Lab - Assignment - 03 - Spring 2020

Signals & Systems

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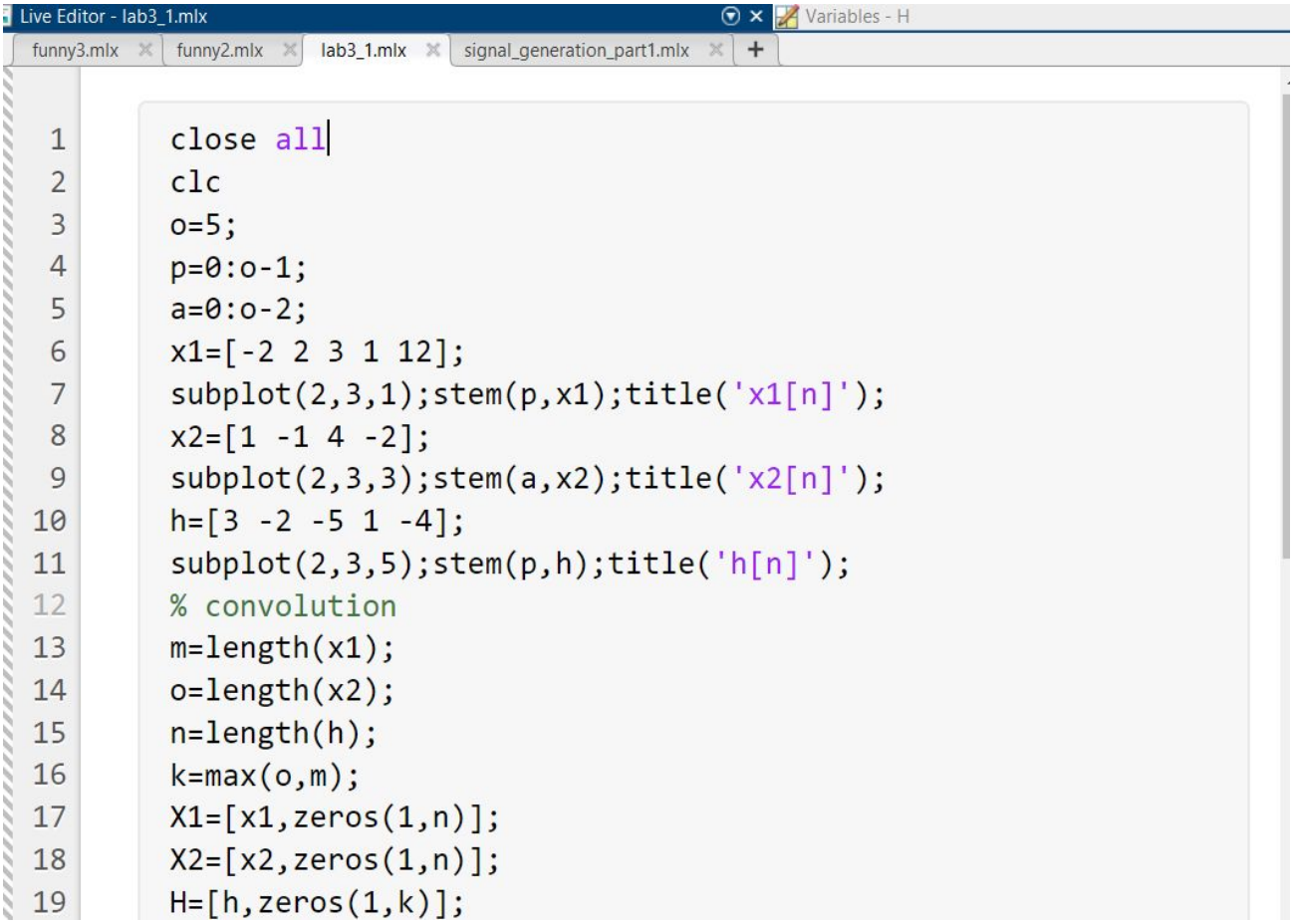
Q1) y1[n] = (x1[n]+x2[n]) * h[n]
y2[n] = x1[n]*h[n] + x2[n]*h[n]
x1, x2 and h are given.
We had to plot x1, x2 ,y1 ,y2 and h.
Here's the code for 1)
➔ First, we find y1 &y2 by using 'for loop'.
➔ Then we run the code and get its output.
Here's the code :




```
close all
clc
o=5;
p=0:o-1;
a=0:o-2;
x1=[-2 2 3 1 12];
subplot(2,3,1);stem(p,x1);title('x1[n]');
x2=[1 -1 4 -2];
subplot(2,3,3);stem(a,x2);title('x2[n]');
h=[3 -2 -5 1 -4];
subplot(2,3,5);stem(p,h);title('h[n]');
% convolution
m=length(x1);
o=length(x2);
n=length(h);
k=max(o,m);
X1=[x1,zeros(1,n)];
X2=[x2,zeros(1,n)];
H=[h,zeros(1,k)];
```

