Lab 7

7.1

7.1 PROBLEM STATEMENT

Design the systems given in Figure-7.1 and Figure-7.2 using MATLAB and then compare its output $y_1[t]$ and $y_2[t]$.

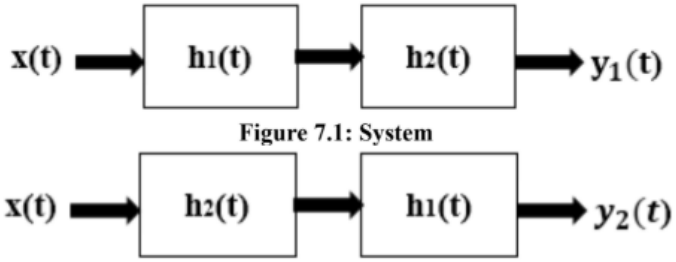


Figure 7.1: System

X(t)

ctep1.m * | ctep2.m | ctep3.m | Untitled3.m

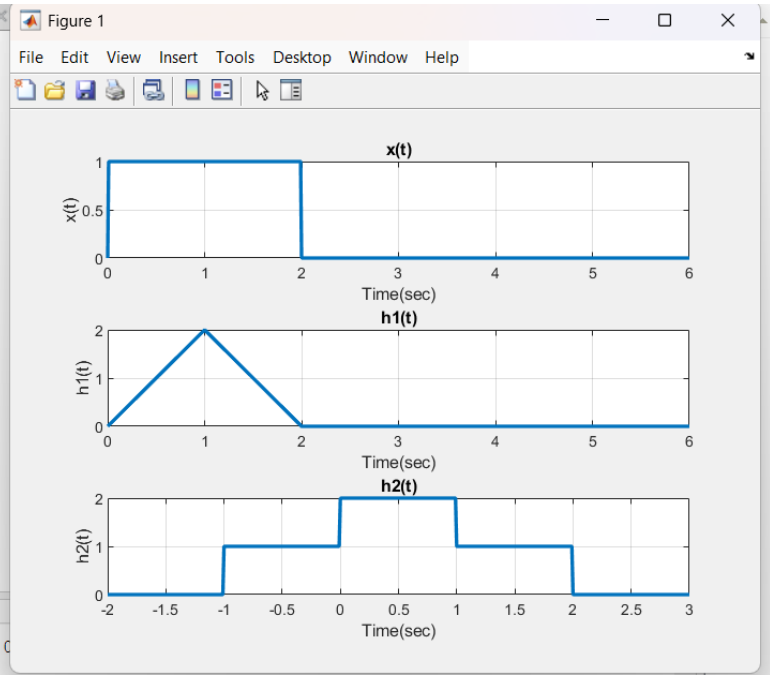
```
1
2   function x1 = ctep1(t1)
3
4   x1 = 1.*(t1>0 & t1<2);
5
6   x1 = x1 + 0*(t1>2);
7
8   subplot(311),plot(t1,x1,'linewidth',2)
9   title('x(t)')
10  grid
11  xlabel('Time(sec)')
12  ylabel('x(t)')
13
14
```

H1(t)

```
function h1 = ctep2(t2)

h1 = 2*t2.*(t2>=0 & t2<1);
h1 = h1 + (-2.*t2+4).*(t2>=1 & t2<2);

subplot(312),plot(t2,h1,'linewidth',2)
title('h1(t)')
grid
xlabel('Time(sec)')
ylabel('h1(t)')
```

H2(t)

```
function h2 = ctep3(t3)

h2 = 0.*(t3<-1);
h2 = h2+1*(t3>=-1 & t3<0);
h2 = h2+2*(t3>=0 & t3<1);
h2 = h2+1*(t3>=1 & t3<2);
h2 = h2+0*(t3>=1);

subplot(313),plot(t3,h2,'linewidth',2)
title('h2(t)')
grid
xlabel('Time(sec)')
ylabel('h2(t)')
```

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• Write down the system response equation of systems in terms of x[t], h1 [t] and h2 [t].

