Date / /

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18BIS0043
ECE-1018: Lab
Assessment - 4

1 Graphing convolution of 2 continuous time signals
$y(t) = tri(t) * tri(t)$

2 a] $y[n] = u[n] * u[n]$
b] $y[n] = u[n+2] * rect_3[n]$
c] $y[n] = rect_2[n] * rect_2[n]$
d] $y[n] = rect_2[n] * rect_4[n]$
e] $y[n] = 2rect_4[n] * (7/8)^n u[n]$
f] $y[n] = rect_3[n] * \delta_{14}[n]$
g] $y[n] = rect_1[n] * \sin(2n\pi/9)$
h] $y[n] = rect_2[n] * \sin(2n\pi/9)$
i] $y[n] = rect_4[n] * \sin(2n\pi/9)$
j] $y[n] = 2\cos(2n\pi/7) * (7/8)^n u[n]$

and comment on obsevations

Assessment - 4

1.

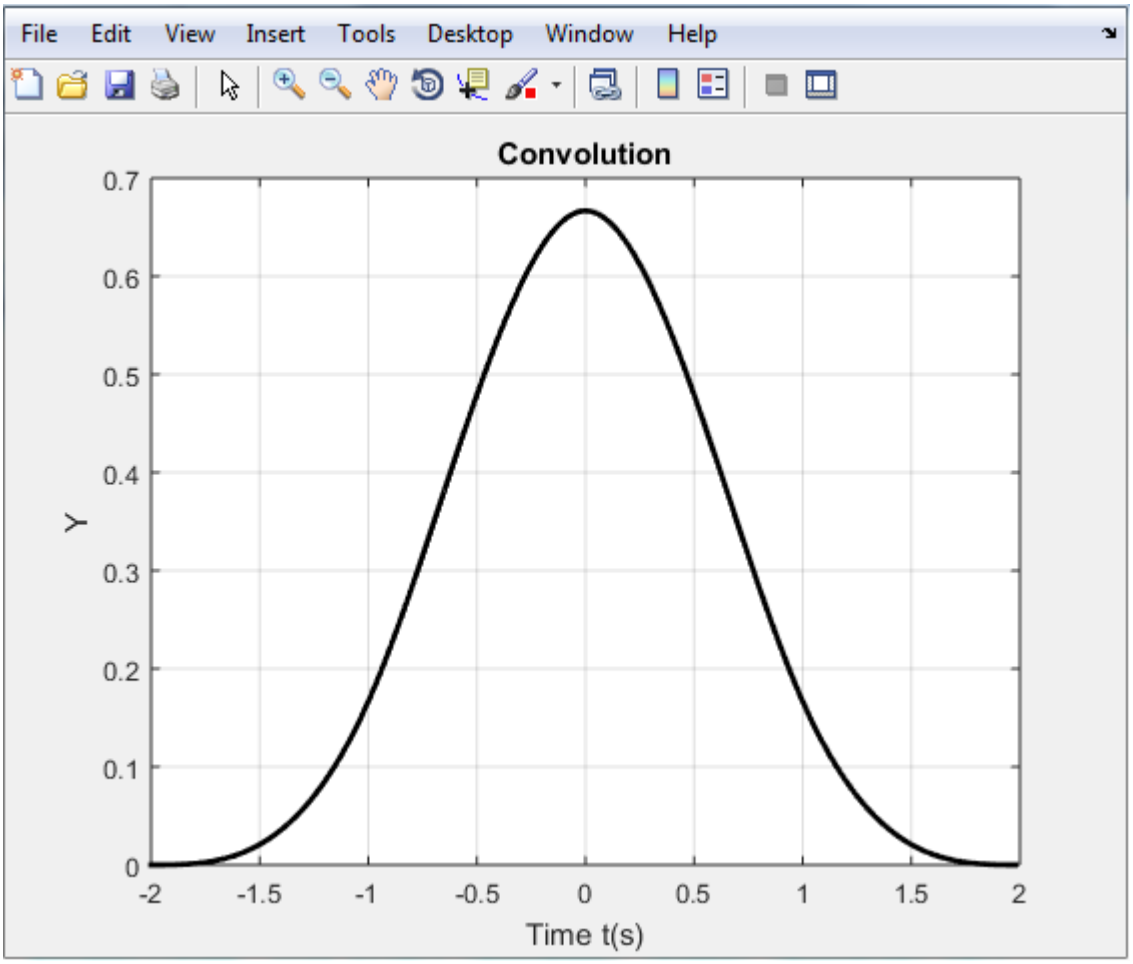
Editor - C:\Users\batch1\Desktop\Allen\T1.m

T1.m | T2.m | T3.m | impND.m | rectD.m | Untitled7 | +

```
clc
clear all
Ts = 0.01;
nx = [-100:99]';
nh = nx;
x = tri(nx*Ts);
h = tri(nh*Ts);
ny = [nx(1) + nx(1):nx(end) + nh(end)]';
y = Ts*conv(x,h);
p = plot((ny*Ts),y,'k');
set(p,'linewidth',2);
grid on;
xlabel('Time t(s)');
ylabel('Y');
title('Convolution');
set(gca);

%xlabel('Time, {\it t}(s)','FontName','Times','FontSize',18);
%ylabel('Y ({\it t})','FontName','Times','FontSize',18);
%title('Convolution','FontName','Times','FontSize',12);
%set(gca,'FontName','Times','FontSize',14);

