Digital Signal Processing Lab Assignment 2

Name: Ahmed Wael Mohamed

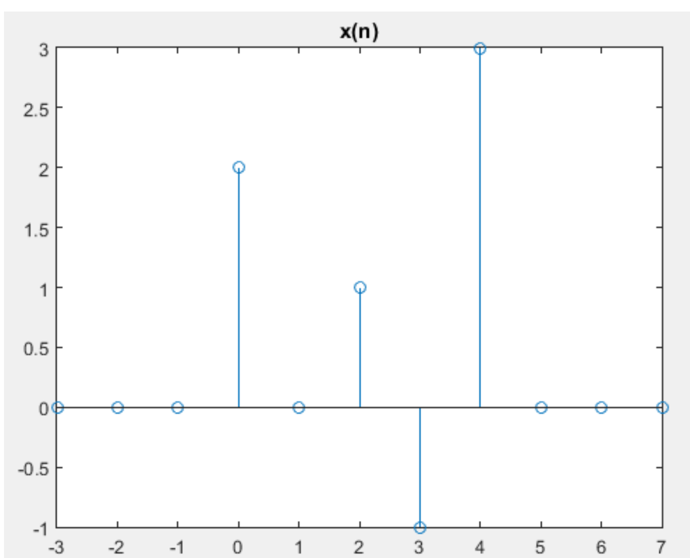
ID: 6071

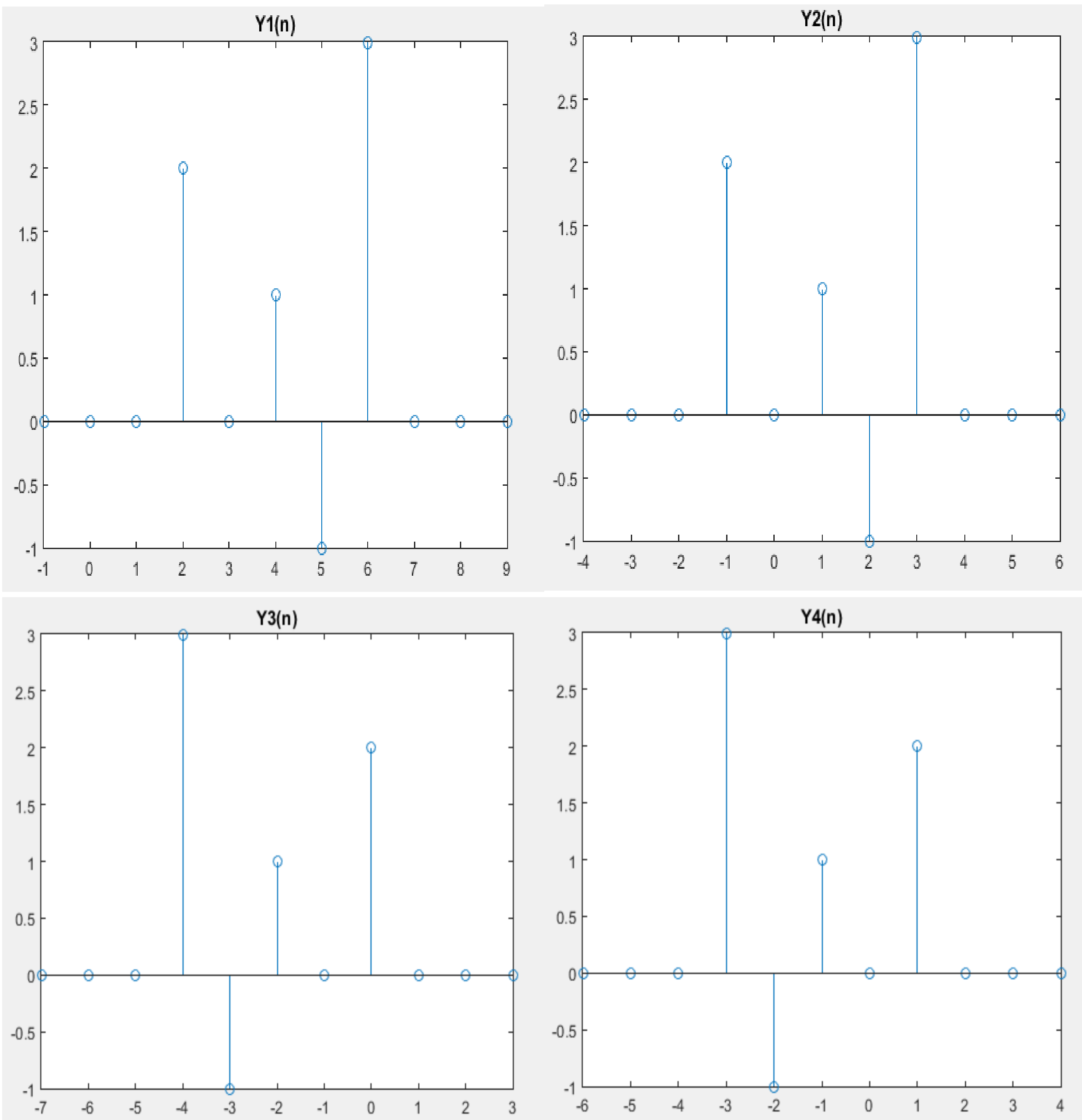
Group: 3

Question 1:

Code:

```
nx =[-3:7];
x = zeros(length(nx),1);
x(4) = 2;
x(6) = 1;
x(7) = -1;
x(8) = 3;
figure
stem(nx,x);
title('x(n)');
y1 = nx+2;
figure
stem(y1,x);
title('Y1(n)');
y2 = nx-1;
figure
stem(y2,x);
title('Y2(n)');
y3 = -nx;
figure
stem(y3,x);
title('Y3(n)');
y4 = -nx+1;