System response equation of systems in terms of x[t], h1 [t]andh2 [t] are:

Y1(t)=x(t)*h1(t)*h2(t)

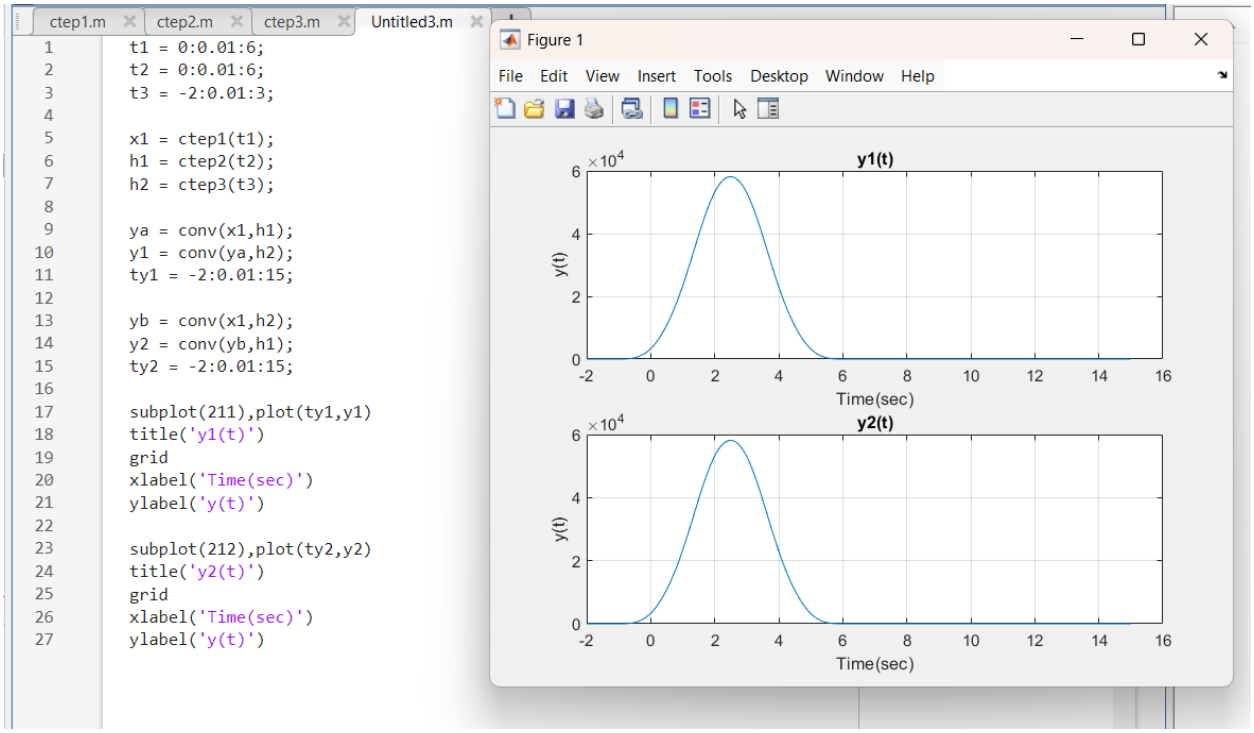
Y2(t)= x(t)* h2(t) *h1(t)

• Write MATLAB code for the system in Figure-1 and Figure-2 using system response equation.

```
ya = conv(x1,h1);
y1 = conv(ya,h2);
ty1 = -2:0.01:15;

yb = conv(x1,h2);
y2 = conv(yb,h1);
ty2 = -2:0.01:15;
```

Plots of Y1(t) and Y2(t)



• Are these plots of y1(t) and y2(t) are similar or different? State the reason for their similarity or difference.

Yes, both the plots y1 and y2 are same according to associative property of convolution x1*(x2*x3) = (x1*x2) *x3

• What will be the time range of the output signals y1 [t] and y2 [t]?

The time range of both the signals will be the sum of lower limits and the upper limits of the signal which will be from -2 to 15

7.2

Design the systems given in Figure-7.7 and Figure-7.8 using MATLAB.