```

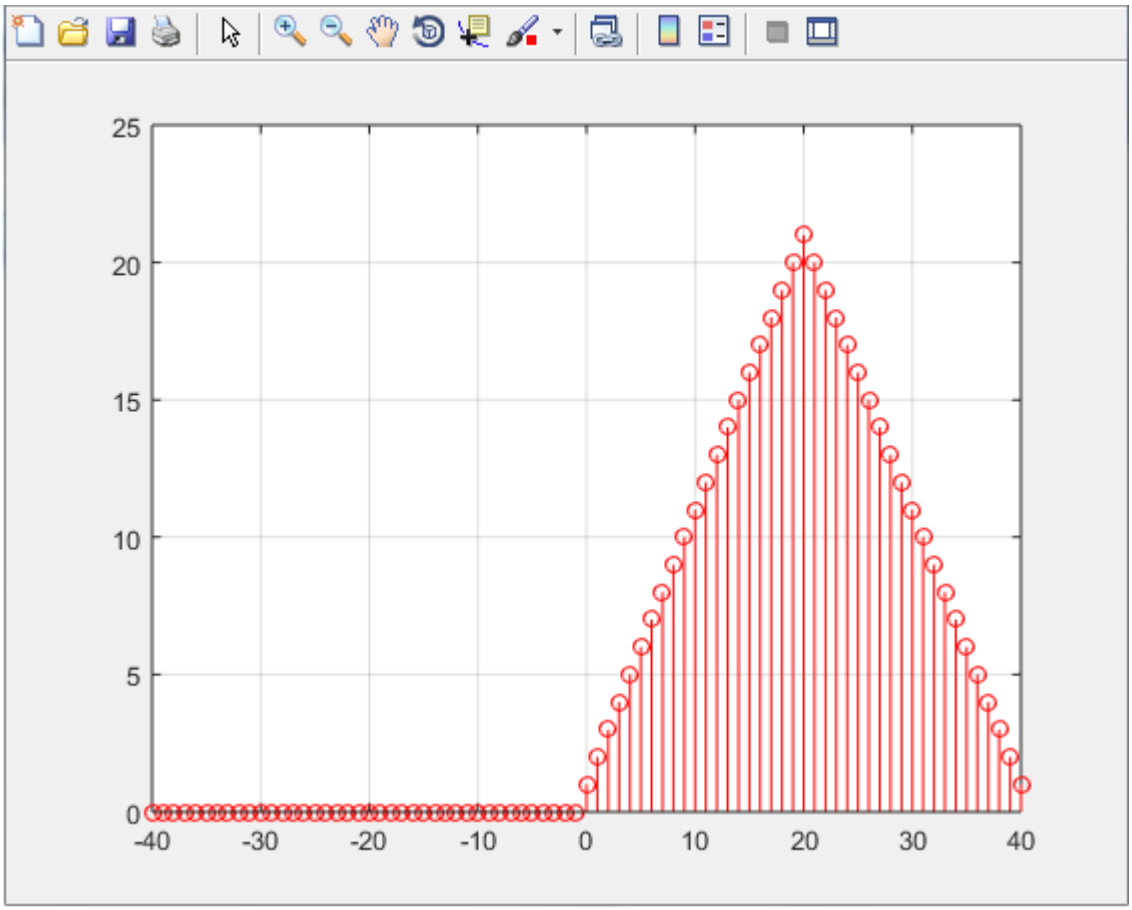

File Edit View Insert Tools Desktop Window Help
Convolution
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Y
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Time t(s)

2a.

Editor - C:\Users\batch1\Desktop\Allen\T3.m

impND.m | rectD.m | T3.m | T4.m | T5.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = usD(n);
5 -    r2 = usD(n);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'r');
9 -    grid on;
```

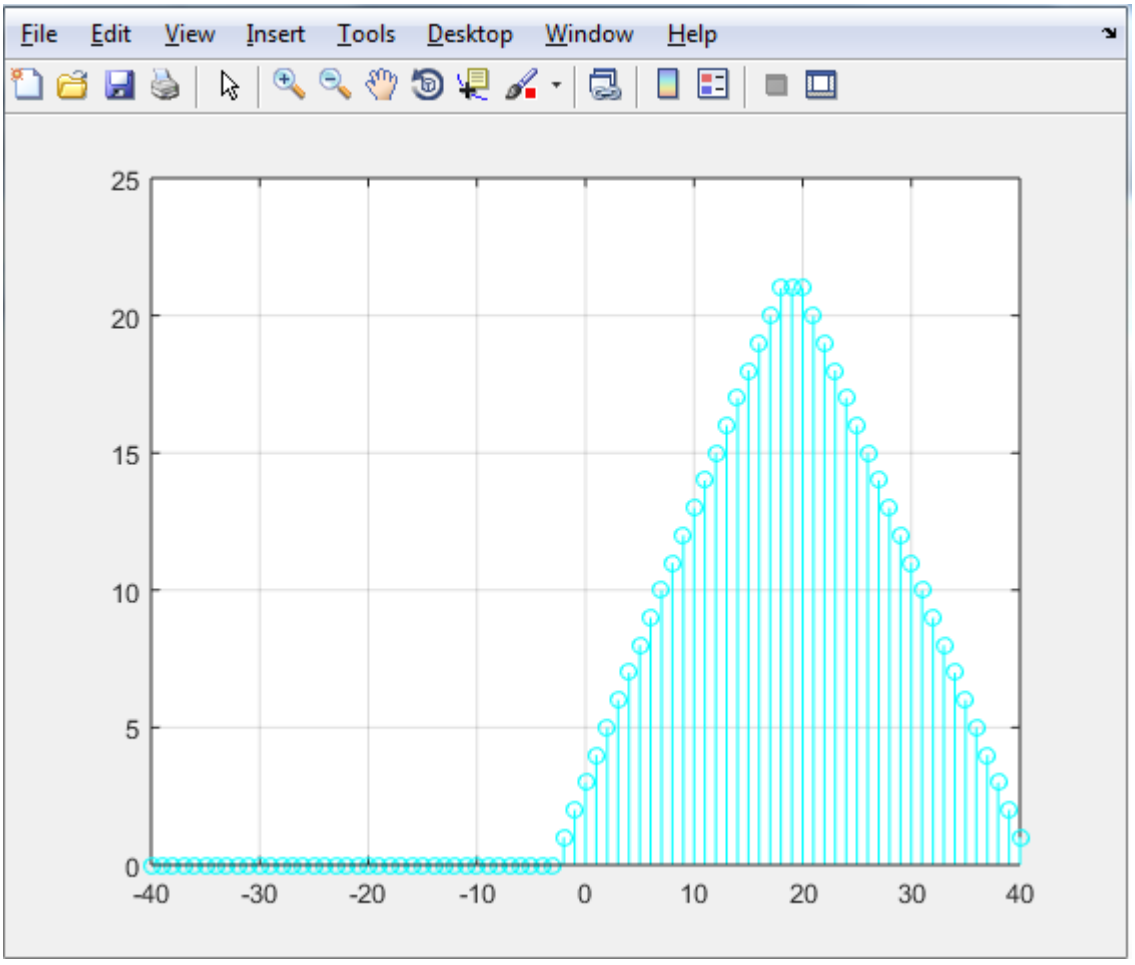


2b.

Editor - C:\Users\batch1\Desktop\Allen\T4.m

impND.m | rectD.m | T3.m | T4.m | T5.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    u1 = usD(n);
5 -    u2 = usD(n+2);
6 -    y = conv(u1,u2);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'c');
9 -    grid on;
```

