SS EXPERIMENT LAB 2

TITLE: Generation and decomposing of signal into Even and Odd components

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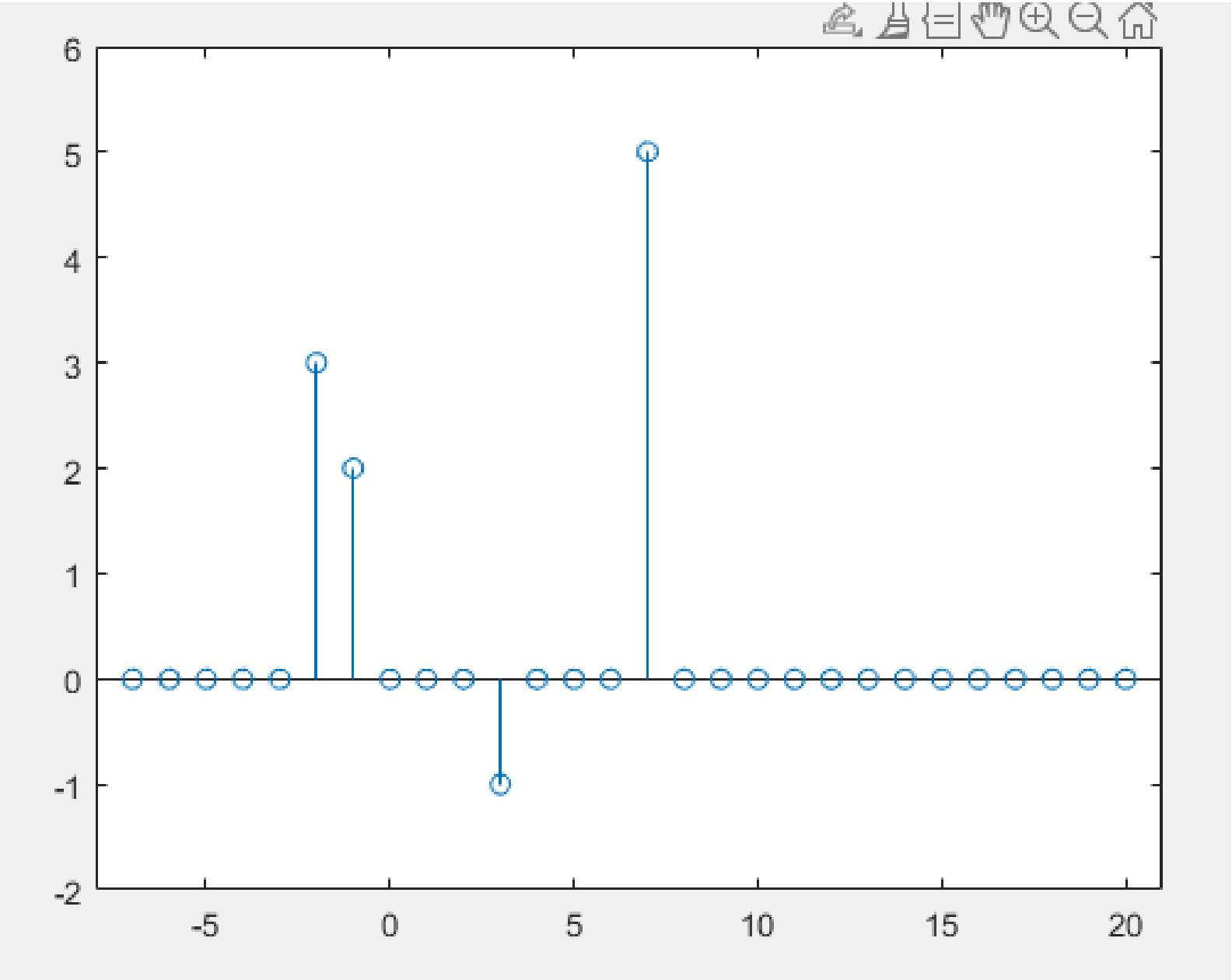
OBSERVATION: In this lab, I learned how to generate and decompose signals into their even and odd components using MATLAB.

