LAB 4

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Q1)

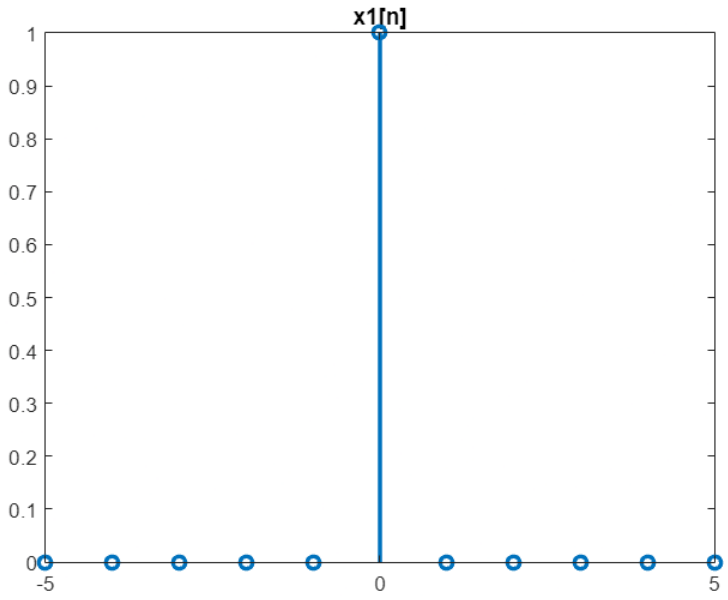
```
   close all;
clear;
clc;
un = [];
c = 1;
for n = -5:5
    if n >= 0
        un(c) = 1;
        c = c+1;
    else
        un(c) = 0;
        c = c+1;
    end
end
n = -5:5;


un1 = [];
clear c;
c = 1;
clear n;
for n = -5:5
    if n>=1
        un1(c) = 1;
        c = c+1;
    else
        un1(c) = 0;
        c = c+1;
```

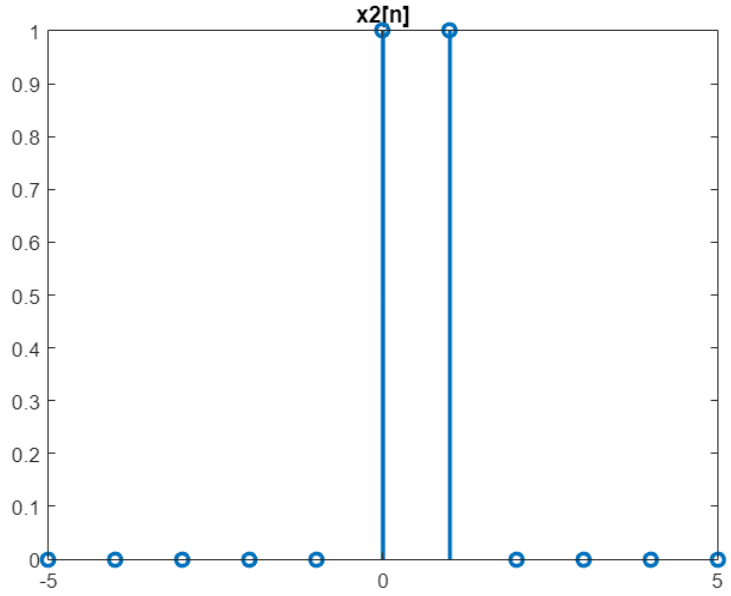
```
    end
end
n = -5:5;

clear c;
clear n;
c = 1;
un2 = [];
for n = -5:5
    if n>=2
        un2(c) = 1;
        c = c+1;
    else
        un2(c) = 0;
        c = c+1;
    end
end
n = -5:5;

x1 = un - un1;
stem(n, x1, 'Linewidth', 2);
title("x1[n]");
```



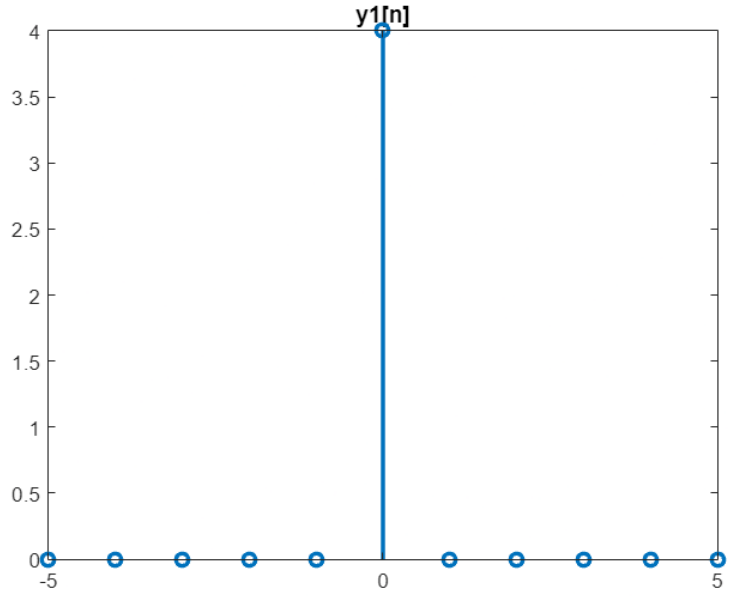

```
x2 = un - un2;
stem(n, x2, 'LineWidth',2);
title("x2[n]");
```