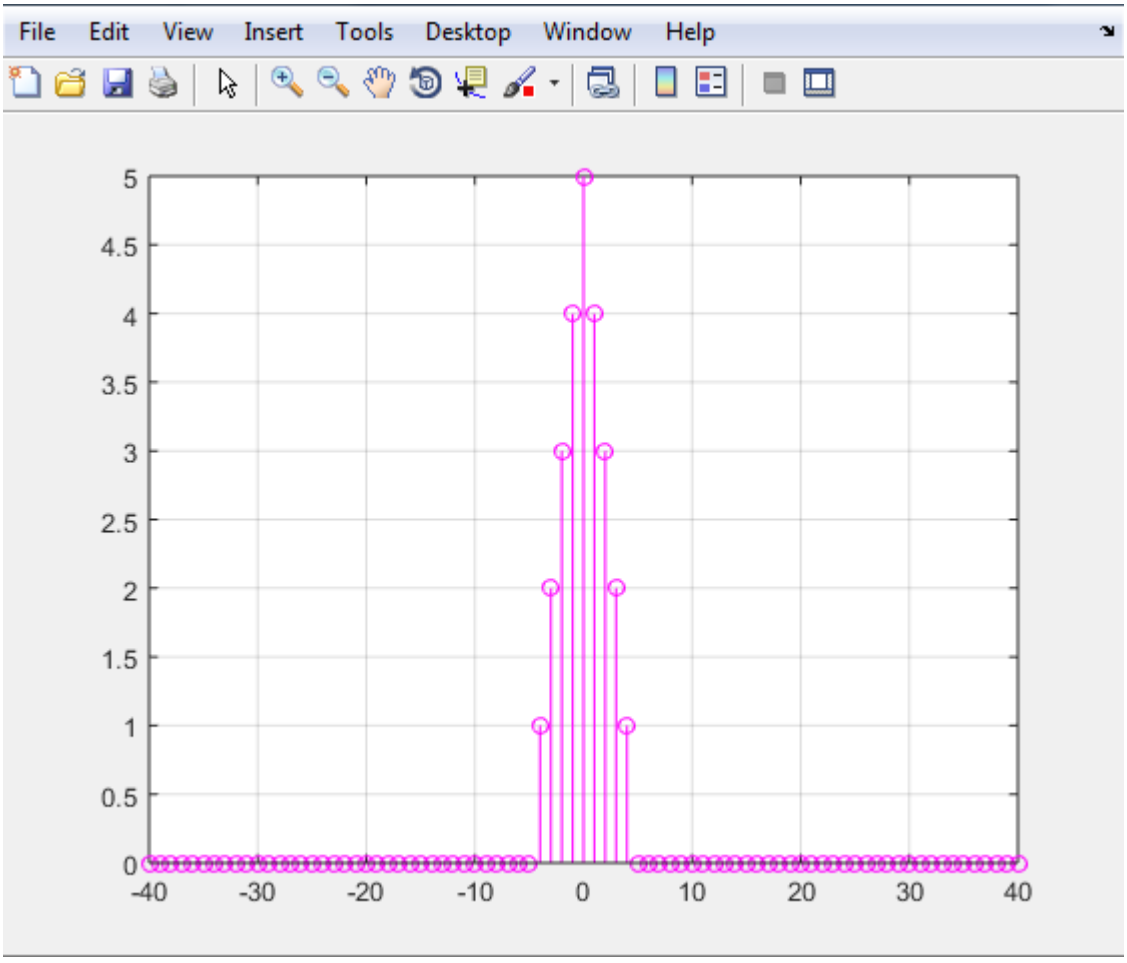


2c.