figure
stem(y4,x);
title('Y4(n)');
```

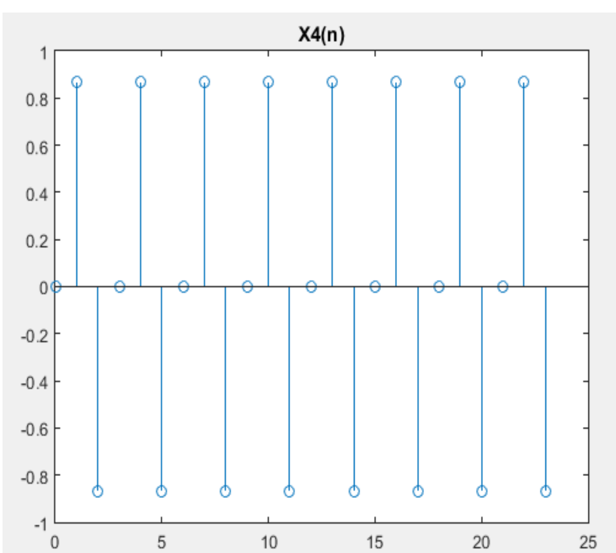


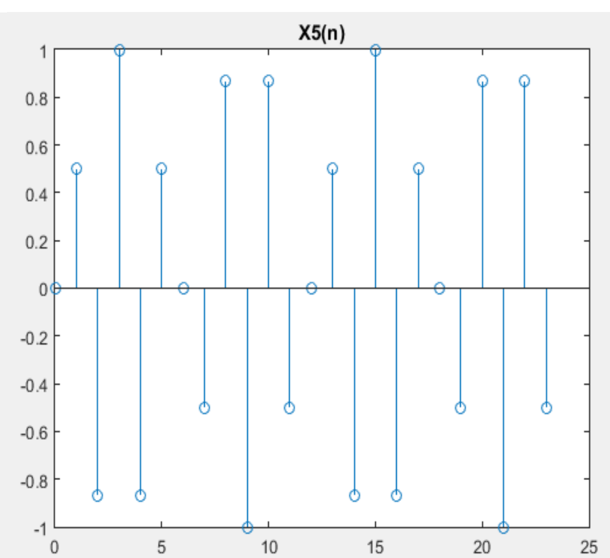

Y1(n)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1 0 1 2 3 4 5 6 7 8 9
Y2(n)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-4 -3 -2 -1 0 1 2 3 4 5 6
Y3(n)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-7 -6 -5 -4 -3 -2 -1 0 1 2 3
Y4(n)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-6 -5 -4 -3 -2 -1 0 1 2 3 4