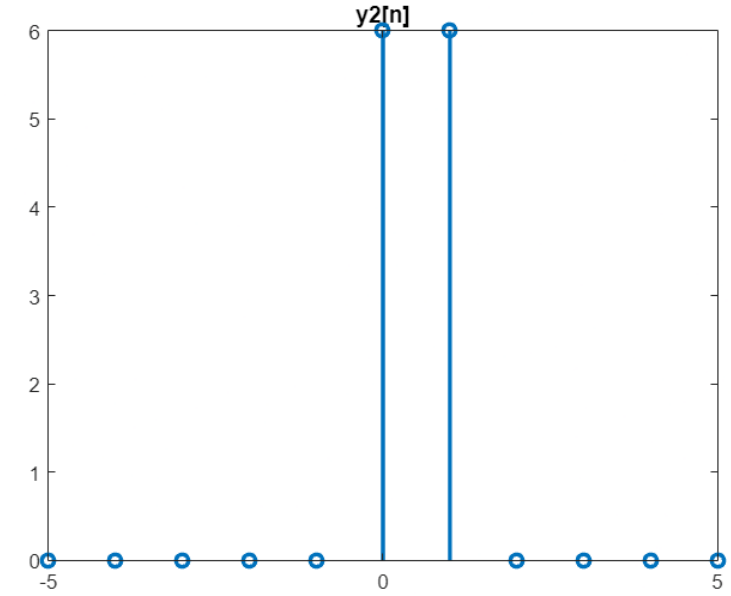

```
a1 = 2;
a2 = 3;
```

Part 1

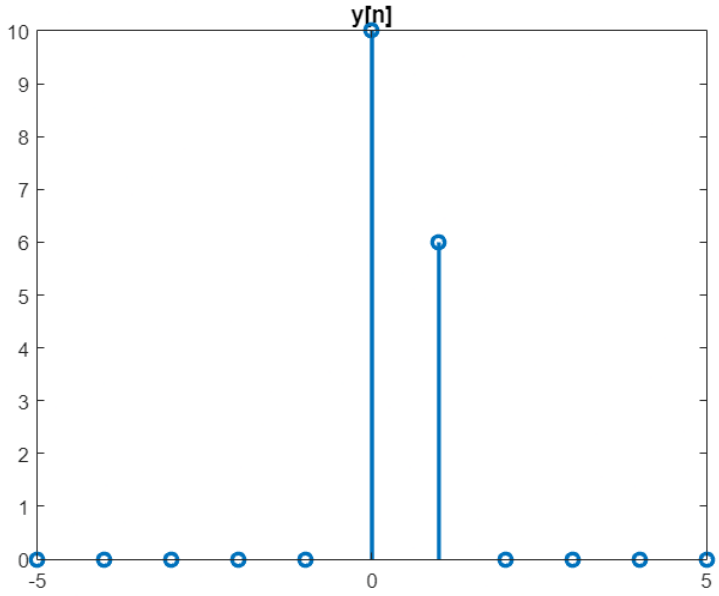
```
y1 = 2*a1.*x1;
y2 = 2*a2.*x2;
stem(n, y1, 'LineWidth',2);
title("y1[n]");
```



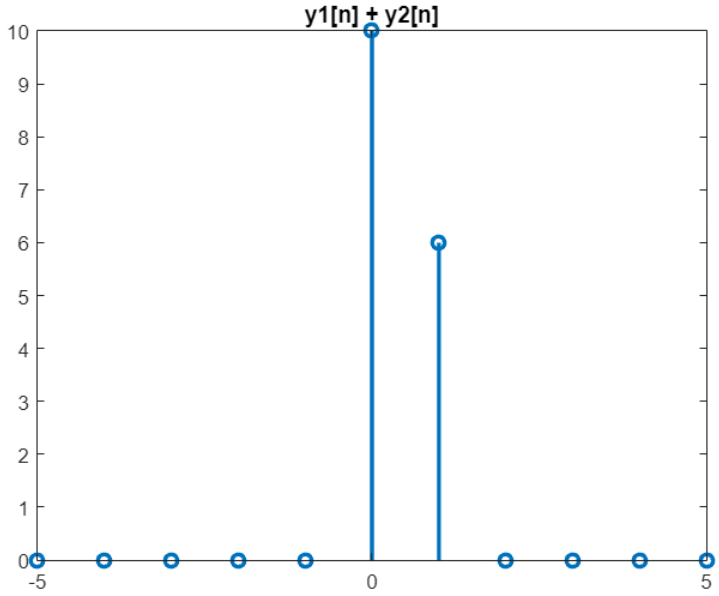

```
stem(n, y2, 'LineWidth',2);
title("y2[n]");
```




```
y = 2.*(a1.*x1 + a2.*x2);
stem(n, y, 'LineWidth',2);
title("y[n]");
```




```
stem(n, y1+y2, 'LineWidth',2);
title("y1[n] + y2[n]");
```