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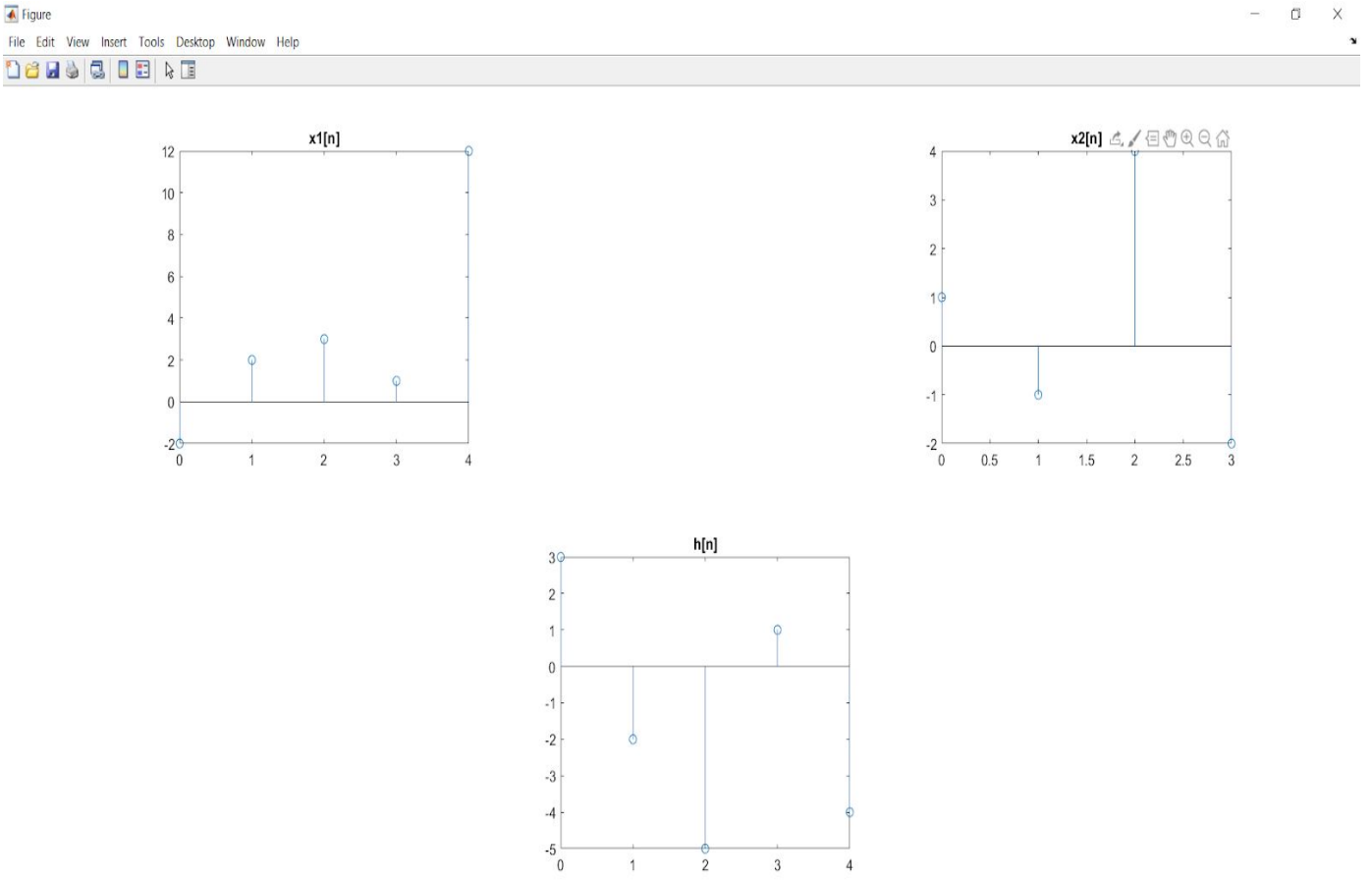
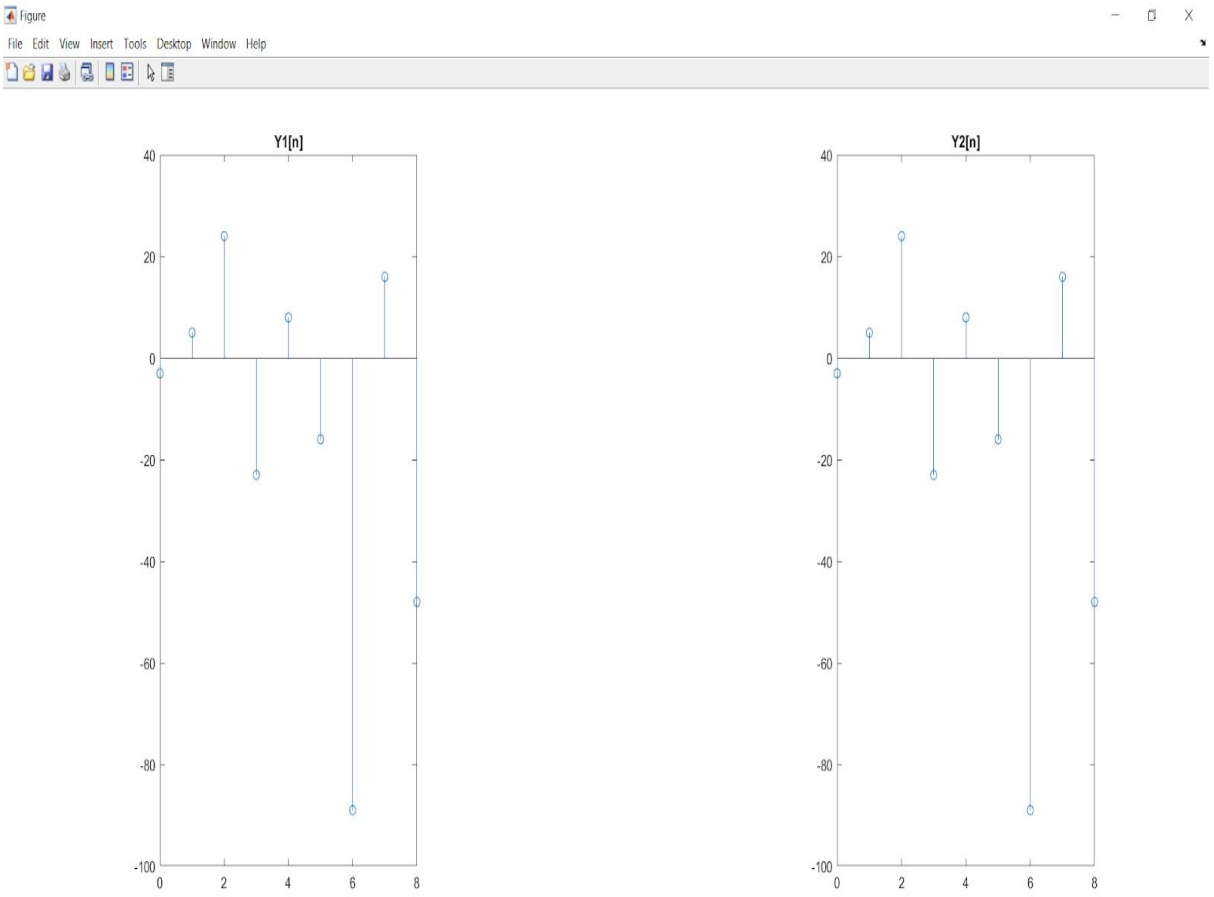
funny3.mlx | funny2.mlx | lab3_1.mlx | signal_generation_part1.mlx

```
X1=[x1,zeros(1,n)];
X2=[x2,zeros(1,n)];
H=[h,zeros(1,k)];
for i=1:n+k-1
    Y1(i)=0;
    Y2(i)=0;
    for j=1:k
        if(i-j+1>0)
            Y1(i)=Y1(i)+(X1(j)+X2(j))*H(i-j+1);
            Y2(i)=Y2(i)+X1(j)*H(i-j+1)+X2(j)*H(i-j+1);
        else
        end
    end
end
% plot results
figure;
p=0:8;
subplot(1,3,1);stem(p,Y1);title('Y1[n]');
subplot(1,3,3);stem(p,Y2);title('Y2[n]');
```

Here's the input graph :