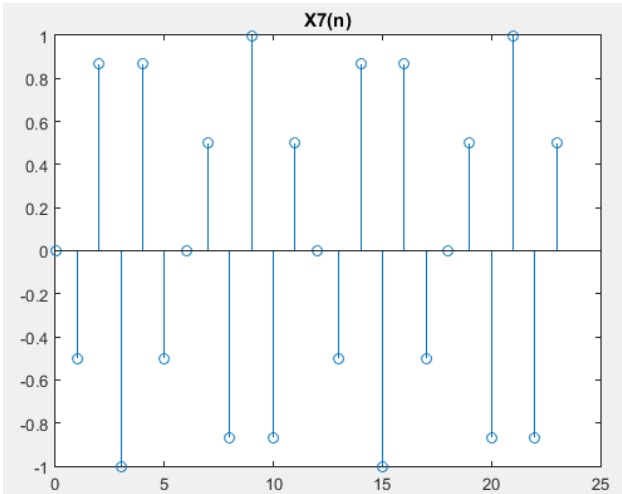
Question 2:

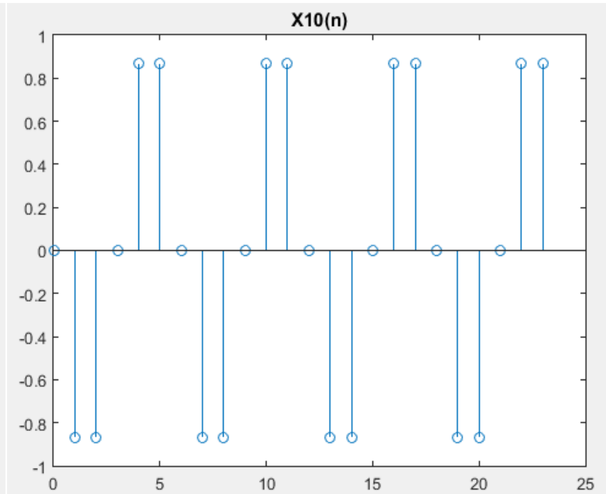
Code:

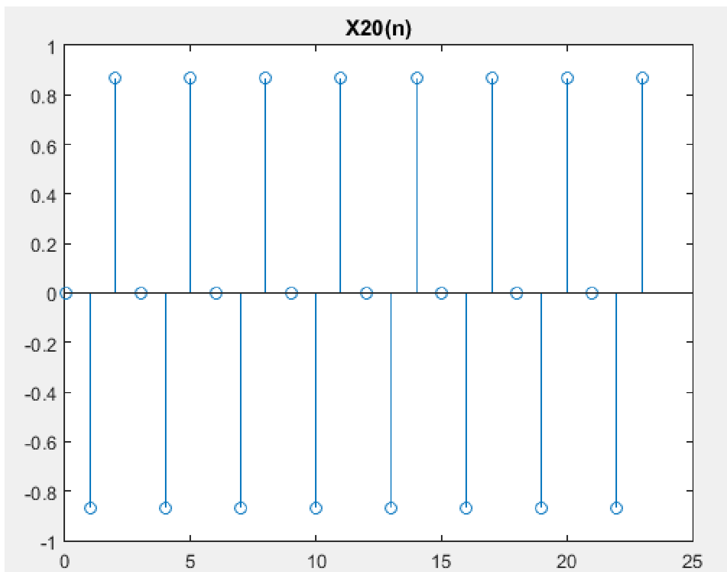
```
n = [0:23];
X4 = sin (2*pi*4*(n/12));
X5 = sin (2*pi*5*(n/12));
X7 = sin (2*pi*7*(n/12));
X10 = sin (2*pi*10*(n/12));
figure
stem(n,X4);
title('X4(n)');
figure
stem(n,X5);
title('X5(n)');
figure
stem(n,X7);
title('X7(n)');
figure
stem(n,X10);
title('X10(n)');
figure
stem(n,X20);
title('X20(n)');
```











The Fundamental Period

- Fundamental period in Discrete Signal is = M
- Fundamental period in Continuous Signal is = N/M

- At N = 4 (In Discrete = 3 ,, In Continuous = 12/4 = 3)
- At N = 5 (In Discrete = 12 ,, In Continuous = 12/5 = 2.4)
- At N = 7 (In Discrete = 12 ,, In Continuous = 12/7 = 1.714)
- At N = 10 (In Discrete = 6 ,, In Continuous = 12/10 = 1.2)
- At N = 20 (In Discrete = 3 ,, In Continuous = 12/20 = 0.6)

Question 3:

Part (a)

Code:

```
n = 1:51;
x1 = sin(2*pi*0.1*n);
j=0;
for N1=1:10:41
j=j+1;
Etot1(j)=sum(x1(N1:N1+9).^2);
Pav1(j)=sum(x1(N1:N1+9).^2)/10;
end;
```

Etot1	[5.0000,5,5,5.0000,5]
Pav1	[0.5000,0.5000,0.5000,...