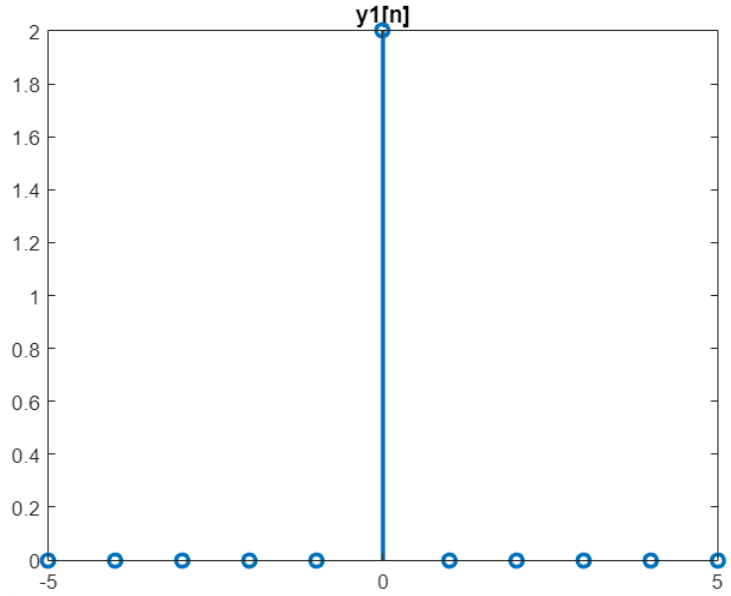



```
disp("System follows property of additivity and homogenity");
```

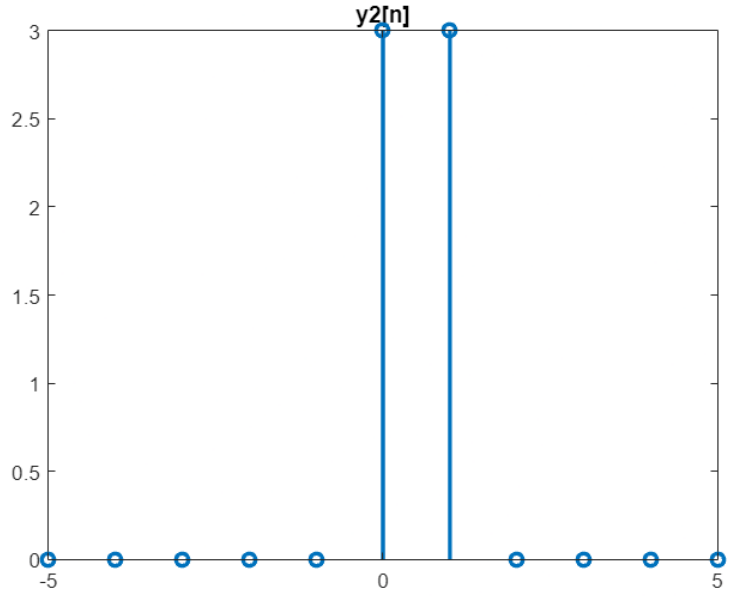
```
System follows property of additivity and homogenity
```

Part 2

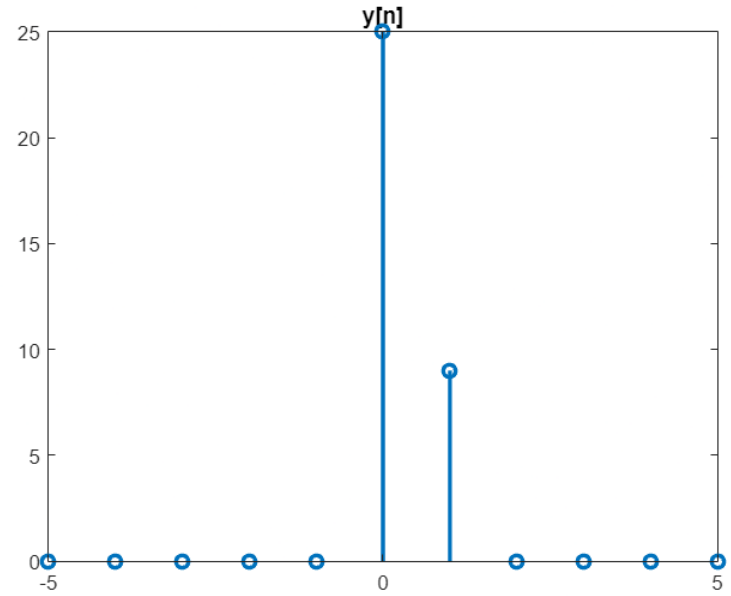
```
clear y1;
clear y2;
clear y;
y1 = a1.*x1.*x1;
y2 = a2.*x2.*x2;
stem(n, y1, 'LineWidth',2);
title("y1[n]");
```