Editor - C:\Users\batch1\Desktop\Allen\T5.m

impND.m | rectD.m | T3.m | T4.m | T5.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = rectD(2,n);
5 -    r2 = rectD(2,n);
6 -    y = conv(r1,r2);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'m');
9 -    grid on;
```

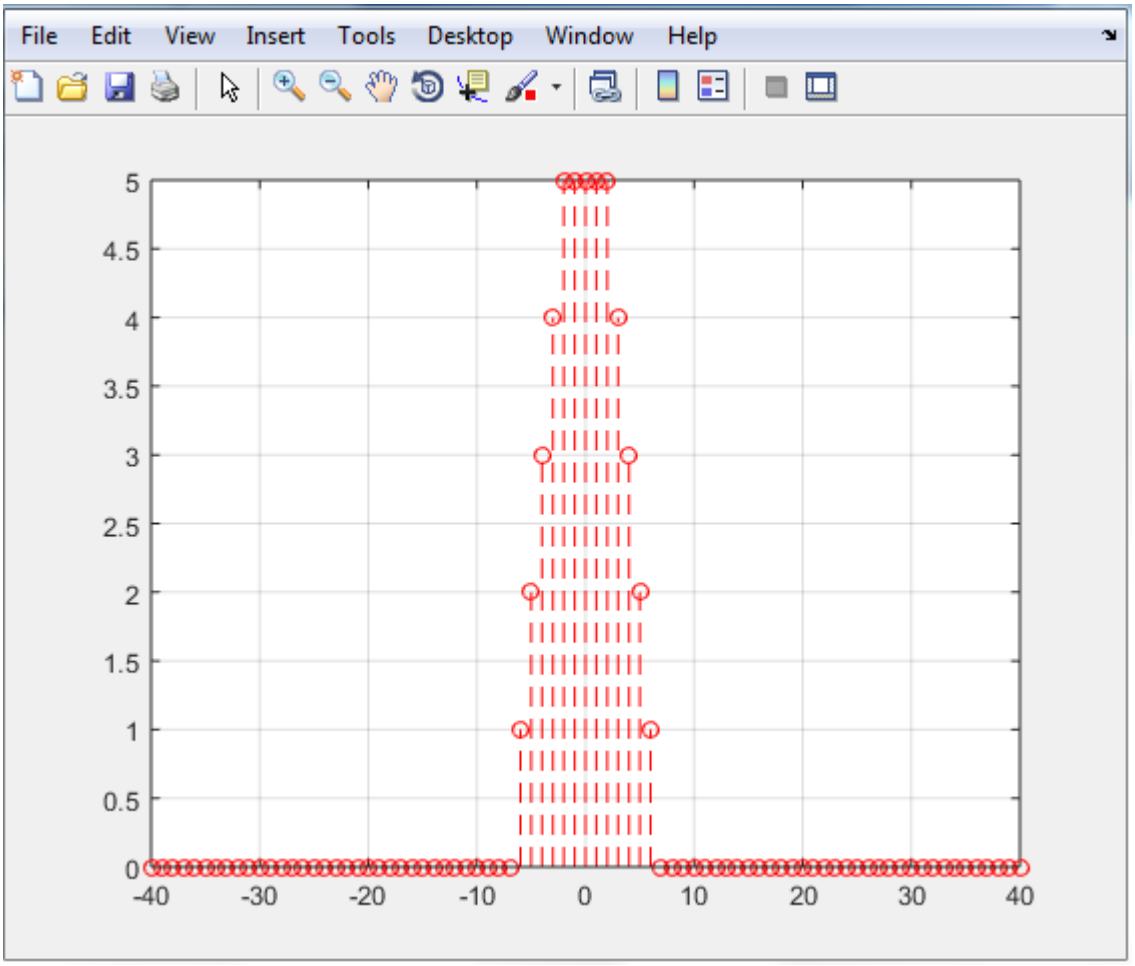


2d.

Editor - C:\Users\batch1\Desktop\Allen\T6.m

impND.m | rectD.m | T3.m | T4.m | T5.m | T6.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = rectD(2,n);
5 -    r2 = rectD(4,n);
6 -    y = conv(r1,r2);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'r','--');
9 -    grid on;
```