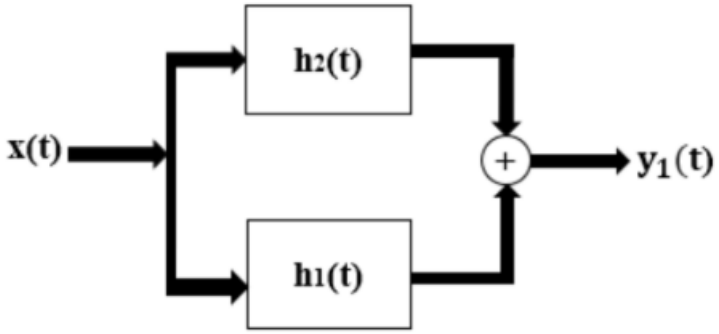


Figure 7.7: System

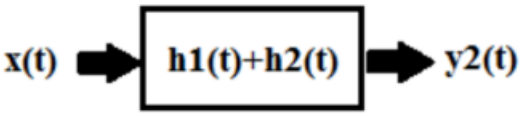


Figure 7.8: System

Plots x(t), h1(t), h2(t)

ctep1.m * | ctep2.m | ctep3.m | Untitled3.m

```
1
2   function x1 = ctep1(t1)
3
4   x1 = 1.*(t1>0 & t1<2);
5
6   x1 = x1 + 0*(t1>2);
7
8   subplot(311),plot(t1,x1,'linewidth',2)
9   title('x(t)')
10  grid
11  xlabel('Time(sec)')
12  ylabel('x(t)')
13
14
```

ctep1.m | ctep2.m | ctep3.m | Untitled3.m

```
function h1 = ctep2(t2)

h1 = 2*t2.*(t2>=0 & t2<1);
h1 = h1 + (-2.*t2+4).*(t2>=1 & t2<2);

subplot(312),plot(t2,h1,'linewidth',2)
title('h1(t)')
grid
xlabel('Time(sec)')
ylabel('h1(t)')
```

ctep1.m | ctep2.m | ctep3.m | Untitled3.m

```
function h2 = ctep3(t3)

h2 = 0.*(t3<-1);
h2 = h2+1*(t3>=-1 & t3<0);
h2 = h2+2*(t3>=0 & t3<1);
h2 = h2+1*(t3>=1 & t3<2);
h2 = h2+0*(t3>=1);

subplot(313),plot(t3,h2,'linewidth',2)
title('h2(t)')
grid
xlabel('Time(sec)')
ylabel('h2(t)')
```

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Figure 1

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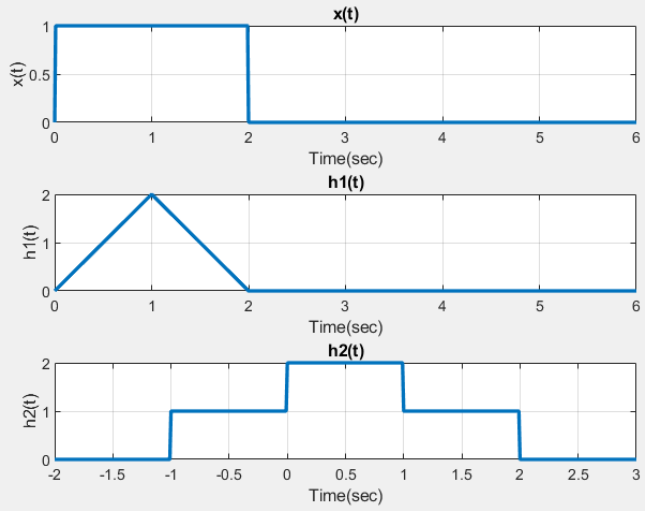


• Write down the system response equation of systems in terms of x[t], h1 [t]andh2 [t].