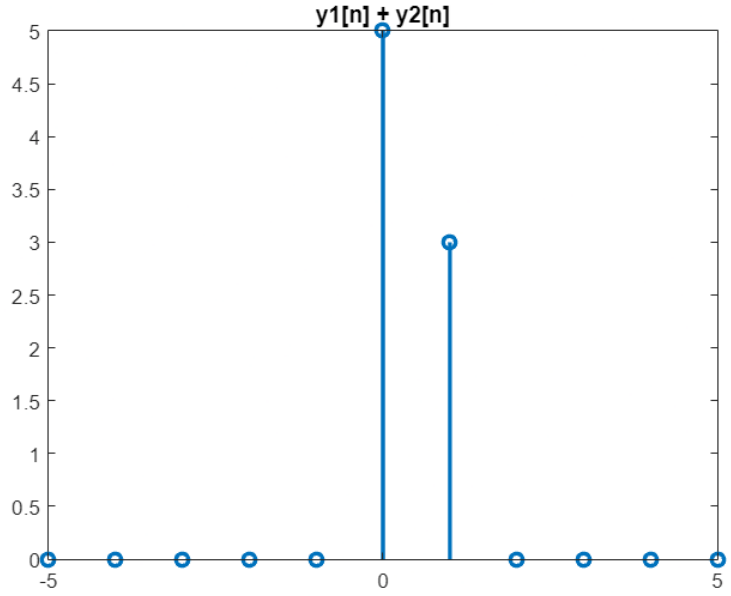

```
stem(n, y2, 'LineWidth',2);
title("y2[n]");
```




```
y = (a1.*x1 + a2.*x2).^2;
stem(n, y, 'LineWidth',2);
title("y[n]");
```




```
stem(n, y1+y2, 'LineWidth',2);
title("y1[n] + y2[n]");
```




```
disp("System doesn't follow property of additivity");
```

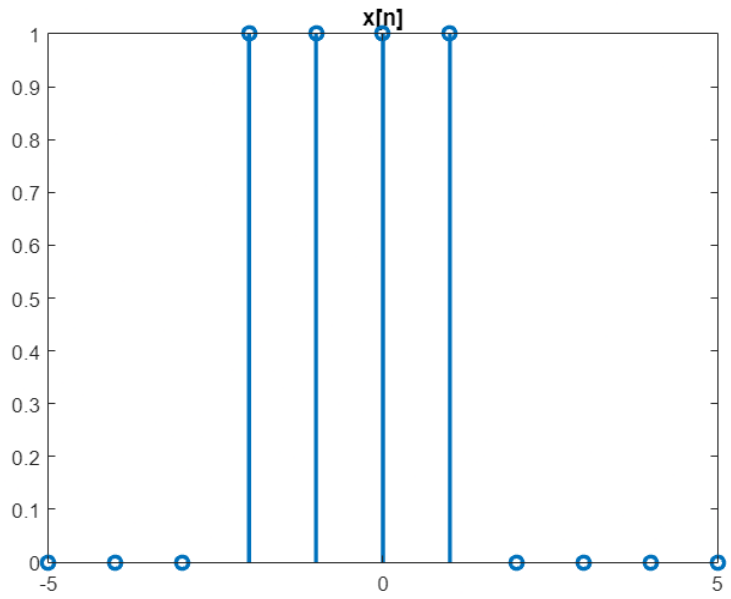
```
System doesn't follow property of additivity
```

Q2)

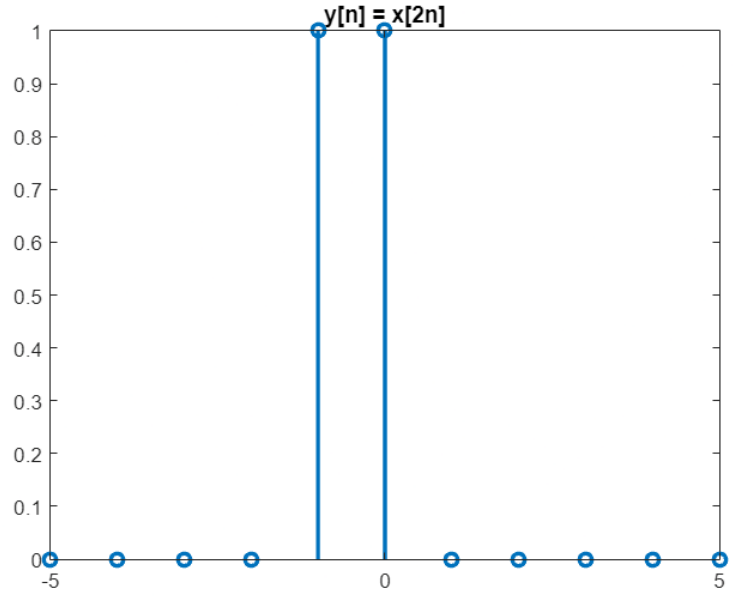
```
close all;
clear;
clc;
un2p = [];
c = 1;
for n = -5:5
    if n >= -2
        un2p(c) = 1;
        c = c+1;
    else
        un2p(c) = 0;
        c = c+1;
    end
end
n = -5:5;

clear c;
un2m = [];
c = 1;
for n = -5:5
    if n >= 2
        un2m(c) = 1;
        c = c+1;
    else
        un2m(c) = 0;
        c = c+1;
    end
end
n = -5:5;

x = un2p - un2m;
stem(n, x, 'LineWidth',2);
title("x[n]");
```