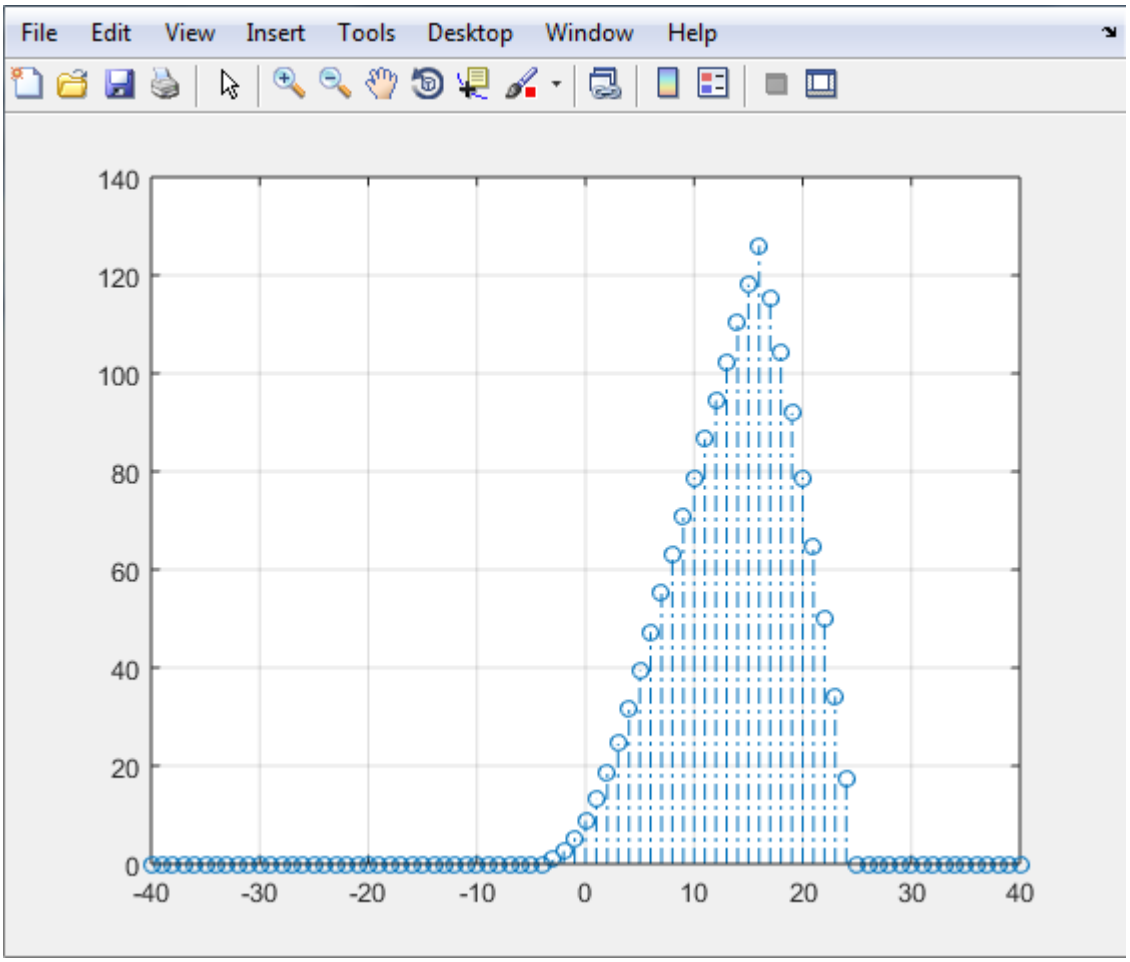


2e.

Editor - C:\Users\batch1\Desktop\Allen\T7.m

impND.m | rectD.m | T3.m | T4.m | T5.m | T6.m | T7.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = (7/8).*n.*usD(n);
5 -    r2 = rectD(4,n);
6 -    y = conv(r1,r2);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'-.');
9 -    grid on;
```

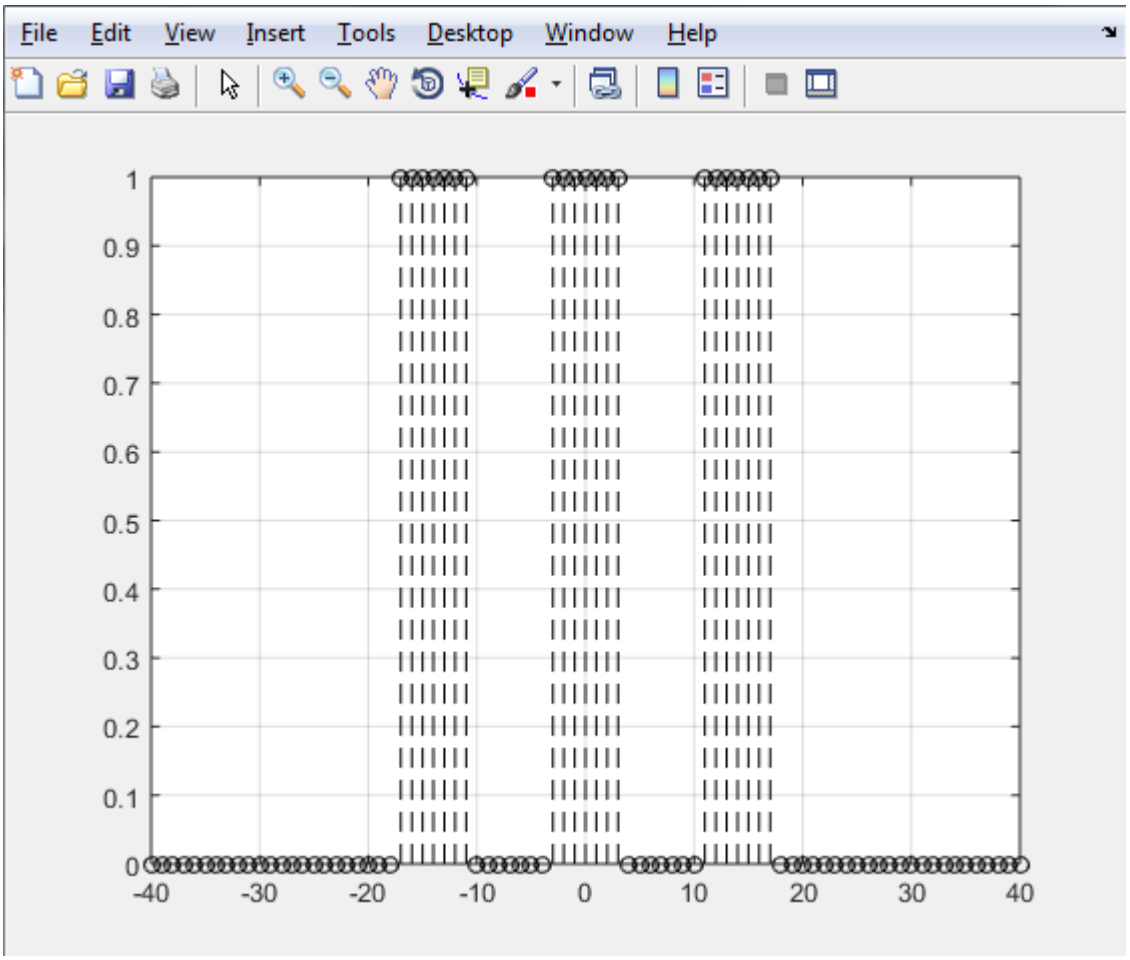


2f.

Editor - C:\Users\batch1\Desktop\Allen\T8.m

impND.m | rectD.m | T7.m | T8.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = impND(14,n);
5 -    r2 = rectD(3,n);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'k','--');
9 -    grid on;
```