Y1(t)=x(t)*h2(t)+ x(t)*h1(t)

Y2(t)= x(t)* (h2(t) +h1(t))

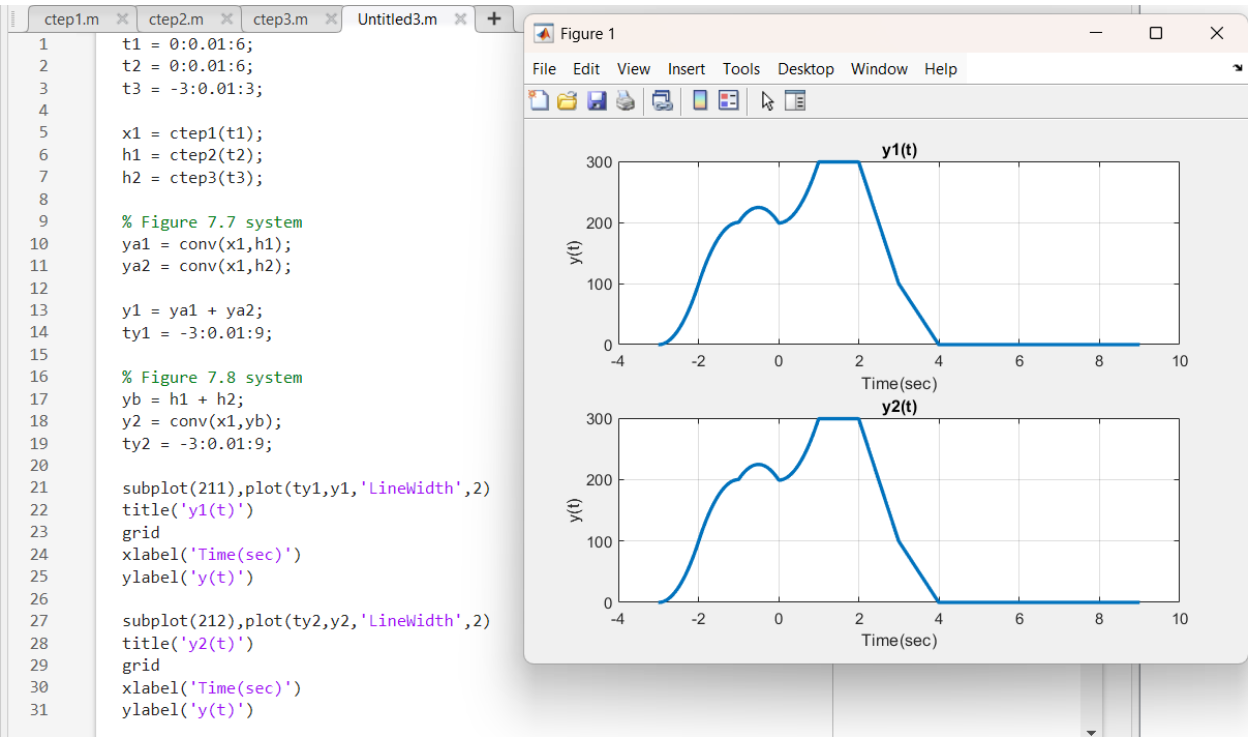
• Write MATLAB code for the system in Figure-7 and Figure-8 using system response equation.

```
% Figure 7.7 system
ya1 = conv(x1,h1);
ya2 = conv(x1,h2);

y1 = ya1 + ya2;
ty1 = -3:0.01:9;

% Figure 7.8 system
yb = h1 + h2;
y2 = conv(x1,yb);
ty2 = -3:0.01:9;
```

Plots of Y1(t) and Y2(t)



• Are these plots of y1(t) and y2(t) are similar or different? State the reason for their similarity or difference.

Yes, both graphs are same according to the distributive property of convolution x1*(x2+x3) = x1*x2+x1*x3

• What will be the time range of the output signals y1 [t] and y2 [t]?

The time range for the output signal will be from -3 to 9 because in both of the signal's convolution and addition both are occurring.

7.3

Design the systems given in Figure-7.9 and Figure-7.10 using MATLAB.

