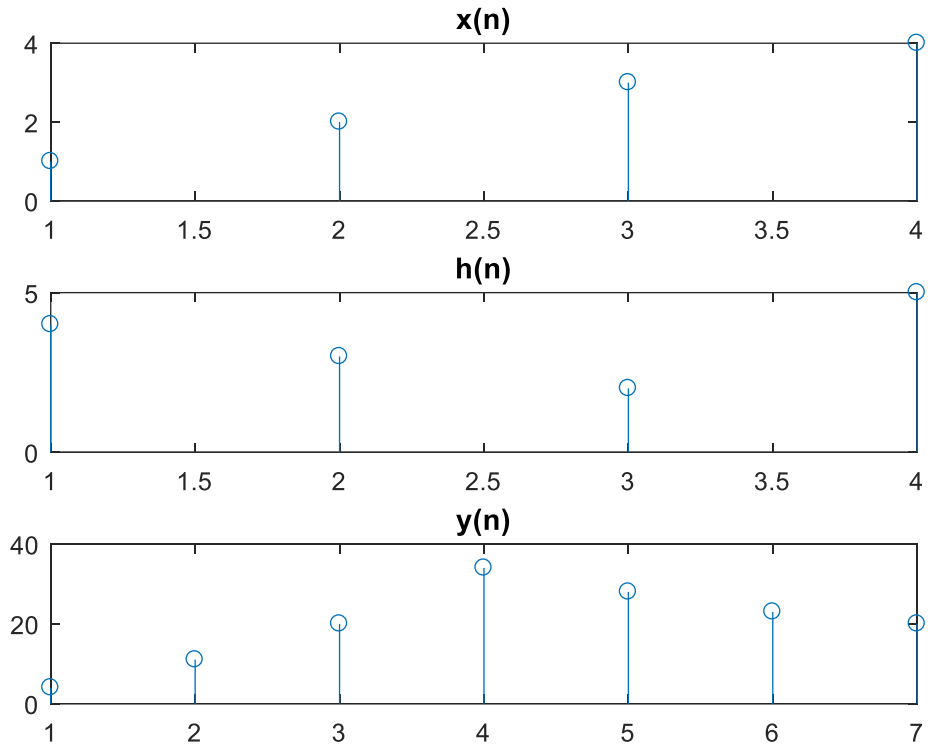
Code:

```
clc;
clear all;

xn = [1 2 3 4];
hn = [4 3 2 5];
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)
 end
 end
end

subplot(3,1,1)
stem (xn)
title('x(n)')

subplot(3,1,2)
stem (hn)
title('h(n)')

subplot(3,1,3)
stem (y)
title('y(n)')
```

Output:

y =

4 11 20 34 28 23 20



Discussion and Conclusion:

The linear convolution code was created in MATLAB. To put the code into action, two 1x4 matrices were declared. The length function was then used to calculate the matrix's length. After that, a nested for loop was used. The first for loop ran from 1 to L+M-1. An if condition was utilized to apply a condition in the second for loop. Using the if condition, a formula for the output was built. In this example, a subplot was used. I plotted the signal using the stem function because it was discrete.