Lab 4: Prateek Grover

Question 1

```
clc
clear all
close all;

fs = 1000;
t = -30: 1/fs: 30;

y1 = rectpuls(t,8);
y2 = rectpuls(t,16);
y3 = rectpuls(t,40);

L1 = length(y1);
L2 = length(y2);
L3 = length(y3);
f1 = linspace(-fs/2,fs/2,L1);
f2 = linspace(-fs/2,fs/2,L2);
f3 = linspace(-fs/2,fs/2,L3);
y1_ft = fft(y1)/L1;
y2_ft = fft(y2)/L2;
y3_ft = fft(y3)/L3;

figure(1)
subplot(2,1,1)
plot(t,y1)
title('Rectangular Pulse of width T = 4 each side');
ylabel('Amplitude');
xlabel('Time');
ylim([-0.5 1.5])

subplot(2,1,2)
plot(t,fftshift(abs(30*y1_ft)))
title('Frequency Response of Rectangular Pulse of width T = 4 each side');
ylabel('Amplitude');
xlabel('Frequency');
xlim([-1 1])

figure(2)
subplot(2,1,1)
plot(t,y2)
title('Rectangular Pulse of width T = 8 each side');
ylabel('Amplitude');
```

```
xlabel('Time');
ylim([-0.5 1.5])

subplot(2,1,2)
plot(t,fftshift(abs(30*y2_ft)))
title('Frequency Response of Rectangular Pulse of width T = 4 each side');
ylabel('Amplitude');
xlabel('Frequency');
xlim([-1 1])

figure(3)
subplot(2,1,1)
plot(t,y3)
title('Rectangular Pulse of width T = 20 each side');
ylabel('Amplitude');
xlabel('Time');
ylim([-0.5 1.5])

subplot(2,1,2)
plot(t,fftshift(abs(30*y3_ft)))
title('Frequency Response of Rectangular Pulse of width T = 20 each side');
ylabel('Amplitude');
xlabel('Frequency');
xlim([-1 1])
```
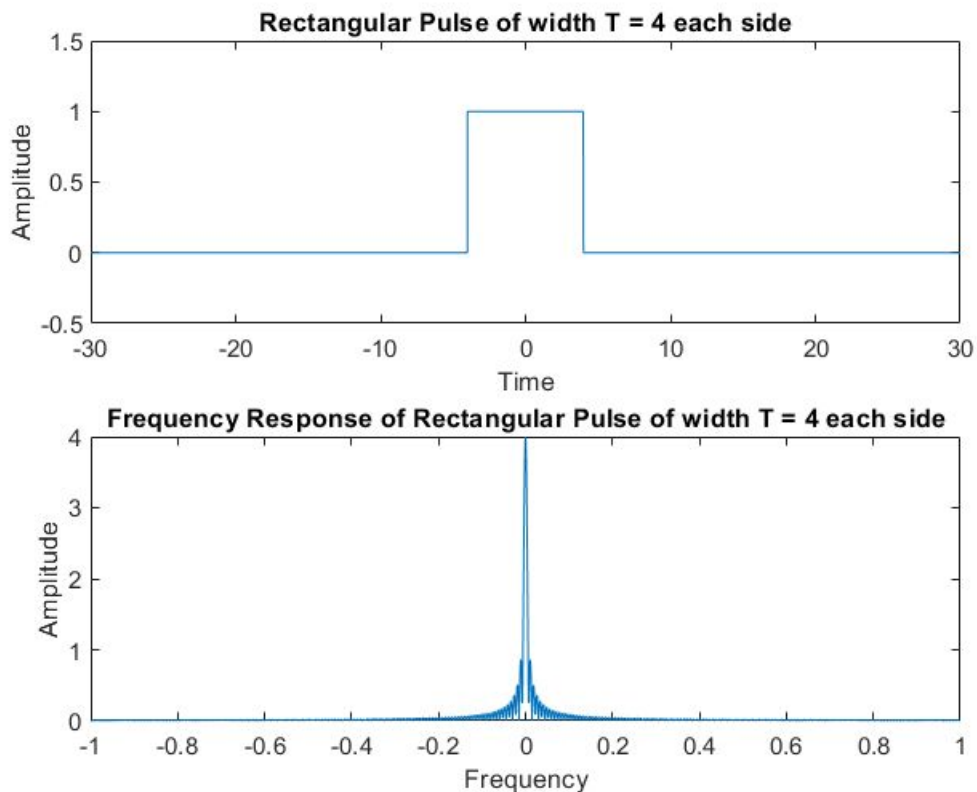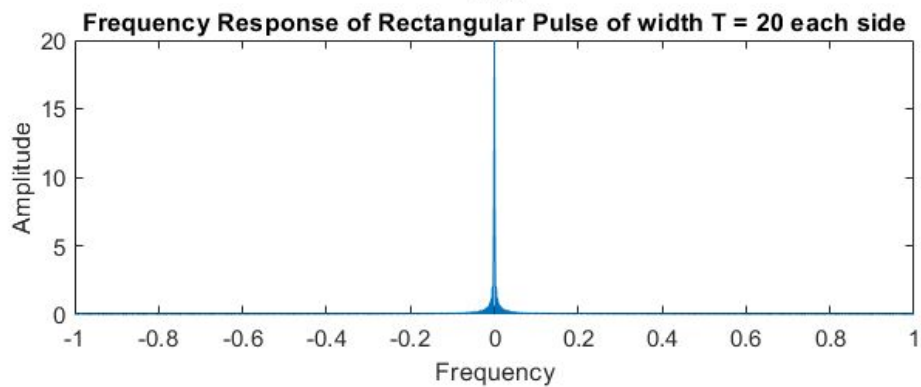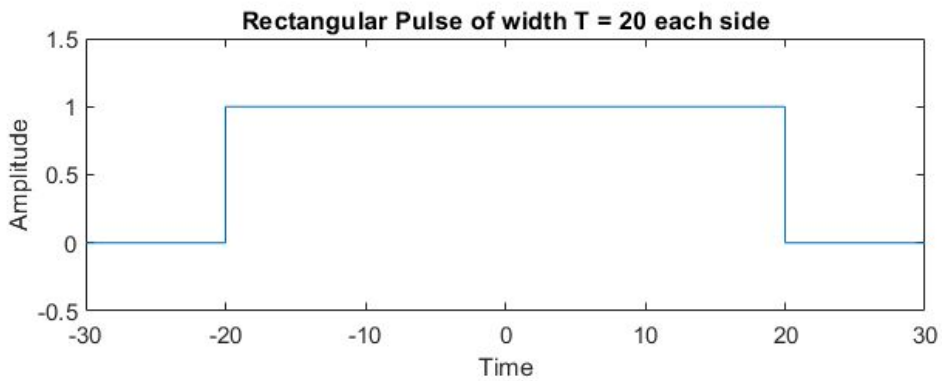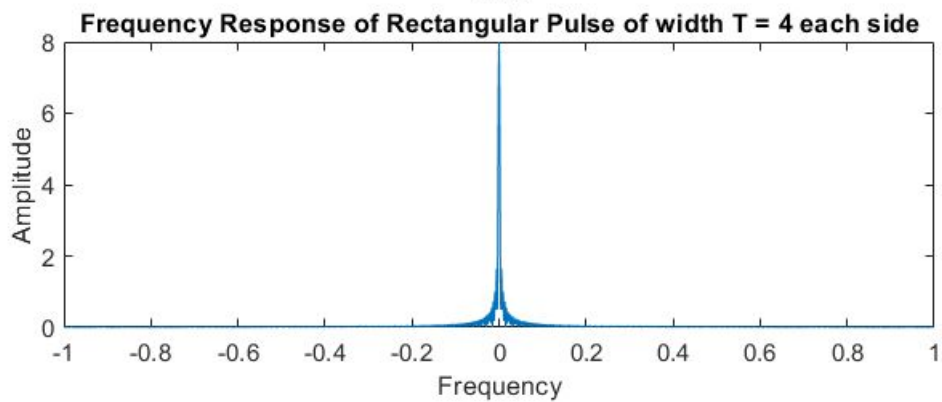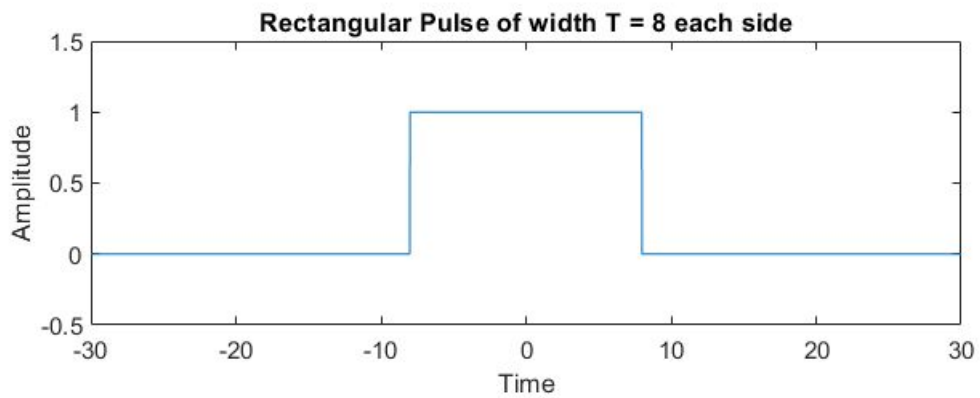
Rectangular Pulse of width T = 8 each side