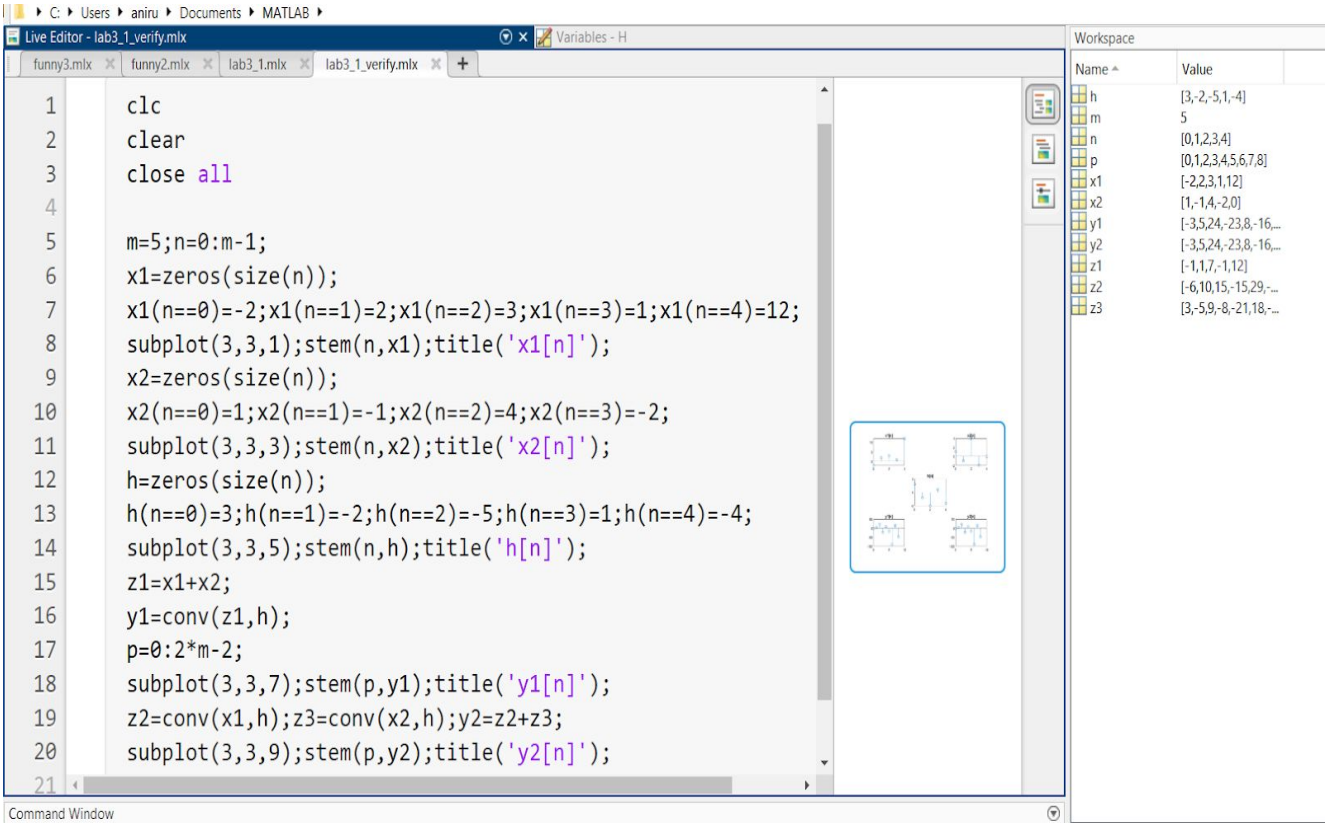
Here's the output graph :



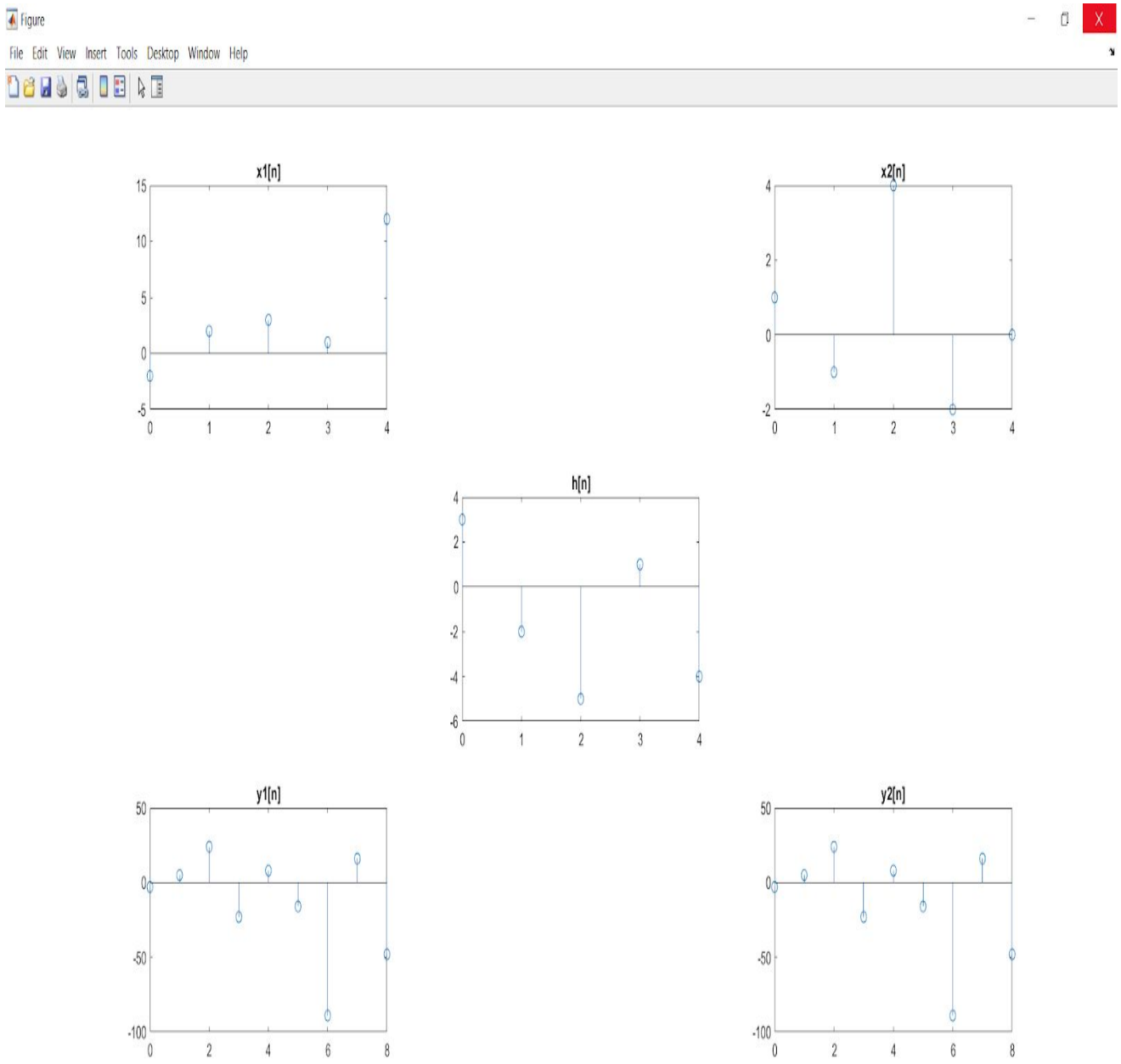
Here's the code for :

➔ First, we find y1 &y2 by using the 'conv' function.