Q1. Write a MATLAB script to generate and plot the following signals:

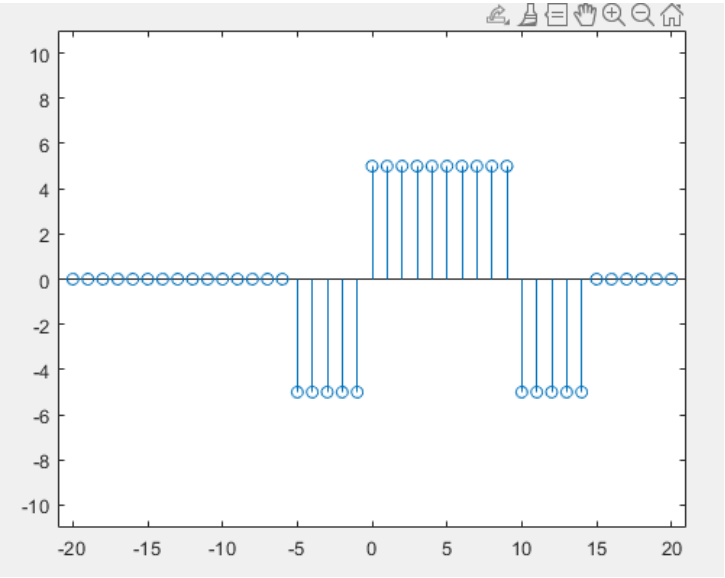
a) $x(n) = 3\delta(n + 2) + 2\delta(n + 1) - \delta(n - 3) + 5\delta(n - 7), -7 \leq n \leq 20$

```
[x1,y1]=sigma(-7,20,-2);
[x2,y2]=sigma(-7,20,-1);
[x3,y3]=sigma(-7,20,3);
[x4,y4]=sigma(-7,20,7);

stem(x1,3*y1+2*y2-y3+5*y4);
axis([-8 21 -2 6])
function [y,n]=sigma(a,b,c)
y=[a:b];
n=[(y-c)==0];
end
```