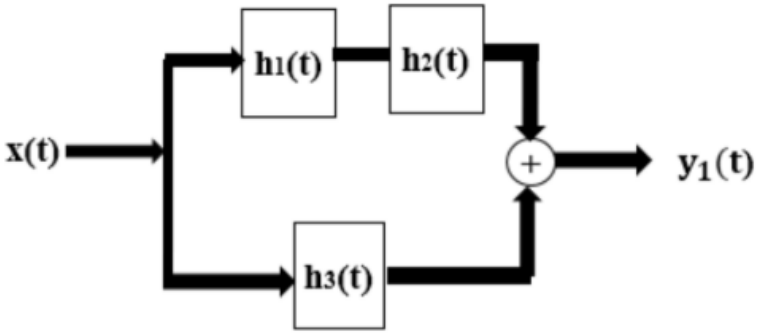


Figure 7.9: System

Plots x(t), h1(t), h2(t), h3(t)

ctep1.m * | ctep2.m | ctep3.m | Untitled3.m | +

```
1
2   function x1 = ctep1(t1)
3
4   x1 = 1.*(t1>0 & t1<2);
5
6   x1 = x1 + 0*(t1>2);
7
8   subplot(311),plot(t1,x1,'linewidth',2)
9   title('x(t)')
10  grid
11  xlabel('Time(sec)')
12  ylabel('x(t)')
13
14
```

ctep1.m | ctep2.m | ctep3.m | Untitled3.m

```
function h1 = ctep2(t2)

h1 = 2*t2.*(t2>=0 & t2<1);
h1 = h1 + (-2.*t2+4).*(t2>=1 & t2<2);

subplot(312),plot(t2,h1,'linewidth',2)
title('h1(t)')
grid
xlabel('Time(sec)')
ylabel('h1(t)')
```

ctep1.m | ctep2.m | ctep3.m | Untitled3.m

```
function h2 = ctep3(t3)

h2 = 0.*(t3<-1);
h2 = h2+1*(t3>=-1 & t3<0);
h2 = h2+2*(t3>=0 & t3<1);
h2 = h2+1*(t3>=1 & t3<2);
h2 = h2+0*(t3>=1);

subplot(313),plot(t3,h2,'linewidth',2)
title('h2(t)')
grid
xlabel('Time(sec)')
ylabel('h2(t)')
```

Figure 1

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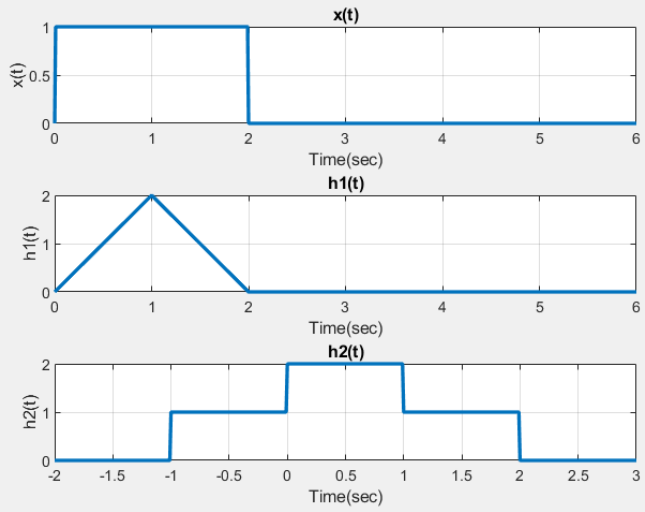