➔ Then we run the code and get its output.



Here’s the output :



As we can see, the output signals y1 & y2 are coming out to be one and the same in both the ways (conv and for loop). So, the given output is verified successfully.

2) Now x and h were already given, we had to find the output signal y.

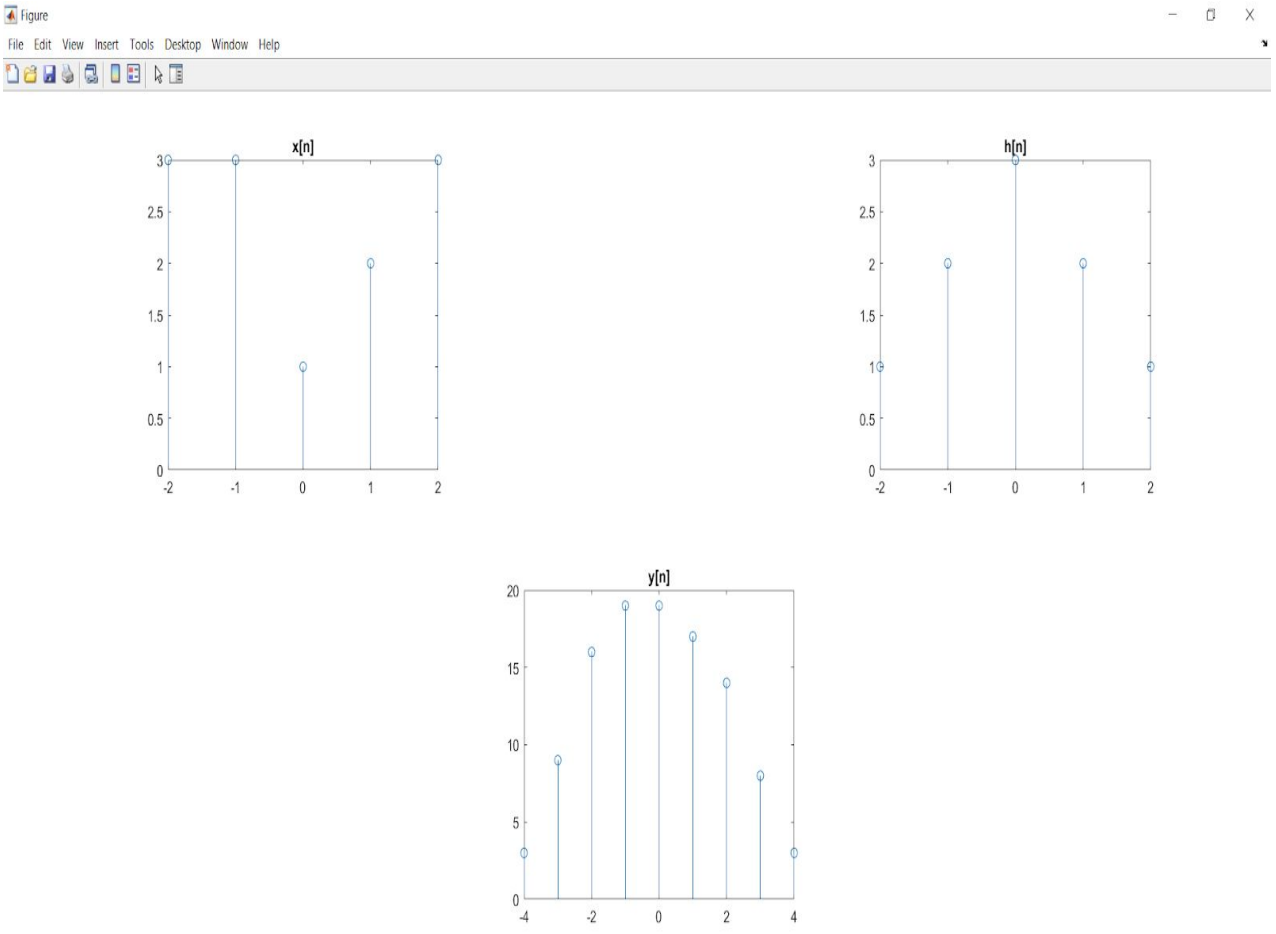
Here’s the code for 2)

➔ First, we find y by using ‘for loop’

➔ Then we run the code and get its output.

```
o=2;p=-o:1:o;
x=zeros(size(p));
x(p==-2)=3;x(p==-1)=3;x(p==0)=1;x(p==1)=2;x(p==2)=3;
subplot(2,3,1);stem(p,x);title('x[n]');
h=zeros(size(p));
h(p==-2)=1;h(p==-1)=2;h(p==0)=3;h(p==1)=2;h(p==2)=1;
subplot(2,3,3);stem(p,h);title('h[n]');
m=length(x);n=length(h);L=m+n-1;
xe=zeros(1,L);
he=zeros(1,L);
y=he;
xe(1:m)=x;
xe(m+1:1)=0;
he(1:n)=h;
he(n+1:1)=0;
for i=1:L
    y(i)=0;
    for k=1:i
        y(i)=y(i)+he(k)*xe(i-k+1);
    end
end
v=-4:1:4;
subplot(2,3,5);stem(v,y);title('y[n]');
```