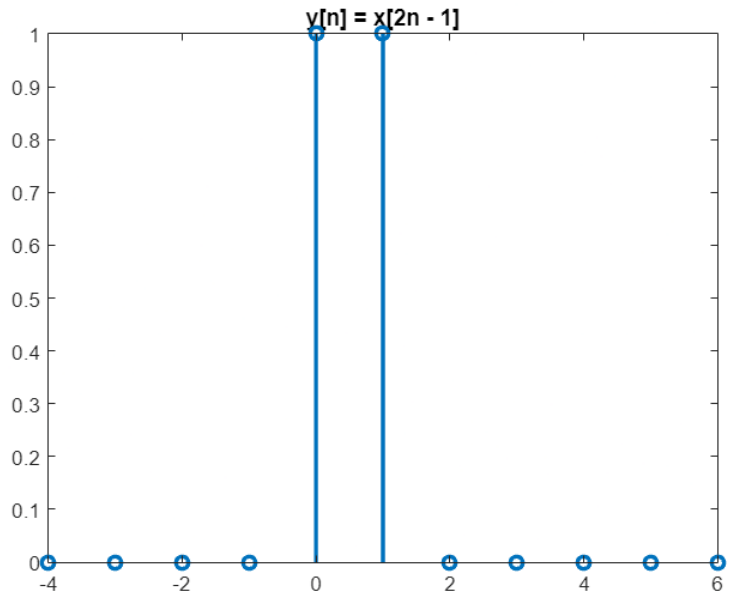

```
x2n = [];
c = 1;
for n = -5:5
    if n == -1 || n == 0
        x2n(c) = 1;
    else
        x2n(c) = 0;
    end
    c = c+1;
end
n = -5:5;
stem(n, x2n, 'LineWidth',2);
title("y[n] = x[2n]");
```




```
n = n+1;
x2n1 = [];
c = 1;
for k = n
    x2n1(c) = x2n(c);
    c = c+1;
end
disp("Simple time shift");
```

```
Simple time shift
```

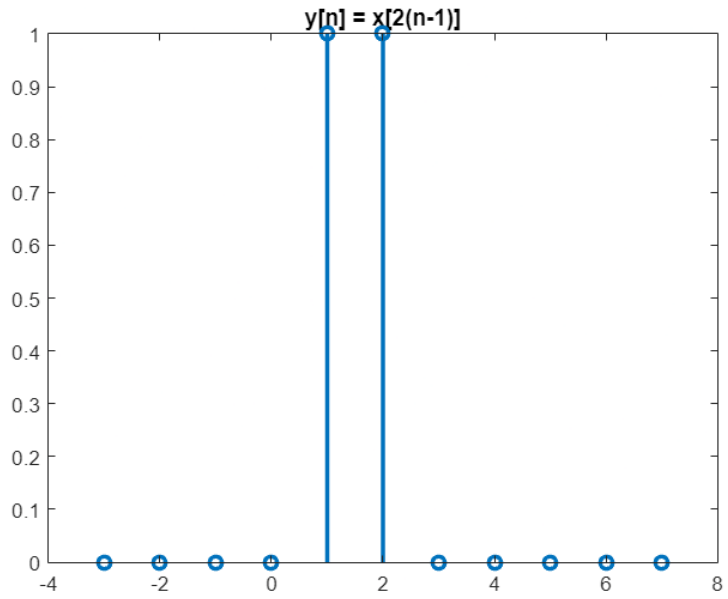
```
stem(n, x2n1, 'LineWidth', 2);
title("y[n] = x[2n - 1]");
```




```
n = n+1;
c = 1;
x2n2 = [];
for k = n
    x2n2(c) = x2n(c);
    c = c+1;
end
disp("Time shift by substituting values of n");
```

```
Time shift by substituting values of n
```

```
stem(n, x2n2, 'LineWidth', 2);
title("y[n] = x[2(n-1)]");
```




```
 disp("The two graphs are different, which suggests the system is time
variant");
```