6
5
4
3
2
1
0
-1
-2
-5
0
5
10
15
20

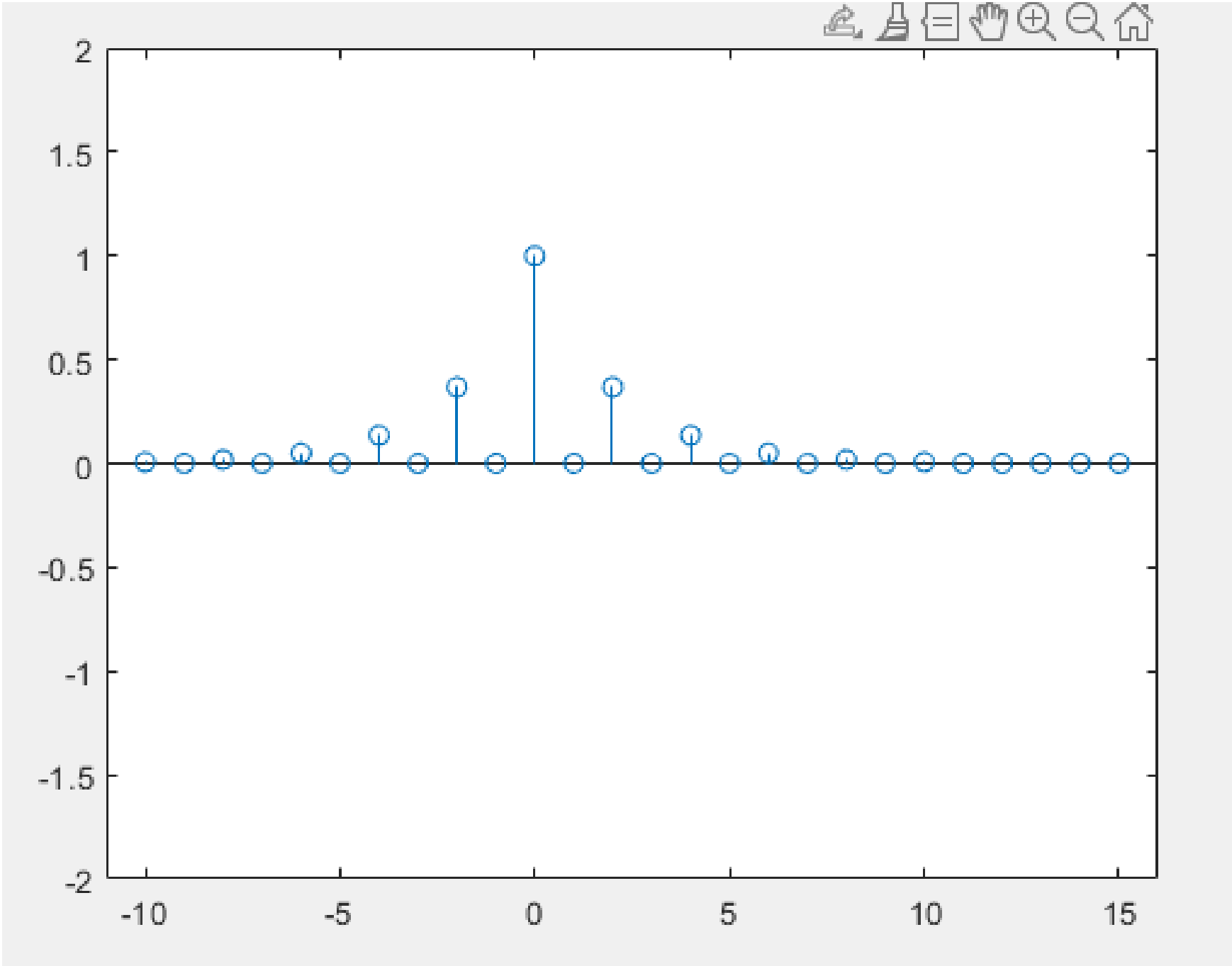
b) x(n)= 10u(n)− 5u(n + 5) − 10u(n – 10) + 5u(n – 15)u(n)

```
[x1,y1]=unit(-20,20,0);
[x2,y2]=unit(-20,20,-5);
[x3,y3]=unit(-20,20,10);
[x4,y4]=unit(-20,20,15);

stem(x1,10*y1-5*y2-10*y3+5*y4.*y1);
axis([-21 21 -11 11])
function [y,n]=unit(a,b,c)
y=[a:b];
n=[(y-c)>=0];
end
```



$$(c)\ x(n) = \sum_{i=-5}^{5} e^{-|i|}\delta(n-2i), \qquad -10 \le n \le 15$$

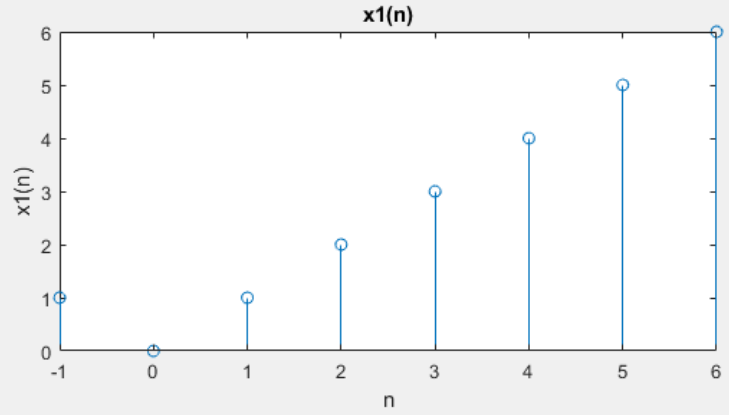
```
n1=-10;
n2=15;
x1=[-10:15];
y1=zeros(1,26);

for i=-5:1:5
    [x2,y0]=sigma(n1,n2,2*i);
    y1=y1+exp(-1*abs(i))*y0;
end
stem(x1,y1);
axis([-11 16 -2 2]);
function [y,n]=sigma(a,b,c)
y=[a:b];
n=[(y-c)==0];
end
```