Part (b)

Code:

```
n2 = 0:12;
x2 = sin(2*pi*0.1*n2);
Etot2 = sum(x2.^2);
Pav2 = sum(x2.^2)/13;
```

Etot1	[5.0000,5,5,5.0000,5]	Pav1	[0.5000,0.5000,0.5000,...
Etot2	6.2500	Pav2	0.4808

❖ As shown in the average power results the average power of the second signal is nearly equal to the average power of the first signal.

Part (c)

Code:

```
n3 = 0:1005;
x3 = sin(2*pi*0.1*n3);
Etot3 = sum(x3.^2);
Pav3 = sum(x3.^2)/1006;
```

Etot1	[5.0000,5,5,5.0000,5]	Pav1	[0.5000,0.5000,0.5000,...
Etot3	502.5000	Pav3	0.4995

- ❖ As shown in the average power of the third signal by increasing the number of the samples the average power is much more equal to the average power of the first signal.

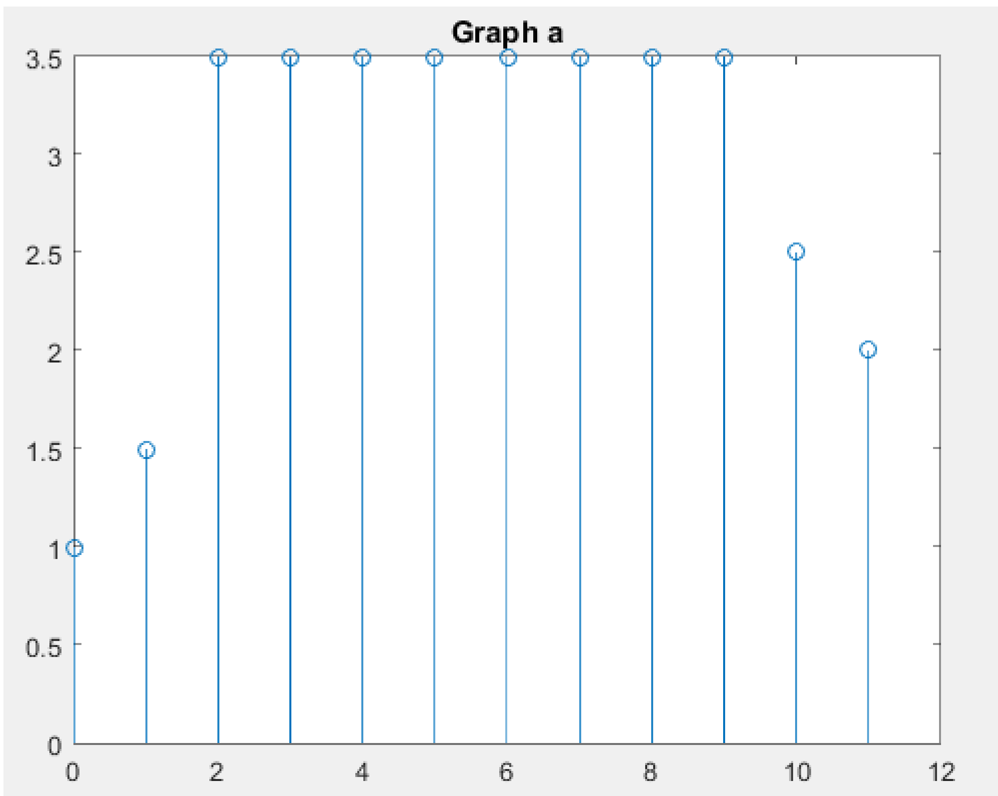
Observation

By increasing the number of Samples, the power average becomes nearly the same.

Question 4:

Code(a):