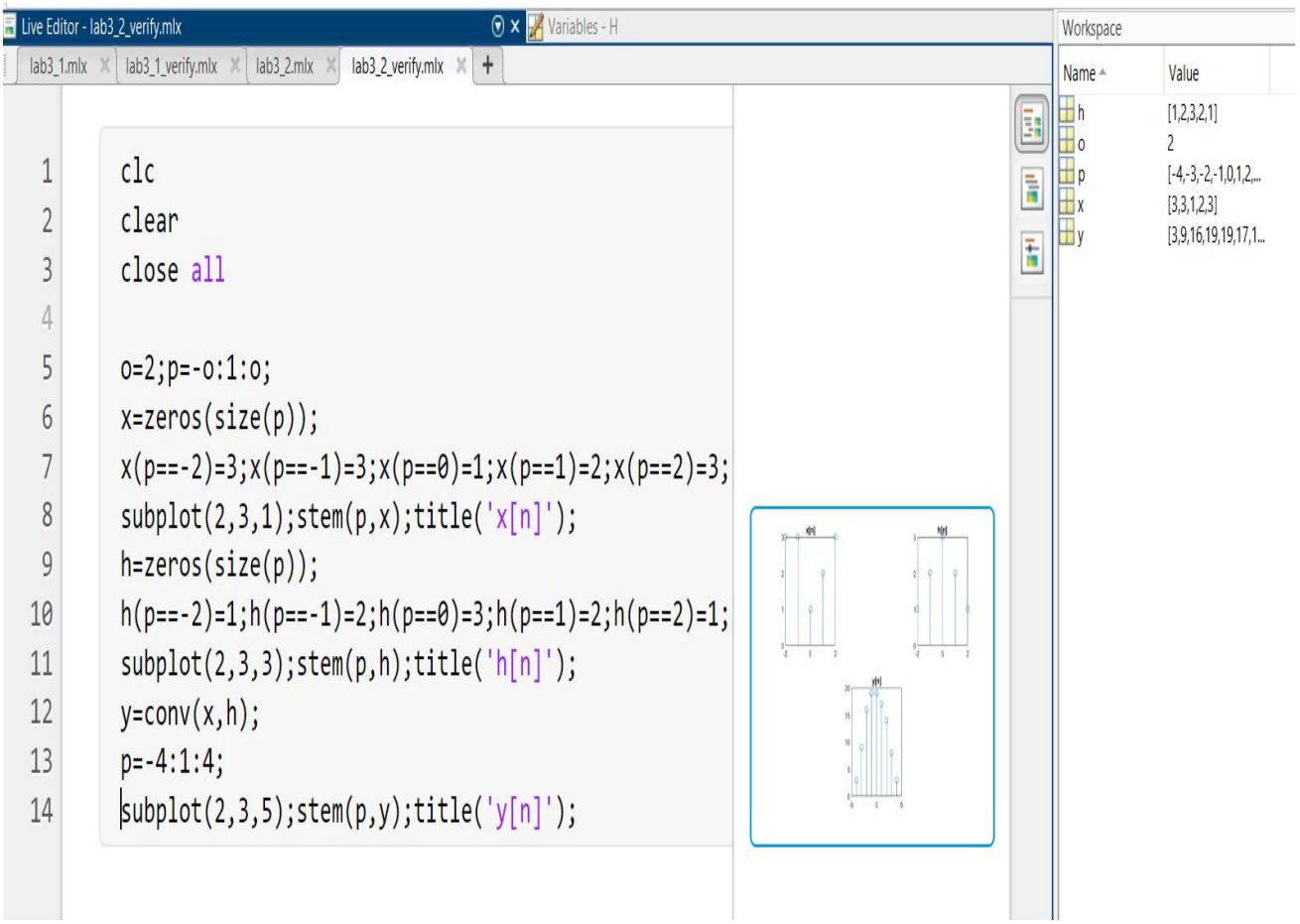
Here's the output :



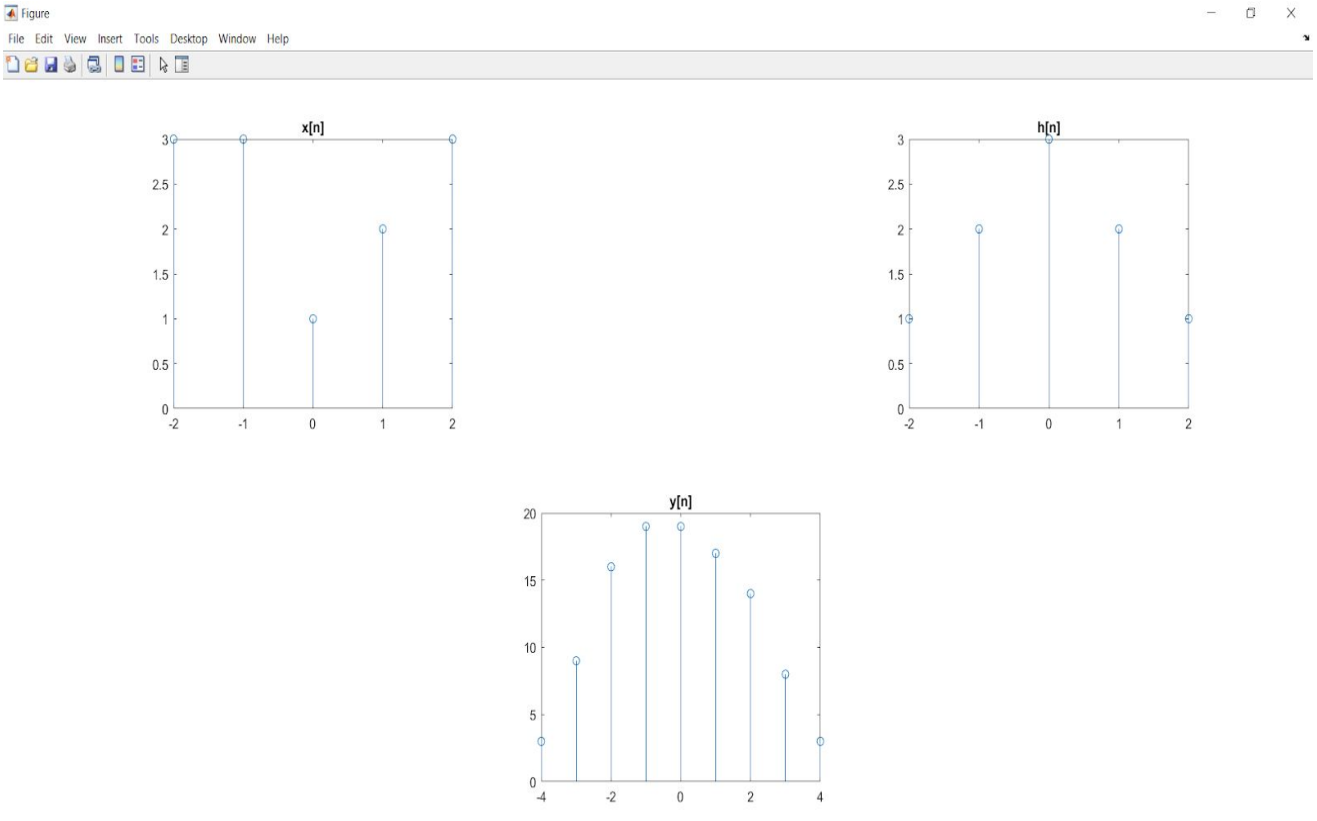
Here’s the code for 2) b):

➔ First, we find y by using the ‘conv’ function.