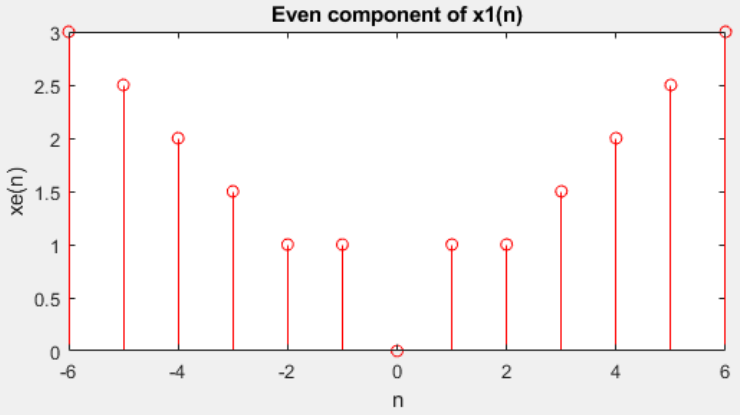

2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-10
-5
0
5
10
15

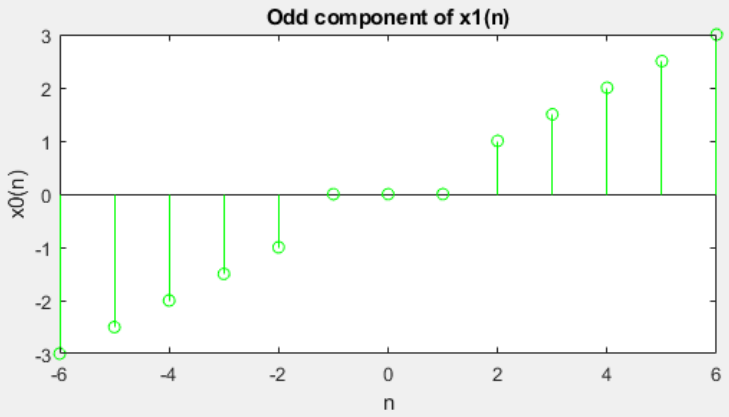
Q2. Decompose the following sequences into their even and odd components and plot these components.

$$(a)\ x(n) = \{1, \underset{\uparrow}{0}, 1, 2, 3, 4, 5, 6\}$$

```
n1= -1:1:6;
x1= [1,0,1,2,3,4,5,6];
[xe1, xo1, m1]= evenodd(x1,n1);

subplot(2,2,1)
stem(n1,x1)
title('x1(n)')
xlabel('n')
ylabel('x1(n)')

subplot(2,2,2)
stem(m1,xe1,'r')
title('Even component of x1(n)')
xlabel('n')
ylabel('xe(n)')

subplot(2,2,3)
stem(m1,xo1,'g')
xlabel('n')
ylabel('x0(n)')
title('Odd component of x1(n)')
```