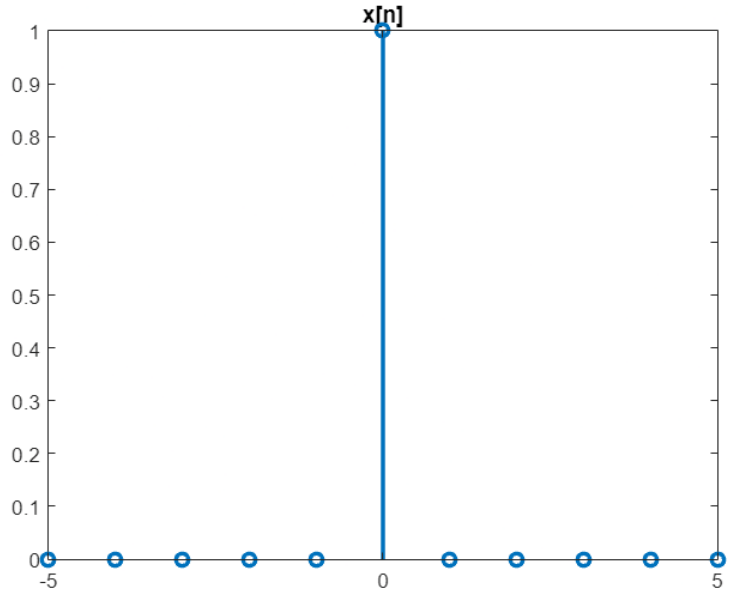
```
The two graphs are different, which suggests the system is time variant
```

Q3)

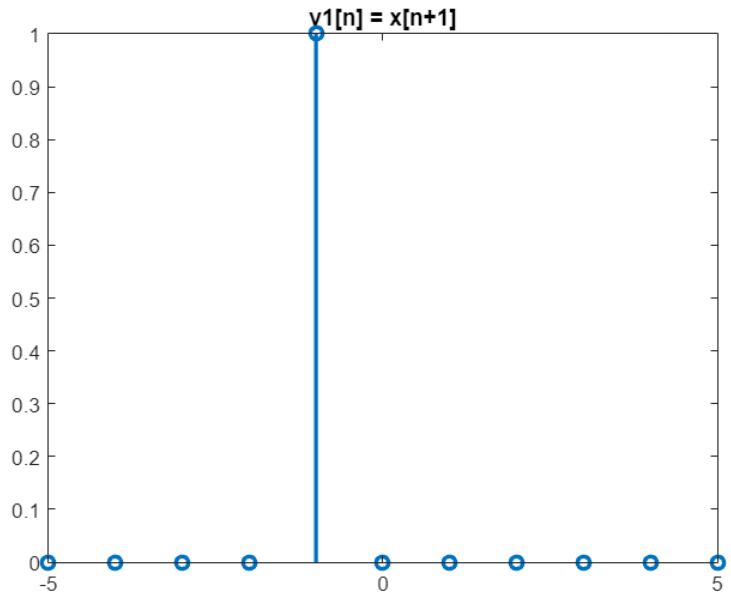
```
close all;
clear;
clc;
un = [];
c = 1;
for n = -5:5
    if n >= 0
        un(c) = 1;
        c = c+1;
    else
        un(c) = 0;
        c = c+1;
    end
end
n = -5:5;

un1 = [];
clear c;
c = 1;
clear n;
for n = -5:5
    if n>=1
        un1(c) = 1;
        c = c+1;
    else
        un1(c) = 0;
        c = c+1;
    end
end
n = -5:5;

x = un - un1;
stem(n, x, 'LineWidth', 2);
title("x[n]");
```




```
xm = [];
clear c;
clear n;
c = 1;
for n = -5:5
    if n == -1
        xm(c) = 1;
        c = c+1;
    else
        xm(c) = 0;
        c = c+1;
    end
end
n = -5:5;
stem(n, xm, 'LineWidth', 2);
title("y1[n] = x[n+1]");
```



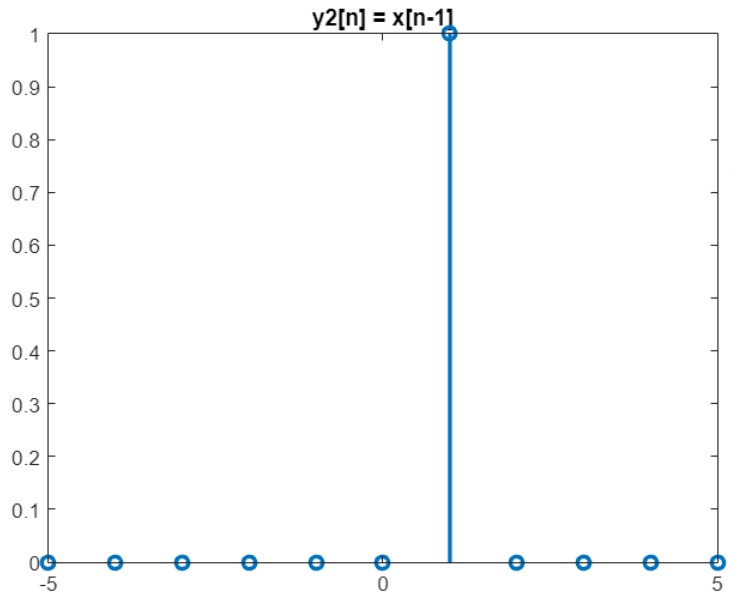

```
disp("From the graph, y depends on future values of x");
```

```
From the graph, y depends on future values of x
```

```
disp("So, this is a non-causal system");
```

```
So, this is a non-causal system
```

```
xp = [];
clear c;
clear n;
c = 1;
for n = -5:5
    if n == 1
        xp(c) = 1;
        c = c+1;
    else
        xp(c) = 0;
        c = c+1;
    end
end
n = -5:5;
stem(n, xp, 'LineWidth',2);
title("y2[n] = x[n-1]");
```




```
disp("From the graph, y doesn't depend on future values of x");
```

```
From the graph, y doesn't depend on future values of x
```