➔ Then we run the code and get its output.



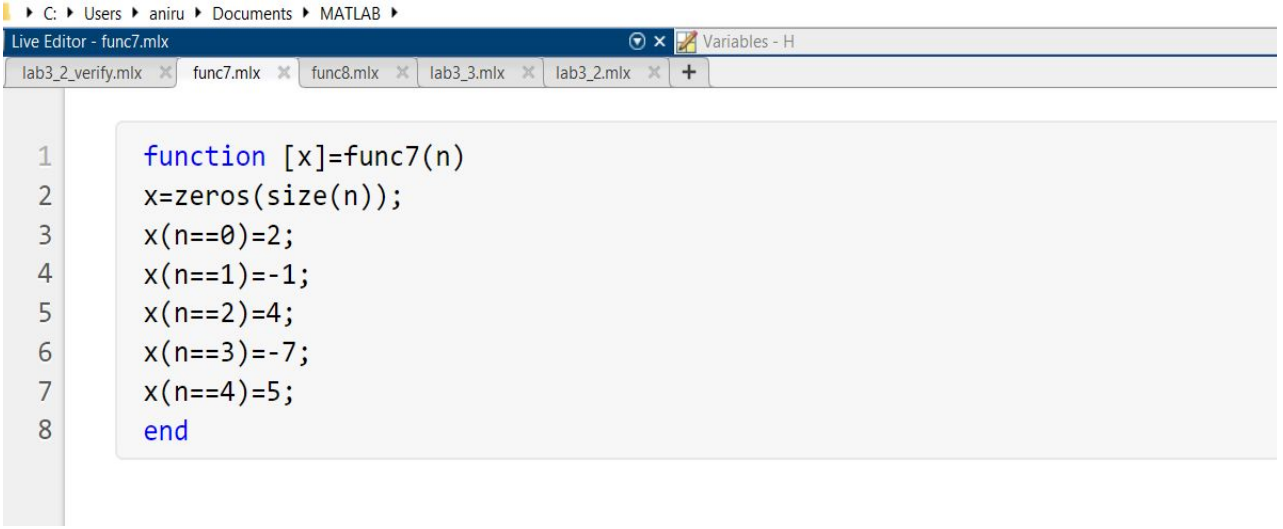
Here’s the output :



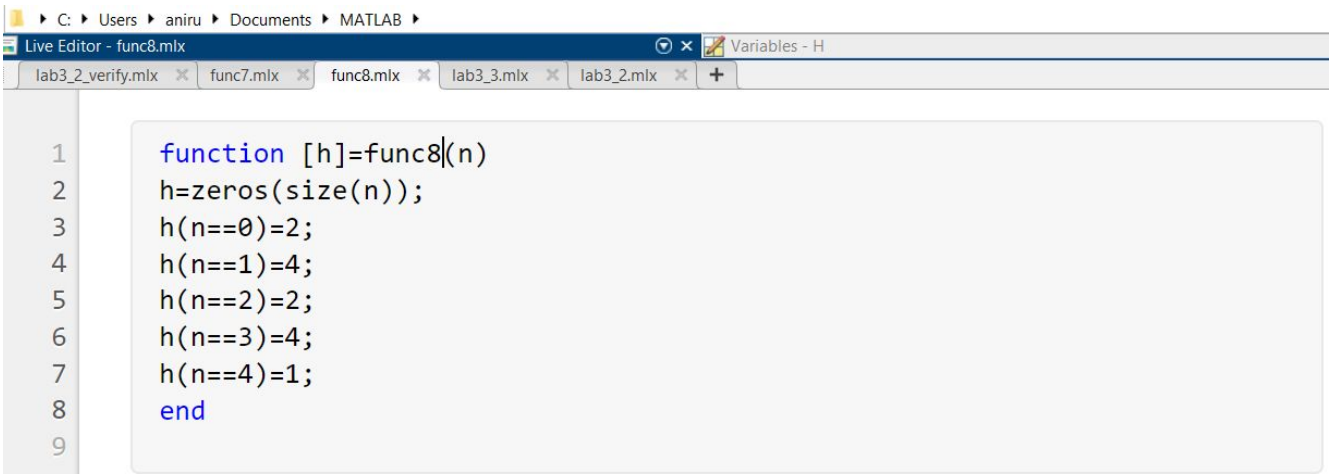
As we can see, the output signal y is coming out to be one and the same in both the ways (conv and for loop). So, the given output is verified successfully.

3) x and h are given. We have to find the output for shifted and scaled version of x and h. Basically, there are two parts in one script and we have to verify the output using the in-built function.
Here's the code for 3) a):
➔ First, we find y by using 'for loop'.
➔ Then we run the code and get its output.
➔ Here we have used two functions func7 & func8

Function 7



Function 8



Here’s the code :

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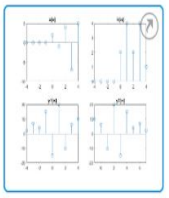
Live Editor - lab3_3.mlx | Variables - H

lab3_2_verify.mlx | func7.mlx | func8.mlx | lab3_3.mlx | lab3_2.mlx

```
clc
clear
close all

o=5;p=-(o-1):1:o-1;
x1=func7(p);subplot(2,2,1);stem(p,x1);title('x[n]');
h1=func8(p);subplot(2,2,2);stem(p,h1);title('h[n]');
h2=func8(-p);
m=5;n=5;L=m+n-1;
x1e=zeros(1,L);
h2e=zeros(1,L);
y1=h2e;
x1e(1:m)=x1(o:2*o-1);
x1e(m+1:L)=0;
h2e(1:n)=h2(1:o);
h2e(n+1:L)=0;
for i=1:L
    y1(i)=0;
    for k=1:i
        y1(i)=y1(i)+h2e(k)*x1e(i-k+1);
    end
end
v=-4:1:4;
```



Workspace

Name	Value
h1	[0,0,0,0,2,4,2,4,1]
h1e	[2,4,2,4,1,0,0,0,0]
h2	[1,4,2,4,2,0,0,0,0]
h2e	[1,4,2,4,2,0,0,0,0]
i	9
k	9
L	9
m	5
n	5
o	5
p	[-4,-3,-2,-1,0,1,2,...
u	[-1,0,1,2,3,4,5,6,7]
v	[-4,-3,-2,-1,0,1,2,...
x1	[0,0,0,0,2,-1,4,-7,5]
x1e	[2,-1,4,-7,5,0,0,0,0]
x2	[0,0,0,5,-7,4,-1,2,0]
x2e	[5,-7,4,-1,2,0,0,0,0]
y1	[2,7,4,15,-15,20,-...
y2	[10,6,-10,20,-15,1...