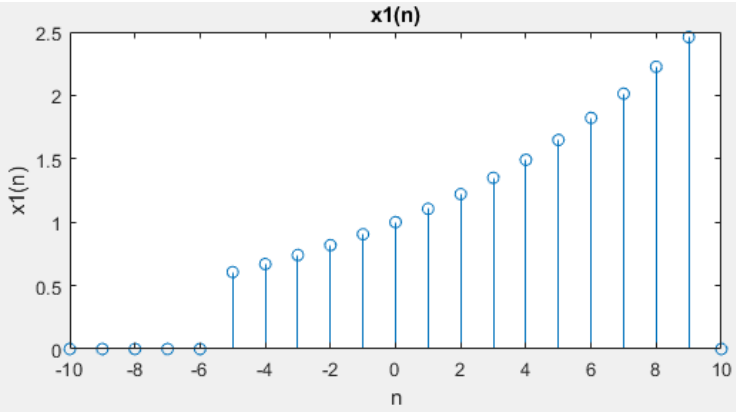

x1(n)
x1(n)
n
0
1
2
3
4
5
6
-1

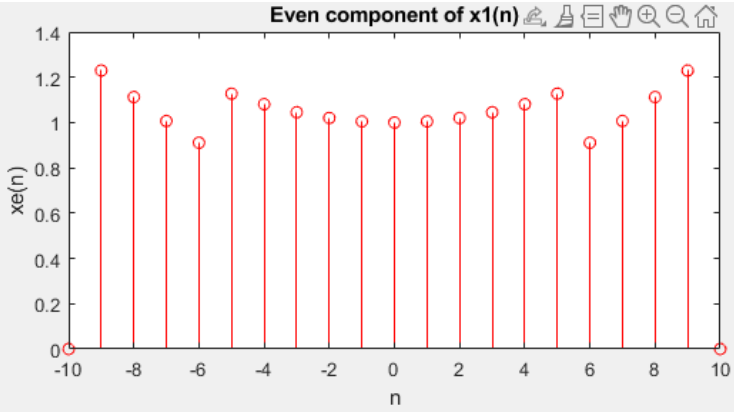

Even component of x1(n)
xe(n)
n
0
0.5
1
1.5
2
2.5
3
-6
-4
-2
0
2
4
6

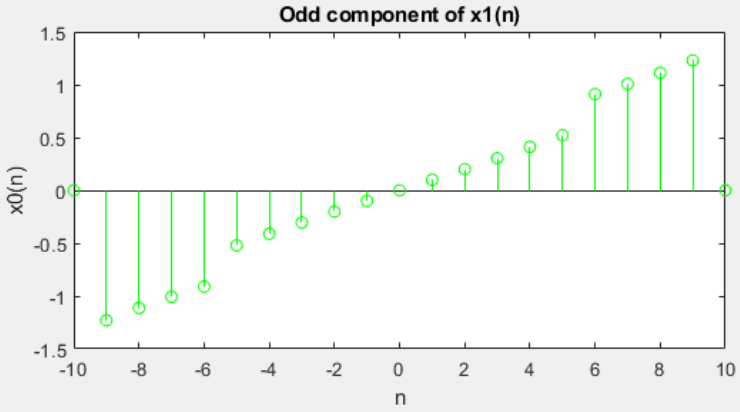

Odd component of x1(n)
x0(n)
n
-3
-2
-1
0
1
2
3
-6
-4
-2
0
2
4
6

$$(b)\ x(n) = e^{0.1n}[u(n+5) - u(n-10)]$$

```
n1= -10:1:10;
[xa,na]= stepseq(-5,-10,10);
[xb,nb]= stepseq(10,-10,10);
x1= (exp(0.1*n1)).*(xa-xb);
[xe1, xo1, m1] = evenodd(x1,n1);

subplot(2,2,1)
stem(n1,x1)
title('x1(n)')
xlabel('n')
ylabel('x1(n)')

subplot(2,2,2)
stem(na,xe1,'r')
title('Even component of x1(n)')
xlabel('n')
ylabel('xe(n)')

subplot(2,2,3)
stem(nb,xo1,'g')
xlabel('n')
ylabel('x0(n)')
title('Odd component of x1(n)')

function [x,n] = stepseq(n0,n1,n2)
n = [n1:n2];
x = [(n-n0) >= 0];
end
```