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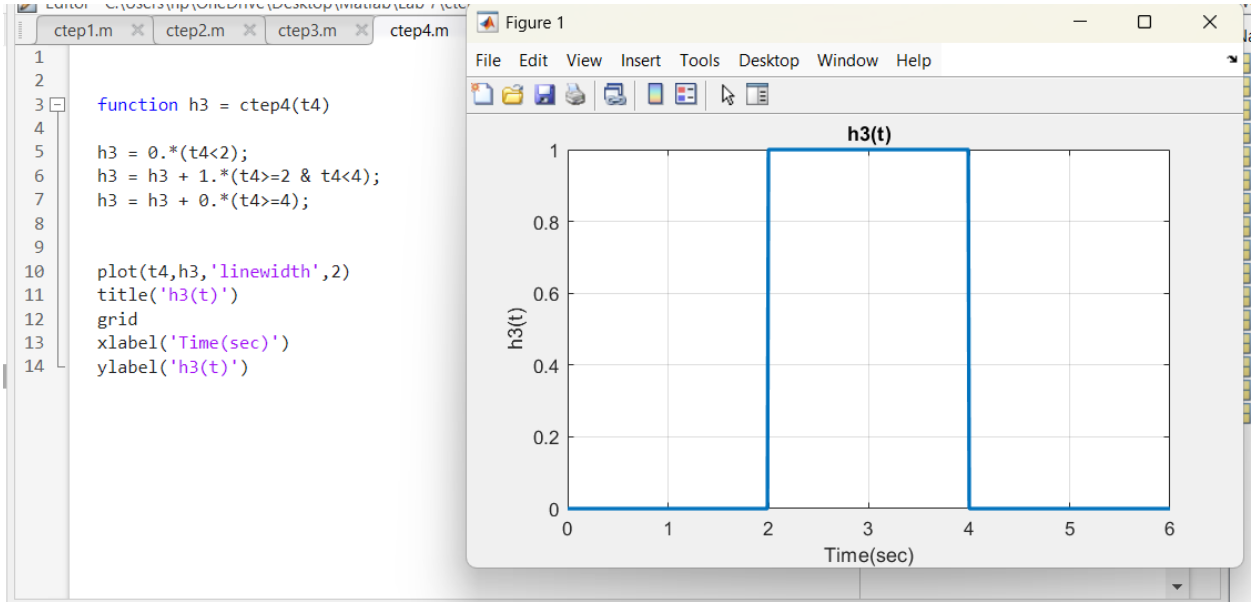


• Write down the system response equation of systems in terms of x[t], h1 [t], h2 [t] and h3 [t].

Y1(t)=x(t)*h1(t)*h2(t)+x(t)*h3(t)

Y2(t)= x(t)* (h1(t)*h2(t)+h3(t))

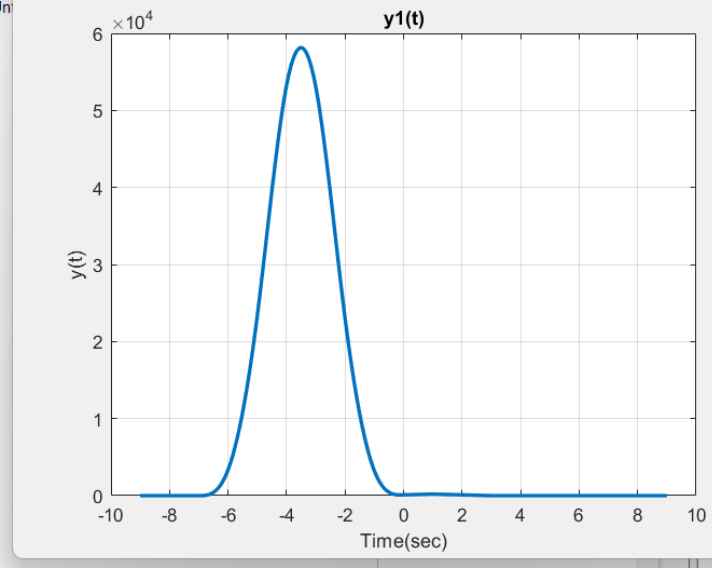
• Write MATLAB code for the system in Figure-9 using system response equation.

```
ya1 = conv(x1,h1);
ya2 = conv(ya1,h2);
ya3 = conv(x1,h3);

y1 = ya2 + ya3;

ty1 = -9:0.01:9;
```

Plot of Y1(t)

ctep1.m | ctep2.m | ctep3.m | ctep4.m

```
t1 = 0:0.01:6;
t2 = 0:0.01:6;
t3 = -3:0.01:3;
t4 = -6:0.01:6;

x1 = ctep1(t1);
h1 = ctep2(t2);
h2 = ctep3(t3);
h3 = ctep4(t4);

ya1 = conv(x1,h1);
ya2 = conv(ya1,h2);
ya3 = conv(x1,h3);

y1 = ya2 + ya3;

ty1 = -9:0.01:9;

plot(ty1,y1,'LineWidth',2)
title('y1(t)')
grid
xlabel('Time(sec)')
ylabel('y(t)')
```



- **What will be the time range of the output signals y1 [t]?**

The time range of the output signal will be from -9 to 9 because the convolution and addition both are occurring in this.