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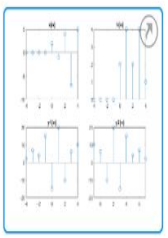
Live Editor - lab3_3.mlx | Variables - H

lab3_2_verify.mlx | func7.mlx | func8.mlx | lab3_3.mlx | lab3_2.mlx

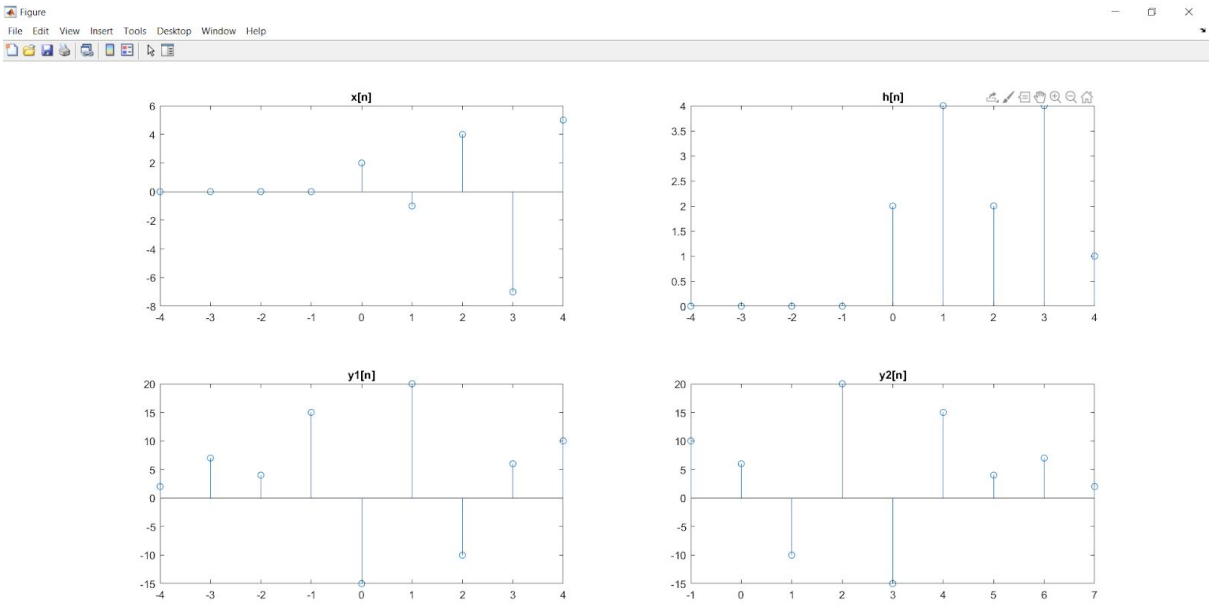
```
    y1(i)=0;
    for k=1:i
        y1(i)=y1(i)+h2e(k)*x1e(i-k+1);
    end
end
v=-4:1:4;
subplot(2,2,3);stem(v,y1);title('y1[n]');
x2=func7(3-p);
m=5;n=5;L=m+n-1;
x2e=zeros(1,L);
h1e=zeros(1,L);
y2=h1e;
x2e(1:m)=x2(4:8);
x2e(m+1:L)=0;
h1e(1:n)=h1(o:2*o-1);
h1e(n+1:L)=0;
for i=1:L
    y2(i)=0;
    for k=1:i
        y2(i)=y2(i)+h1e(k)*x2e(i-k+1);
    end
end
u=3-(m-1):1:((m-1)-1+(m-1)); %x:(-1:3) h:(0:4) hence y:(-1+0:4+3)
subplot(2,2,4);stem(u,y2);title('y2[n]');
```



Workspace

Name	Value
h1	[0,0,0,0,2,4,2,4,1]
h1e	[2,4,2,4,1,0,0,0,0]
h2	[1,4,2,4,2,0,0,0,0]
h2e	[1,4,2,4,2,0,0,0,0]
i	9
k	9
L	9
m	5
n	5
o	5
p	[-4,-3,-2,-1,0,1,2,...
u	[-1,0,1,2,3,4,5,6,7]
v	[-4,-3,-2,-1,0,1,2,...
x1	[0,0,0,0,2,-1,4,-7,5]
x1e	[2,-1,4,-7,5,0,0,0,0]
x2	[0,0,0,5,-7,4,-1,2,0]
x2e	[5,-7,4,-1,2,0,0,0,0]
y1	[2,7,4,15,-15,20,-...
y2	[10,6,-10,20,-15,1...