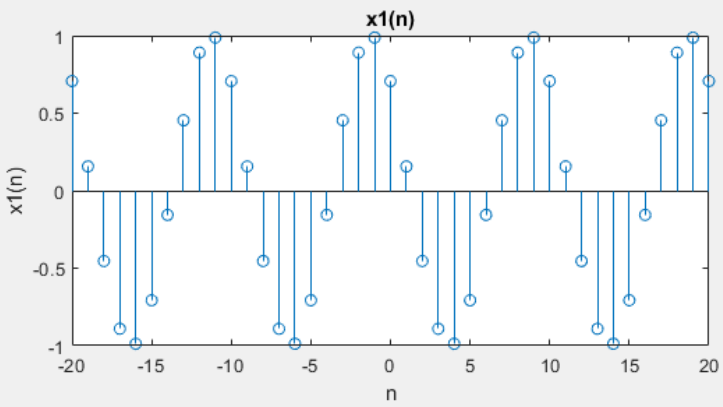

x1(n)
x1(n)
n

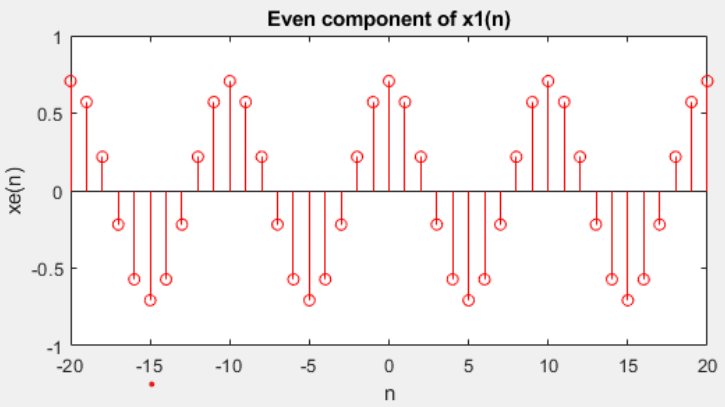

Even component of x1(n)
xe(n)
n

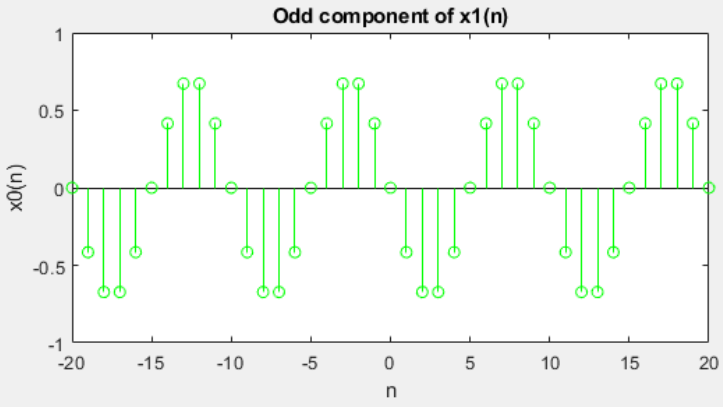

Odd component of x1(n)
x0(n)
n

$$(c)\ x(n) = \cos\left(0.2\pi n + \frac{\pi}{4}\right), \qquad -20 \le n \le 20$$

```
n1= -20:1:20;
x1= cos((0.2*pi*n1)+(pi/4));
[xe1, xo1, m1] = evenodd(x1,n1);

subplot(2,2,1)
stem(n1,x1)
title('x1(n)')
xlabel('n')
ylabel('x1(n)')

subplot(2,2,2)
stem(m1,xe1,'r')
title('Even component of x1(n)')
xlabel('n')
ylabel('xe(n)')

subplot(2,2,3)
stem(m1,xo1,'g')
xlabel('n')
ylabel('x0(n)')
title('Odd component of x1(n)')
```


x1(n)
x1(n)
n
1
0.5
0
-0.5
-1
-20
-15
-10
-5
0
5
10
15
20


Even component of x1(n)
xe(n)
n
1
0.5
0
-0.5
-1
-20
-15
-10
-5
0
5
10
15
20


Odd component of x1(n)
x0(n)
n
1
0.5
0
-0.5
-1
-20
-15
-10
-5
0
5
10
15
20