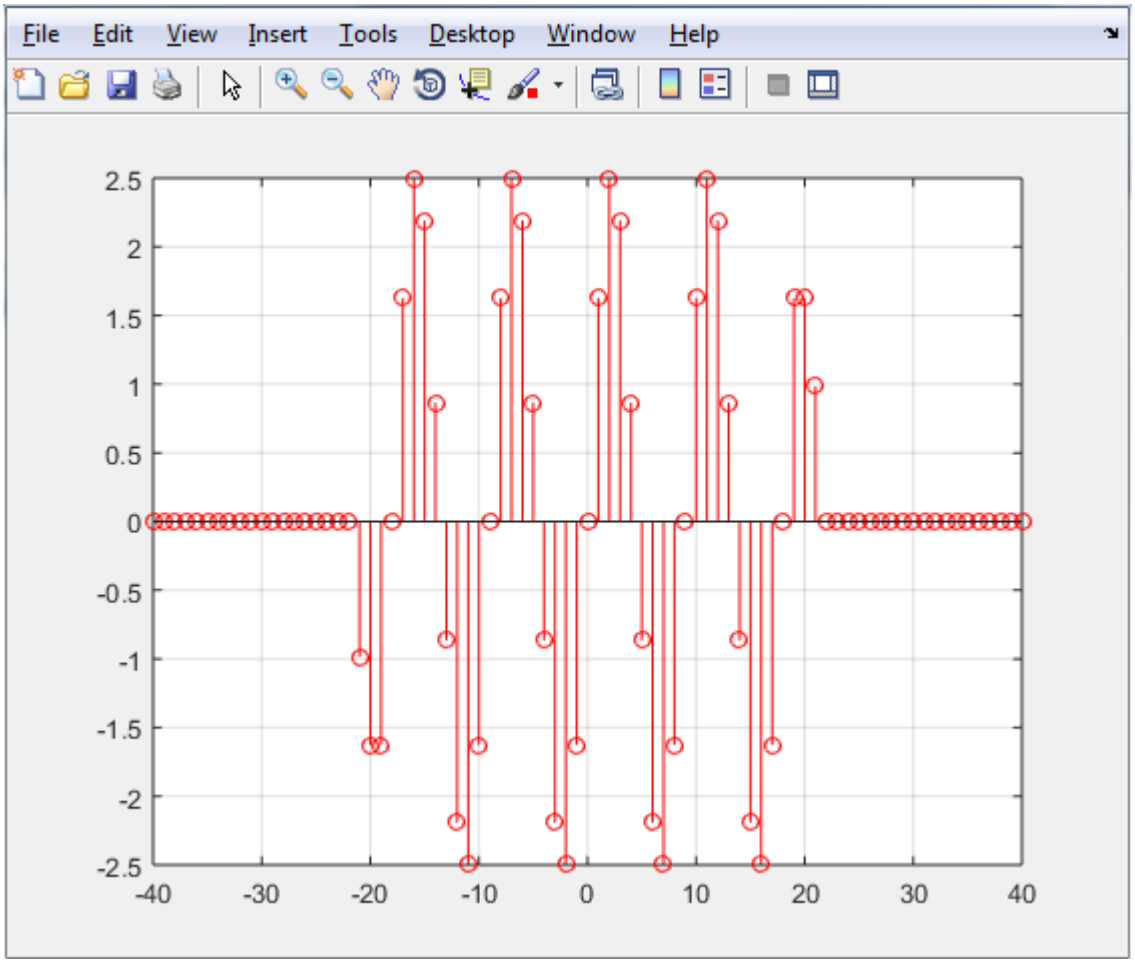


2g.