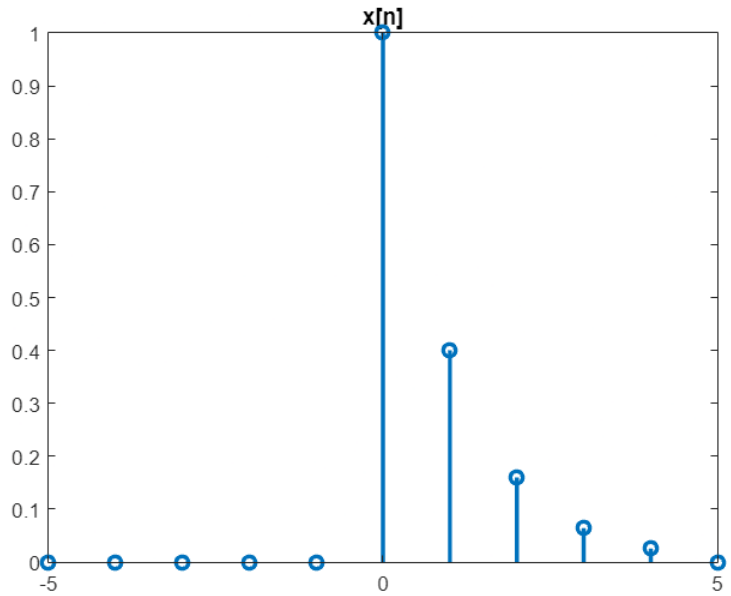
```
disp("So, this is a causal system");
```

```
So, this is a causal system
```

Q4)

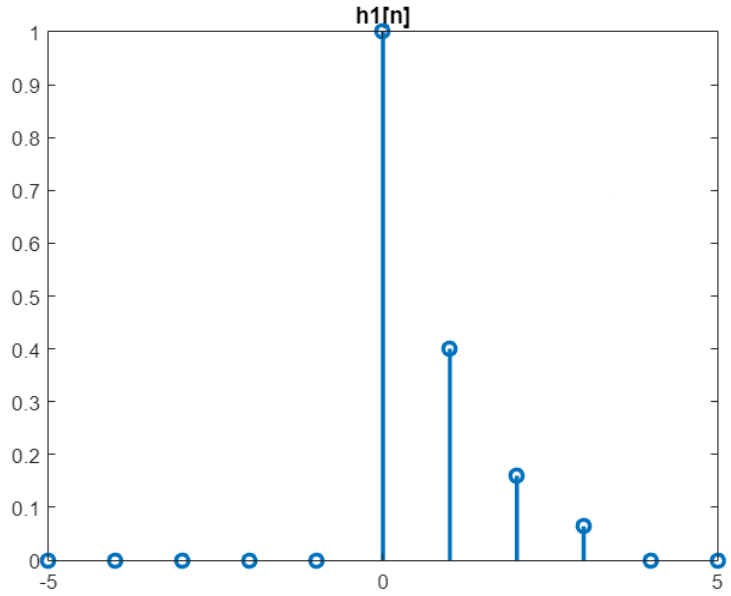
```
close all;
clear;
clc;
u1 = [];
c = 1;
for n = -5:5
    if n >= 0 && n <= 4
        u1(c) = 1;
        c = c+1;
    else
        u1(c) = 0;
        c = c+1;
    end
end

n = -5:5;
x = (0.4.^n).*u1;
stem(n, x, 'LineWidth', 2);
title("x[n]");
```