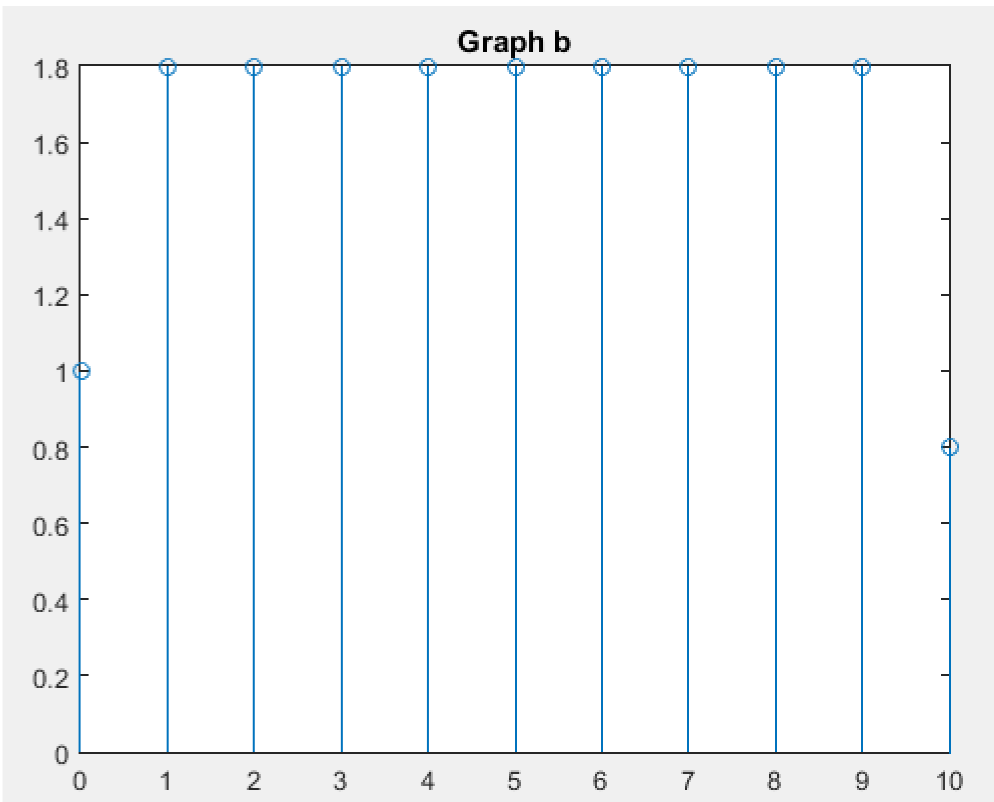
```
nx = 0:11;
x = ones(1,10);
y1 = [x 0 0];
y2 = (0.5)*[0 x 0];
y3 = 2*[0 0 x];
y = y1+y2+y3;
figure
stem(nx,y);
title('Graph a');
```



❖ The steady state output is = 3.5

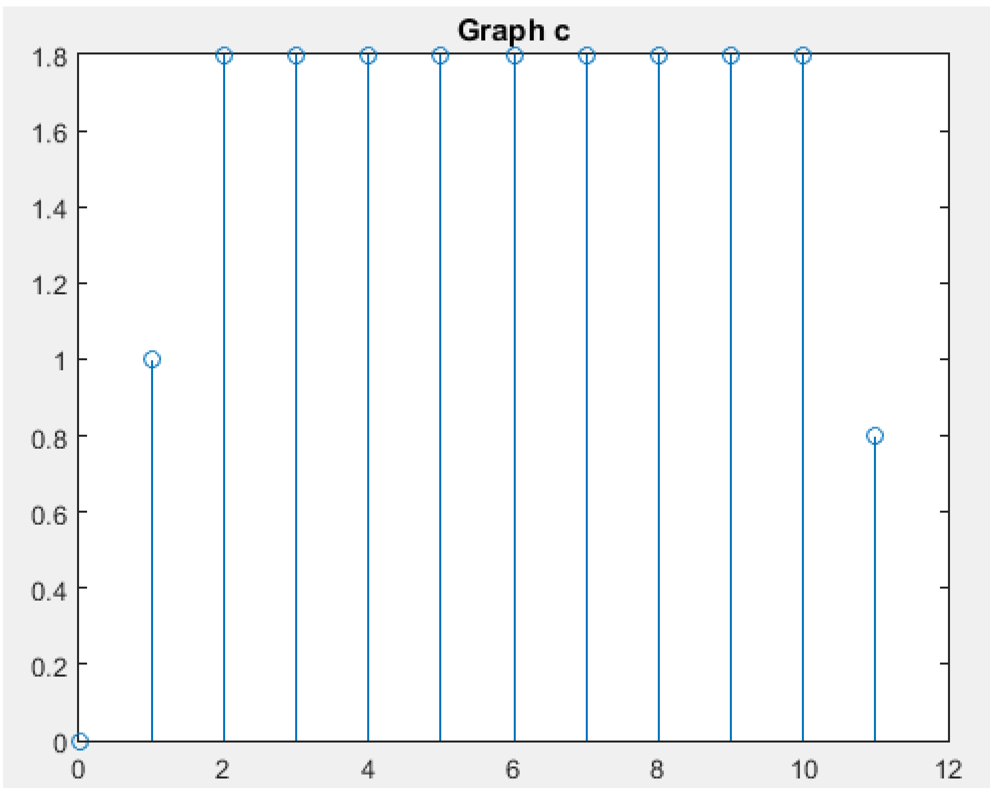
Code(b):

```
nx2 = 0:10;
x = ones(1,10);
y1b = [x 0];
y2b = (0.8)*[0 x];
yb = y1b+y2b;
figure
stem(nx2,yb);
title('Graph b');
```



