

## 2. Convolution

Aim: To find the linear and circular convolution of given sequences.

1. Write a MATLAB program to perform convolution of the following two discrete time signals.

$$x_1(n) = 1; \quad 1 < n < 10 \quad \text{and} \quad x_2(n) = 1; \quad 2 < n < 10$$

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```
clc;
clear all;
n=0:15;
x1=1.*(n>=1 & n<=10); %generate signal x1(n)
x2=1.*(n>=2 & n<=10); %generate signal x2(n)
N1=length(x1);
N2=length(x2);
x3=conv(x1,x2);          %perform convolution of signals x1(n) and x2(n)
n1=0:1:N1+N2-2;
%To plot the results
subplot(3,1,1); stem(n,x1);
xlabel('n');ylabel('x1(n)');
title('signal x1(n)');
subplot(3,1,2); stem(n,x2);
xlabel('n');ylabel('x2(n)');
title('signal x2(n)');
subplot(3,1,3); stem(n1,x3);
xlabel('n');ylabel('x3(n)');
title('signal x1(n)*x2(n)');
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2. Write a MATLAB program to perform circular convolution of the following two discrete time signals.

$$x_1(n) = [1 \ 2] \quad \text{and} \quad x_2(n) = [1 \ 2 \ 3 \ 4]$$

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```
clc;
clear all;
close all;
x1=input('Enter the first sequence x1[n]= ');
x2=input('Enter the second sequence x2[n]= ');
n = max(length(x1),length(x2));
Y=cconv(x1,x2,n);          %perform circular convolution
stem(Y);
xlabel('n'),ylabel('Y');
title('Plot of circularly convoluted sequence');
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3. Write a MATLAB program to perform convolution of the following two discrete time signals.

$x_1(n) = [1 \ 2 \ -1 \ 1]$  and  $x_2(n) = [1 \ 0 \ 1 \ 1]$

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4. Write a MATLAB program to verify associative property of convolution.
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5. Write a MATLAB program to perform convolution of the following two discrete time signals.

$$x(n) = u(n) - u(n - 10) \quad \text{and} \quad h(n) = (0.9)^n u(n)$$

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```
clc;
clear all;
b = [1]; a = [1,-0.9];
n = -5:50;
x = stepseq(0,-5,50) - stepseq(10,-5,50);
y = filter(b,a,x);
subplot(2,1,2); stem(n,y); title('Output sequence');
xlabel('n'); ylabel('y(n)'); axis([-5,50,-0.5,8]);
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