Editor - C:\Users\batch1\Desktop\Allen\T8.m

impND.m | rectD.m | T7.m | T8.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = sin(2*pi*n/9);
5 -    r2 = rectD(1,n);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'r');
9 -    grid on;
```

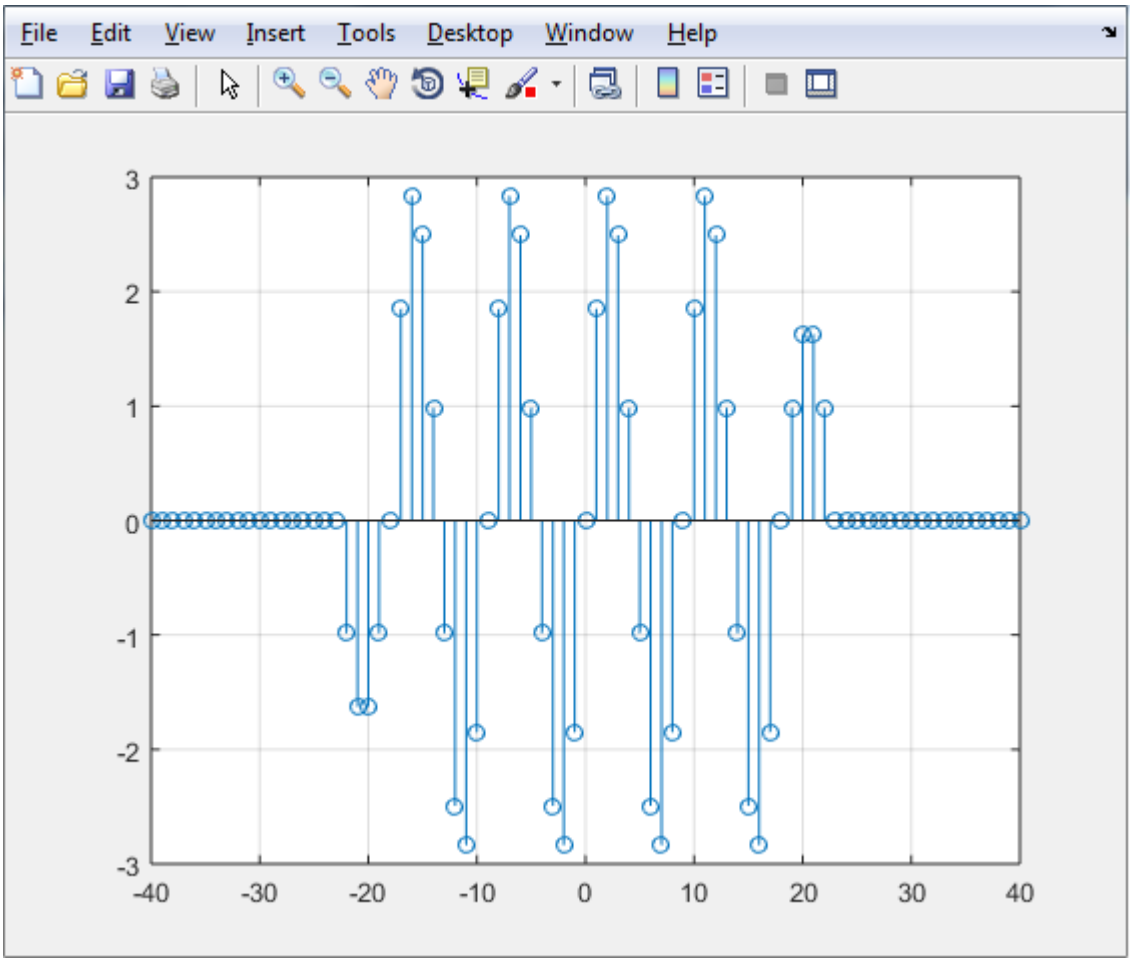


2h.

Editor - C:\Users\batch1\Desktop\Allen\T9.m

impND.m | rectD.m | T7.m | T8.m | T9.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = sin(2*pi*n/9);
5 -    r2 = rectD(2,n);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'o');
9 -    grid on;
```