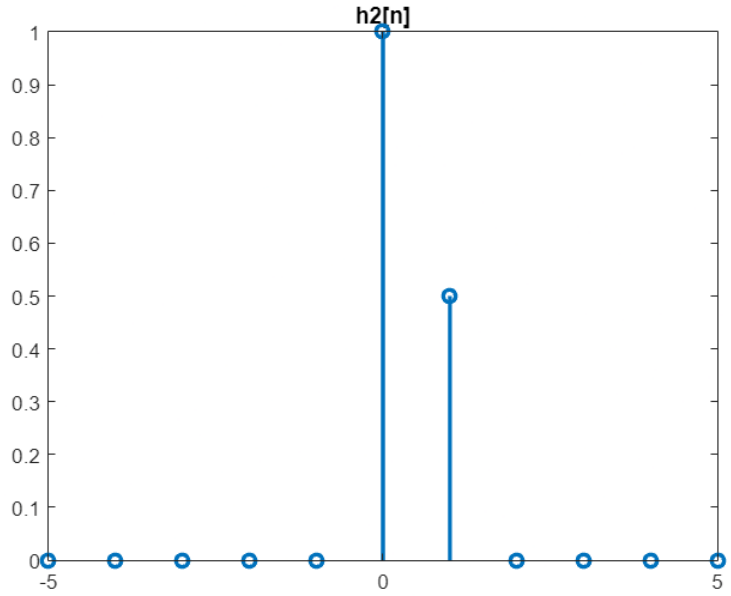

```
u2 = [];
c = 1;
for n = -5:5
```

```
    if n >= 0 && n <= 3
        u2(c) = 1;
        c = c+1;
    else
        u2(c) = 0;
        c = c+1;
    end
end
n = -5:5;
h1 = (0.4.^n).*u2;
stem(n, h1, 'LineWidth', 2);
title("h1[n]");
```




```
c=1;
deln=[];
for n = -5:5
    if n == 0
        deln(c) = 1;
        c = c+1;
    else
        deln(c) = 0;
        c = c+1;
    end
end
c=1;
deln1=[];
for n = -5:5
```

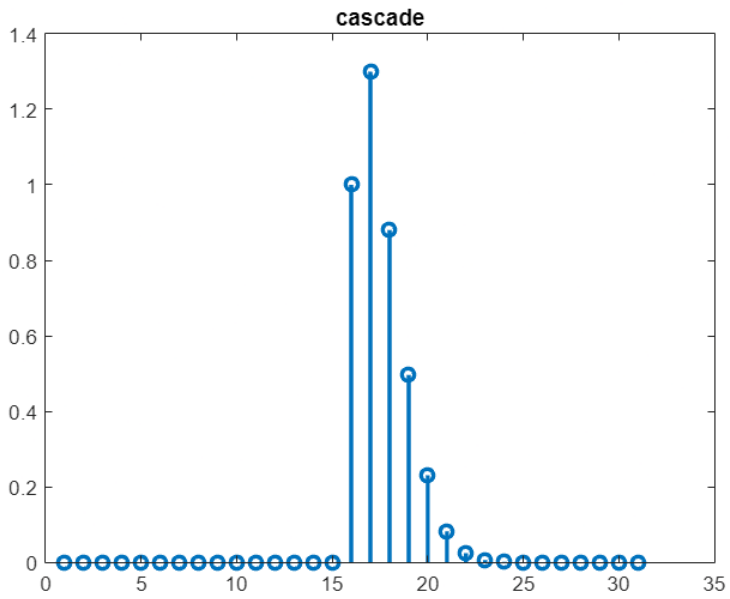
```
    if n == 1
        deln1(c) = 1;
        c = c+1;
    else
        deln1(c) = 0;
        c = c+1;
    end
end
n = -5:5;
h2 = deln + 0.5.*deln1;
stem(n, h2, 'LineWidth', 2);
title("h2[n]");
```




```
disp("Cascade Connection:");
```

```
Cascade Connection:
```

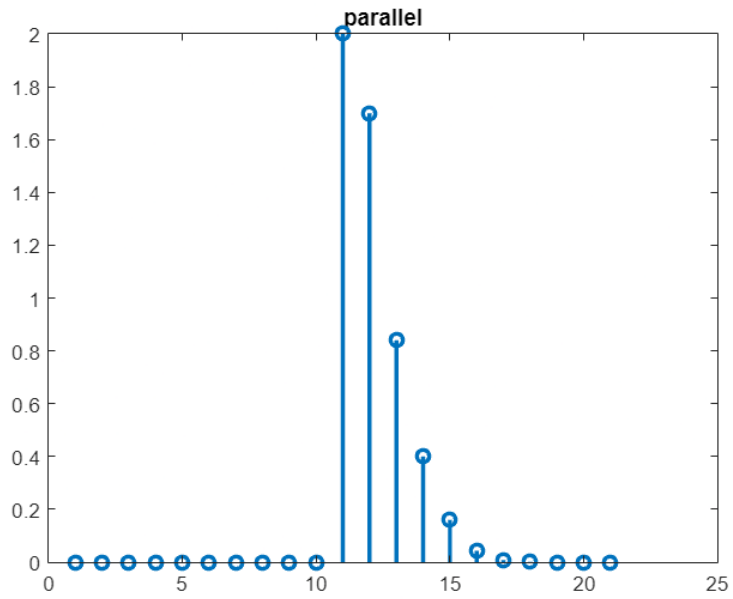
```
z = conv(x, h1);
y = conv(z, h2);
stem(y, 'LineWidth', 2);
title("cascade");
```




```
disp("Parallel Connection:");
```

```
Parallel Connection:
```

```
clear y;
y1 = conv(x, h1);
y2 = conv(x, h2);
y = y1 + y2;
stem(y, 'LineWidth', 2);
title("parallel");
```


parallel
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25