Code(c):

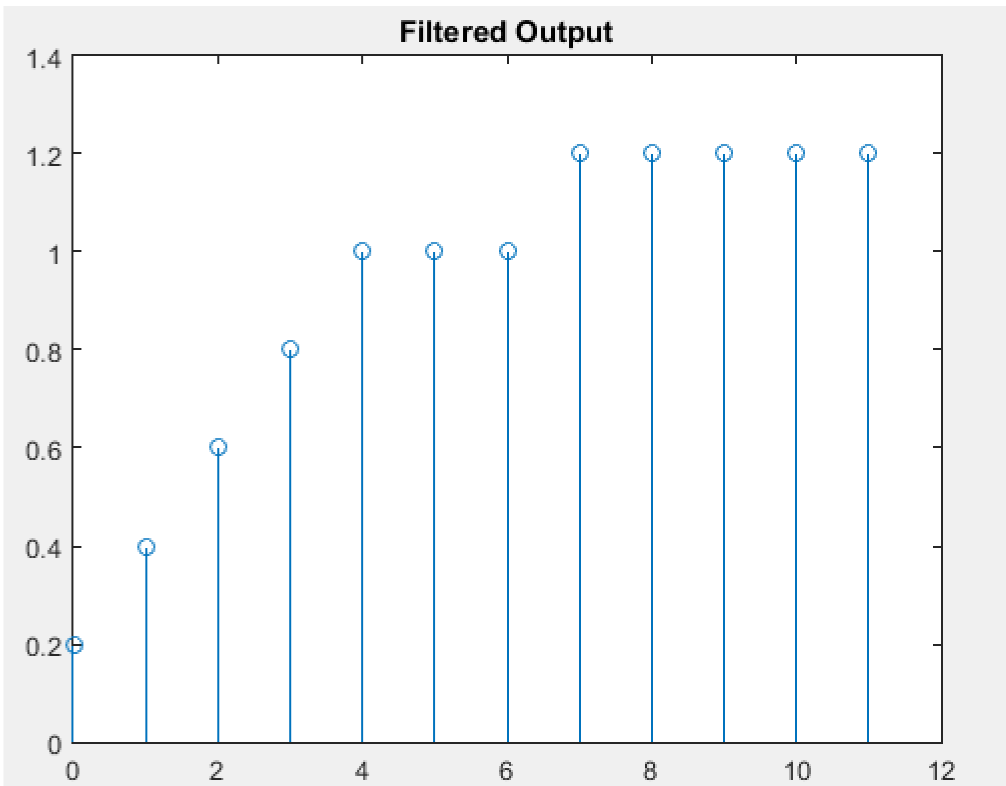
```
nx3 = 0:11;
x = ones(1,10);
y1c = [0 x 0];
y2c = (0.8)*[0 0 x];
yc = y1c+y2c;
figure
stem(nx3,yc);
title('Graph c');
```



❖ The relationship between the two graphs is that graph (c) is shifted by one to the right with respect to graph (b)

Code of filtered graph:

```
x = [1 1 1 1 1 1 1 2 1 1 1 1];
n = 0:11;
y = (1/5) * (x + [0 x(1:end-1)] + [0 0 x(1:end-2)] + [0 0 0
x(1:end-3)] + [0 0 0 0 x(1:end-4)]);
figure
stem(n,y);
title('Filtered Output');
```