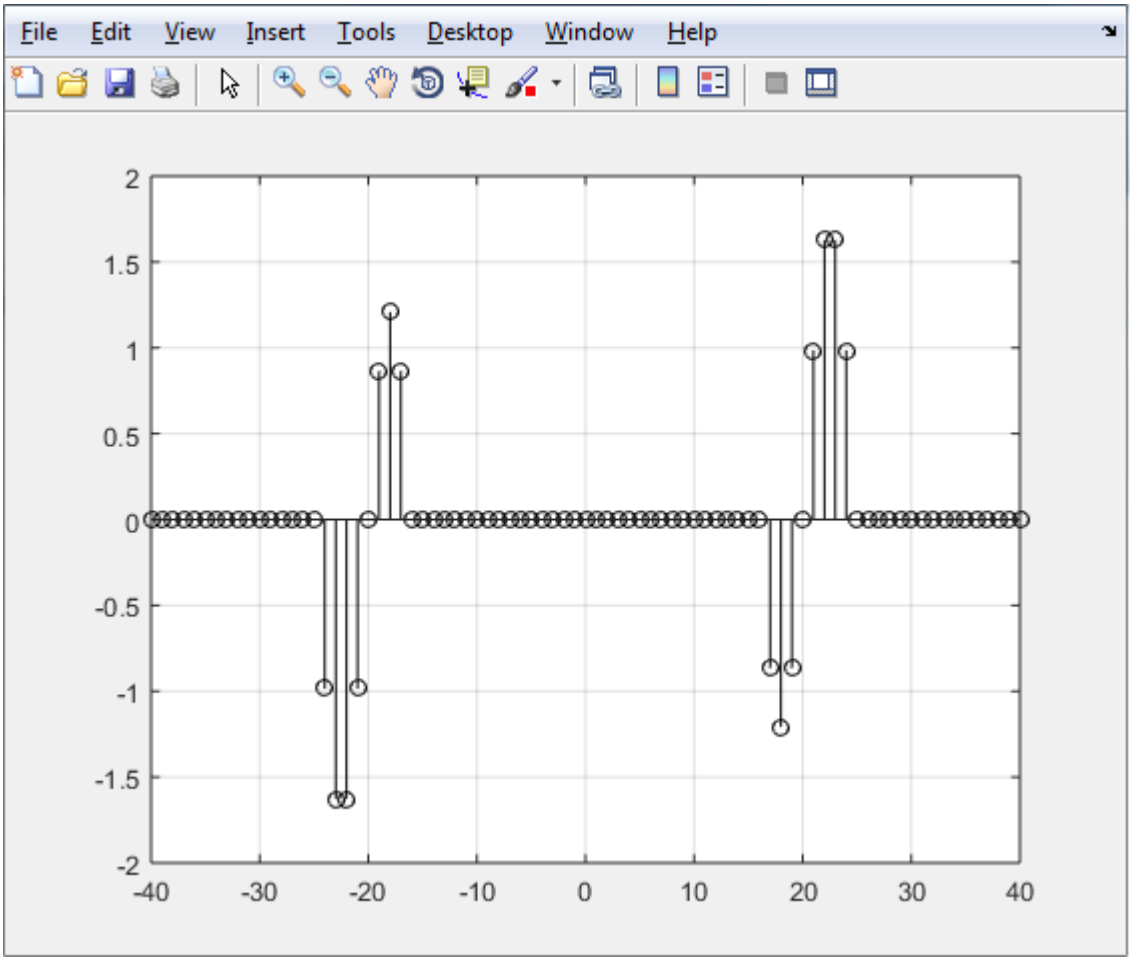


2i.

Editor - C:\Users\batch1\Desktop\Allen\T10.m

impND.m | rectD.m | T7.m | T8.m | T9.m | T10.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = sin(2*pi*n/9);
5 -    r2 = rectD(4,n);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'k');
9 -    grid on;
```

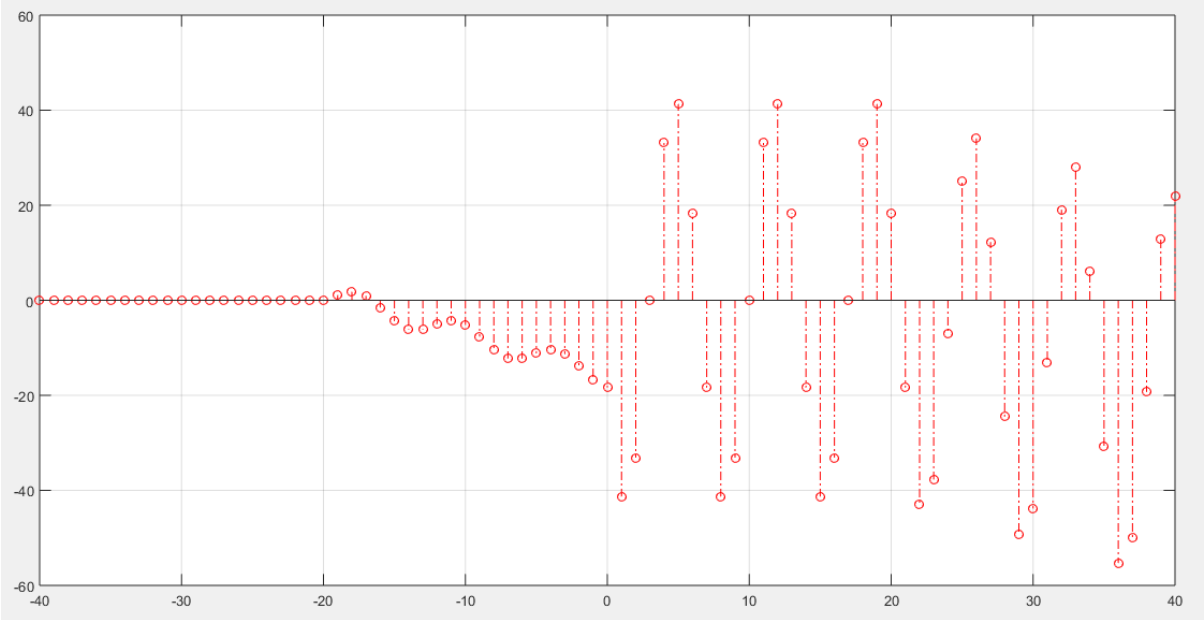


2j.

Editor - C:\Users\batch1\Desktop\Allen\T10.m

impND.m | rectD.m | T10.m

```
1 -    clc
2 -    clear all
3 -    n = -20:1:20;
4 -    r1 = (7/8).*n.*usD(n);
5 -    r2 = 2*cos(2*pi*n/7);
6 -    y = conv(r2,r1);
7 -    ny = (n(1)+n(1))+(0:(length(n)+length(n)-2));
8 -    stem(ny,y,'r','-.');
9 -    grid on;
```



Observations:

a] Triangle obtained after convolution. '0' at all negative values
Increasing: 0 → 20
Decreasing: 20 → 40

b] Graph exists for some negative values
Increasing: -2 → 19
Decreasing: 19 → 40

c] On convoluting 2 rectangular signals of same width, we get a triangular graph from -5 to 5 range and '0' otherwise.

d] Evaluating 2 different width range rectangular signals, trapezoid shaped graph is obtained and will have multiple peak points

e] Increasing: 0 → 15
Decreasing: 15 → 20
Zero: Otherwise

f] Graph exists for 3 rectangle signals for 3 different time intervals, otherwise zero.

g] Signal oscillates as a sinusoidal signal for -2.5 to 2.5, and the graph exists for -20 to 20, zero otherwise. Graph limits are given by the 'n' values given at the beginning of the program.

h] Oscillation: $-3 \rightarrow 3$
Range: $-25 \rightarrow 25$
zero for all the other given values

i] As the width of the rectangle increases, the oscillation reduces and the graph expands
Range: $-30 \rightarrow 30$

j] Unit step = 0, from -20 to 0, so the graph goes in negative y-axis and from '0' it oscillates as a sinusoidal signal since cos is present along with ramp signal.