Independent University Bangladesh

Department of Electrical and Electronics Engineering

Lab Report 05

Name: Injamamul Haque Sourov

Id: 1820170

Course code: EEE 321L

Couse name: Digital Signal Processing Lab

Lab no: 05

Lab title: Study on cross-correlation, auto-correlation and impulse response

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a) Cross-correlation of two signals

Code and output:

```
>> % cross correlation
x = [1 2 4 0];  % always takes 1st point as n=0
y = [1 1 1 1];
xcorr(x,y)

ans =

    1.0000    3.0000    7.0000    7.0000    6.0000    4.0000    0.0000
```

b) Auto-correlation of a signal

Code and output:

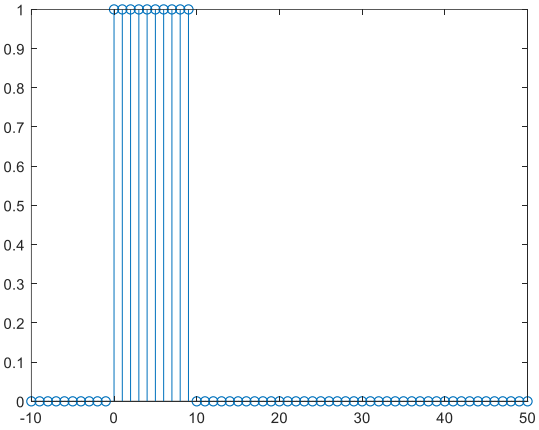
```
>> % autocorrelation
x = [1 2 1 1];
xcorr(x)

ans =

    1.0000    3.0000    5.0000    7.0000    5.0000    3.0000    1.0000
```

c) Convolution of signals

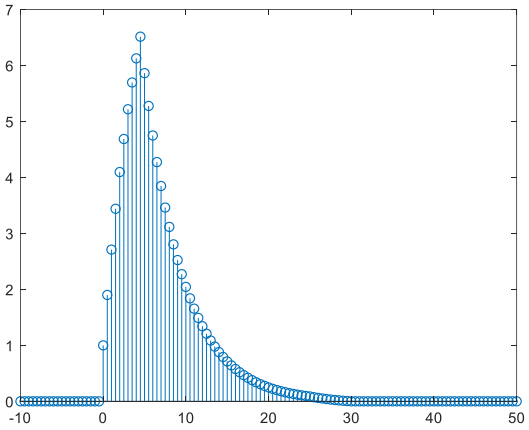
Code:

```
% convolution
n = -10:50;
x = stepseq(0,-10,50) - stepseq(10,-10,50);
stem(n,x)
h = ((0.9).^n).*(stepseq(0,-10,50));
figure(2);
stem(n,h)
m = -10:0.5:50; % convolution doubles the number of points
y = conv(x, h);
figure(3);
stem(m,y)
```

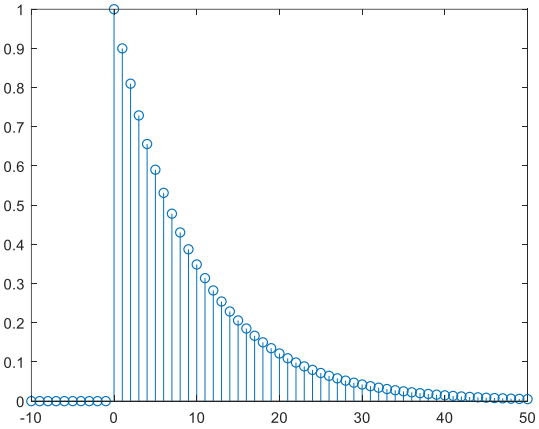
Output:



x(n)



x(n)*h(n)



h(n)

d) Assignment (median and 3-point moving average of a signal)

i. Function definition

```
% compute the median(m) and the n-point moving average(y) of a signal
function [m, y] = med_avg(x, n)
m = median(x);
y = movmean(x, n);
end
```

ii. Calls and outputs

Example 1:

```
x = [1 2 3 4 5 6 7];     % odd number of points
[median, mov_agv] = med_avg(x, 3) % 3-point moving average


median =

     4


mov_agv =

    1.5000    2.0000    3.0000    4.0000    5.0000    6.0000    6.5000
```

Example 2:

```
x = [2 4 6 8 6 4];  % even number of points
[median, mov_agv] = med_avg(x, 3) % 3-point moving average
median =

     5


mov_agv =

    3.0000    4.0000    6.0000    6.6667    6.0000    5.0000
```