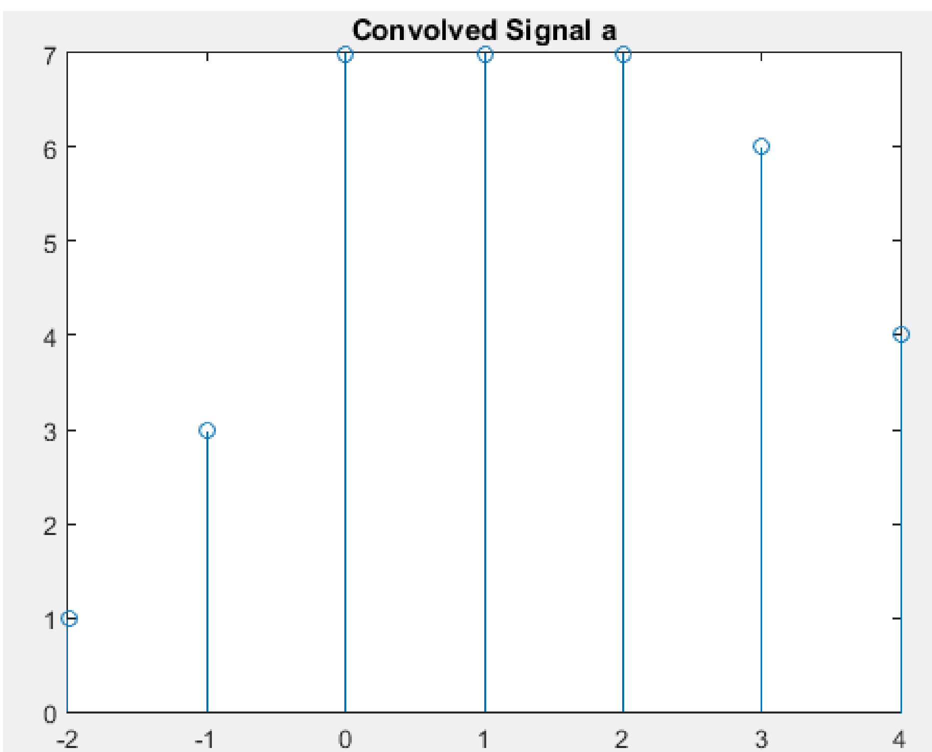


❖ The output tends to rise until it becomes steady. The output is much more stable by increasing the number of samples.

Question 5:

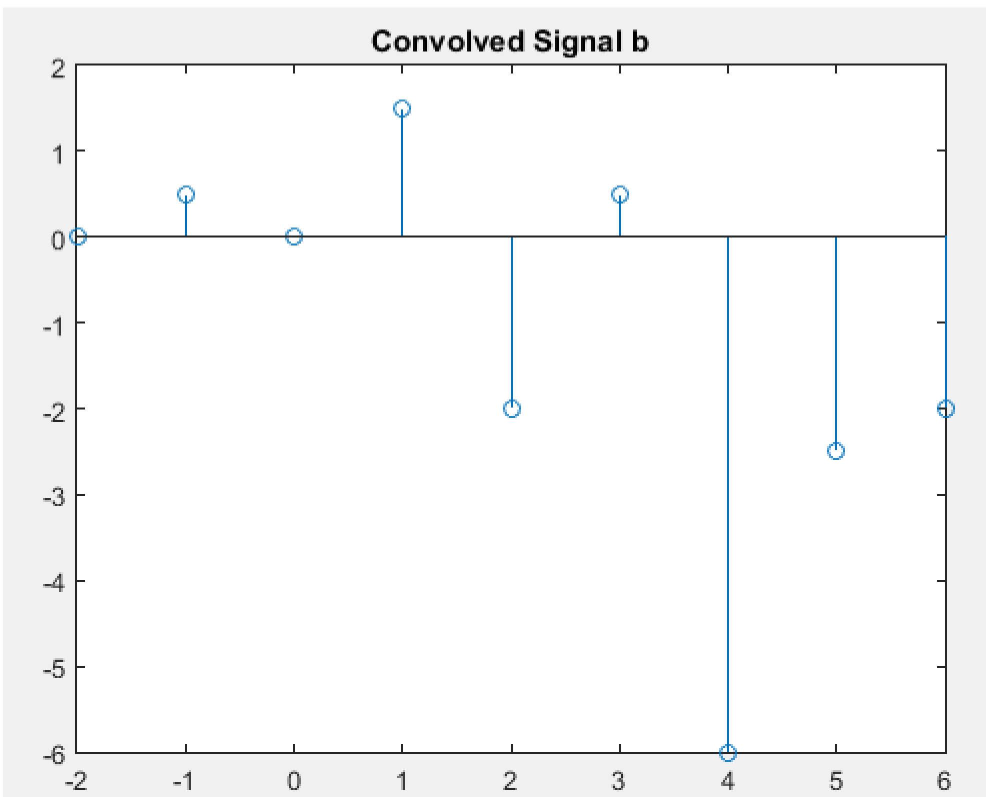
Code (a):

```
nx1=[0 1 2];
nh1=[-2 -1 0 1 2];
x=[1 2 4];
h=[1 1 1 1 1];
M=length(x);
N=length(h);
ny1= -2:4;
y=zeros(1, M+N-1);
for u=1:N
    x1 = h(u)*[zeros(1,u-1) x zeros(1,M-u+2)];
    y = y+x1;
end
figure
stem (ny1,y);
title('Convolved Signal a');
```