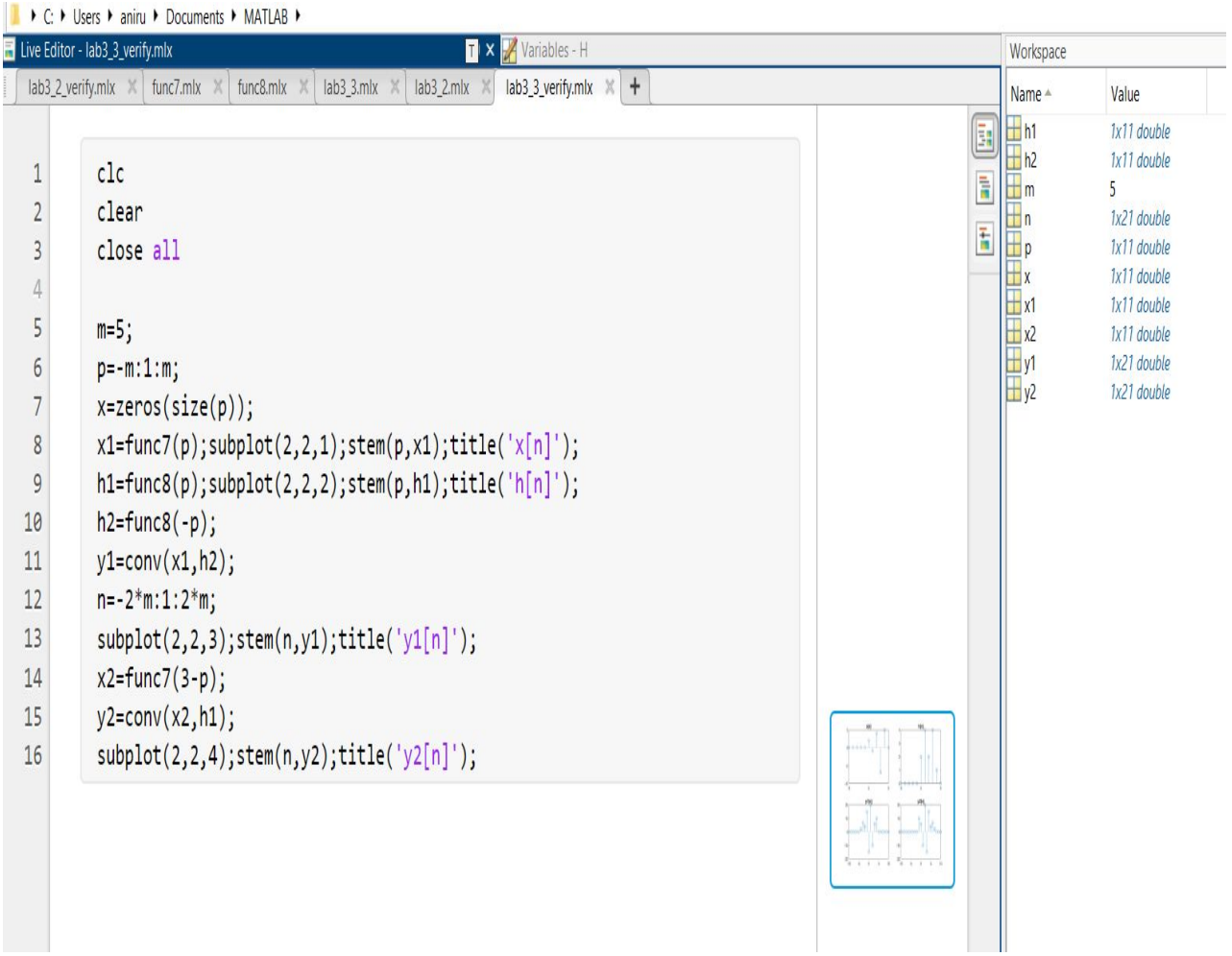
Here’s the output :



Here’s the code for 3) b):

➔ First, we find y by using the ‘conv’ function.

➔ Then we run the code and get its output.




```
clc
clear
close all

m=5;
p=-m:1:m;
x=zeros(size(p));
x1=func7(p);subplot(2,2,1);stem(p,x1);title('x[n]');
h1=func8(p);subplot(2,2,2);stem(p,h1);title('h[n]');
h2=func8(-p);
y1=conv(x1,h2);
n=-2*m:1:2*m;
subplot(2,2,3);stem(n,y1);title('y1[n]');
x2=func7(3-p);
y2=conv(x2,h1);
subplot(2,2,4);stem(n,y2);title('y2[n]');
```

Here’s the output :

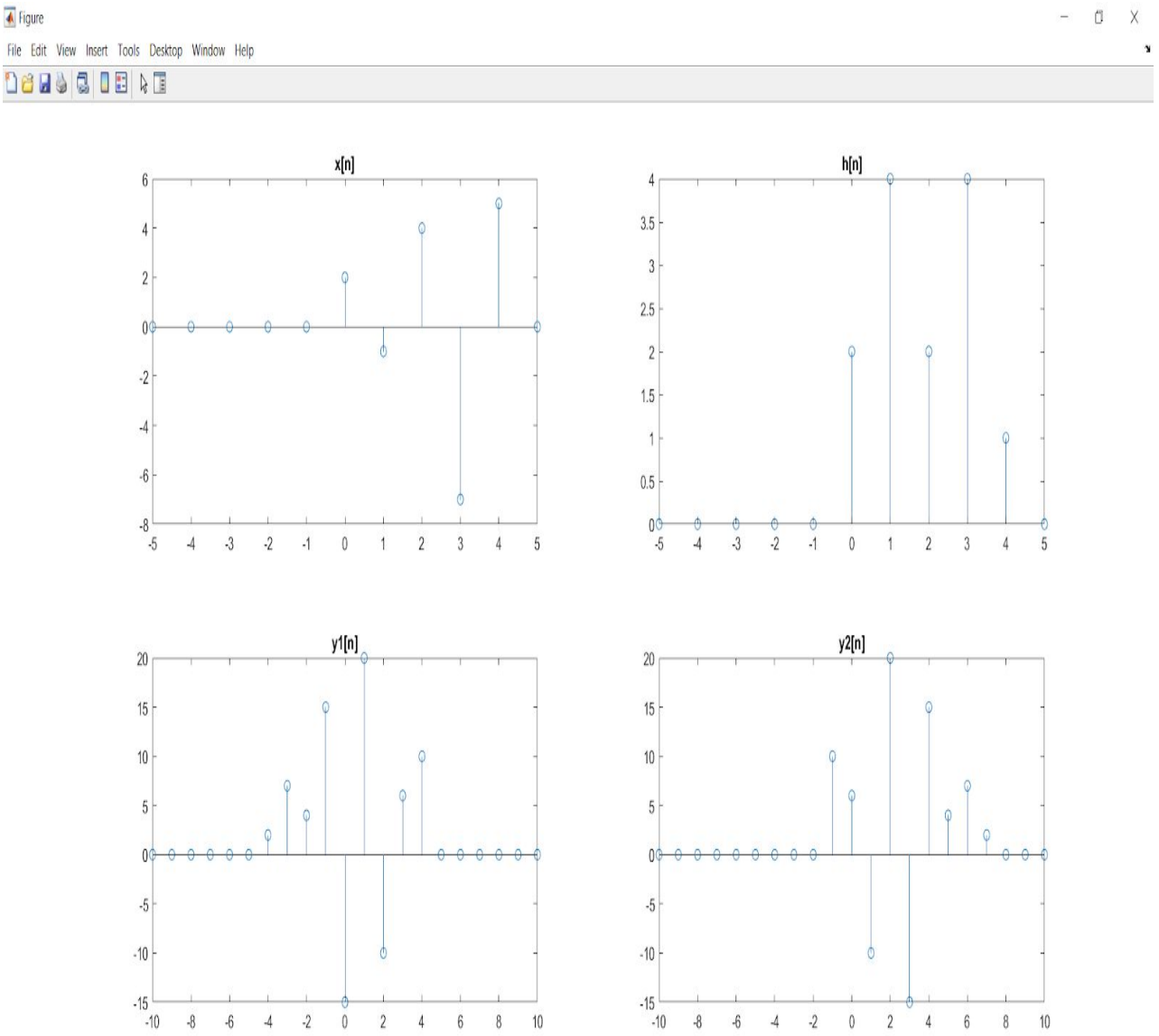


Figure
File Edit View Insert Tools Desktop Window Help
x[n]
h[n]
y1[n]
y2[n]

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