Frequency Response of Rectangular Pulse of width T = 4 each side

Rectangular Pulse of width T = 20 each side

Frequency Response of Rectangular Pulse of width T = 20 each side

Question 2

```
%Given Frequency Response of Signal G(f)
f = -4.01: 0.01:4;
G_f = 2*rectpuls(f,8);

%g(t) : Impulse Response of G(f)
fs = 1000;
t = -2*8:1/fs:2*8;
g_t = 8*sinc(8*t);

%Input to system is x(t)
x_t = rectpuls(t,8);

%Output of system is y(t)
y_t = conv(x_t,g_t,'same');

figure(1)

subplot(2,2,1)
plot(f,G_f)
title('G(f)')
ylabel('Amplitude');
xlabel('Frequency');
xlim([-5 5])
ylim([0 2.5])

subplot(2,2,2)
plot(t,g_t);
title('g(t)')
ylabel('Amplitude');
xlabel('Time');
xlim([-10 10])
ylim([-5 10])

subplot(2,2,3)
plot(t,x_t);
ylabel('Amplitude');
xlabel('Time');
title('x(t)')
xlim([-5 5])
ylim([0 1.5])

subplot(2,2,4)
plot(t,y_t);
title('x(t)*g(t)')
ylabel('Amplitude');
```
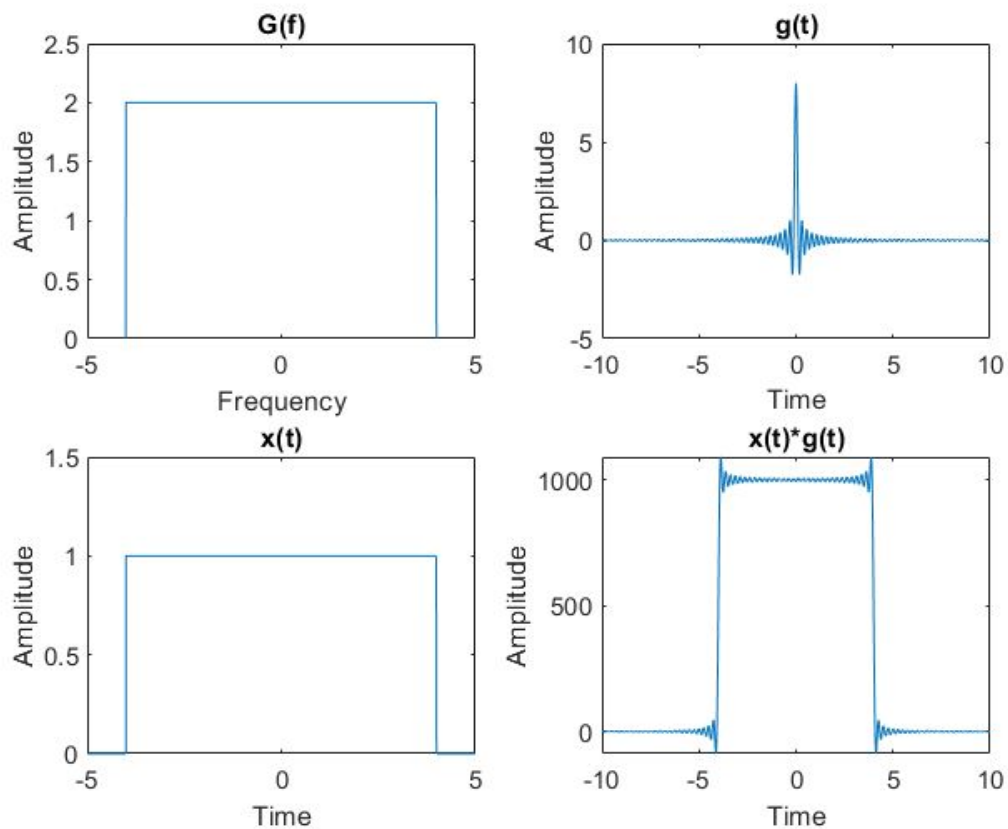
```
xlabel('Time');
xlim([-10 10])
```

G(f)

g(t)

x(t)

x(t)*g(t)

Question 3

```
clc
clear all
close all

fs = 2000;
t = -30:1/fs:30;
y1 = sinc(t);
y2 = cos(2000*pi*t);
y = y1.*y2;

figure(1)
subplot(2,1,1)
plot(t,y)
title('Time Domain Signal : sinc(t).cos(2000*pi*t)')
ylabel('Amplitude');
xlabel('Time');
```

```
N = length(y);
f = linspace(-fs/2,fs/2,N);
y_f = fft(y)/N;

subplot(2,1,2)
plot(f,fftshift(abs(y_f)))
title('Frequency Domain Signal for sinc(t).cos(2000*pi*t)')
ylabel('Frequency');
xlabel('Time');
xlim([-2000 2000])
```


Time Domain Signal : sinc(t).cos(2000*pi*t)

Frequency Domain Signal for sinc(t).cos(2000*pi*t)