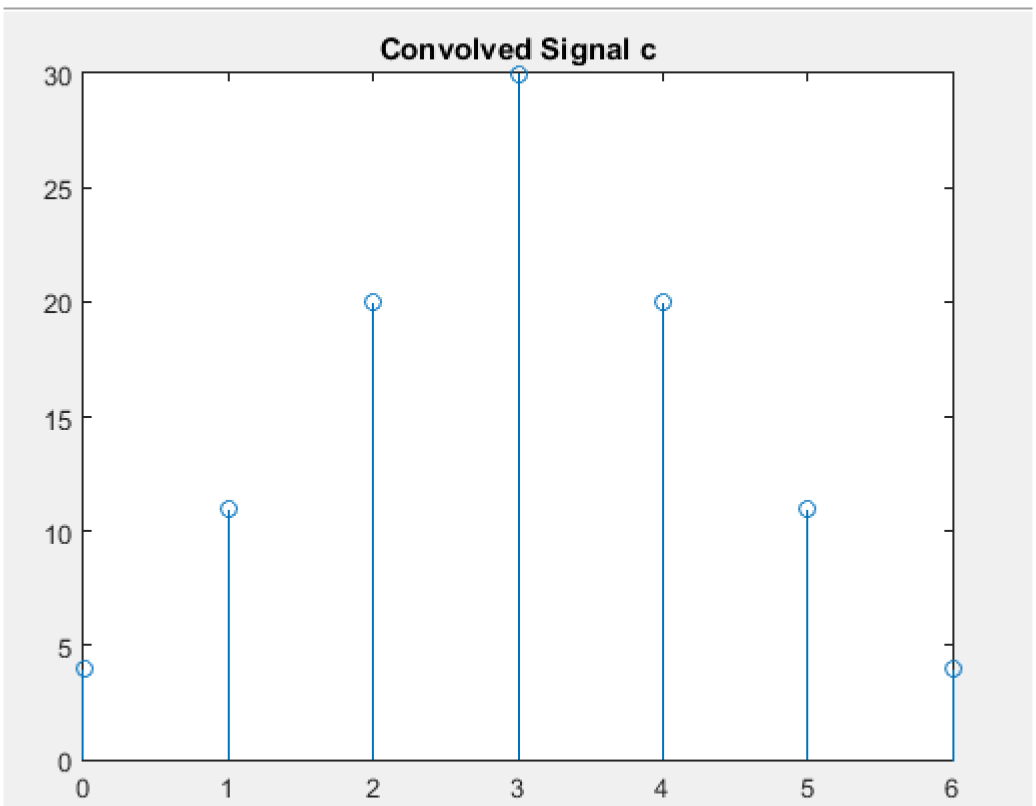
Code (b):

```
nx2=[0 1 2 3 4];
nh2=[-2 -1 0 1 2];
x=[0 1 -2 3 -4];
h=[0.5 1 2 1 0.5];
M=length(x);
N=length(h);
ny2= -2:6;
y=zeros(1, M+N-1);
for u=1:N
    x1 = h(u)*[zeros(1,u-1) x zeros(1,M-u)];
    y = y+x1;
end
figure
stem (ny2,y);
title('Convolved Signal b');
```



Code (c):

```
nx3=[0 1 2 3];
nh3=[0 1 2 3];
x=[1 2 3 4];
h=[4 3 2 1];
M=length(x);
N=length(h);
ny3= 0:6;
y=zeros(1, M+N-1);
for u=1:N
    x1 = h(u)*[zeros(1,u-1) x zeros(1,M-u)];
    y = y+x1;
end
figure
stem (ny3,y);
title('Convolved Signal c');
```



Code (d):

```
nx4=[0 1 2 3];
nh4=[0 1 2 3];
x=[1 2 3 4];
h=[1 2 3 4];
M=length(x);
N=length(h);
ny4= 0:6;
y=zeros(1, M+N-1);
for u=1:N
    x1 = h(u)*[zeros(1,u-1) x zeros(1,M-u)];
    y = y+x1;
end
figure
stem (ny4,y);
title('Convolved Signal d');
```