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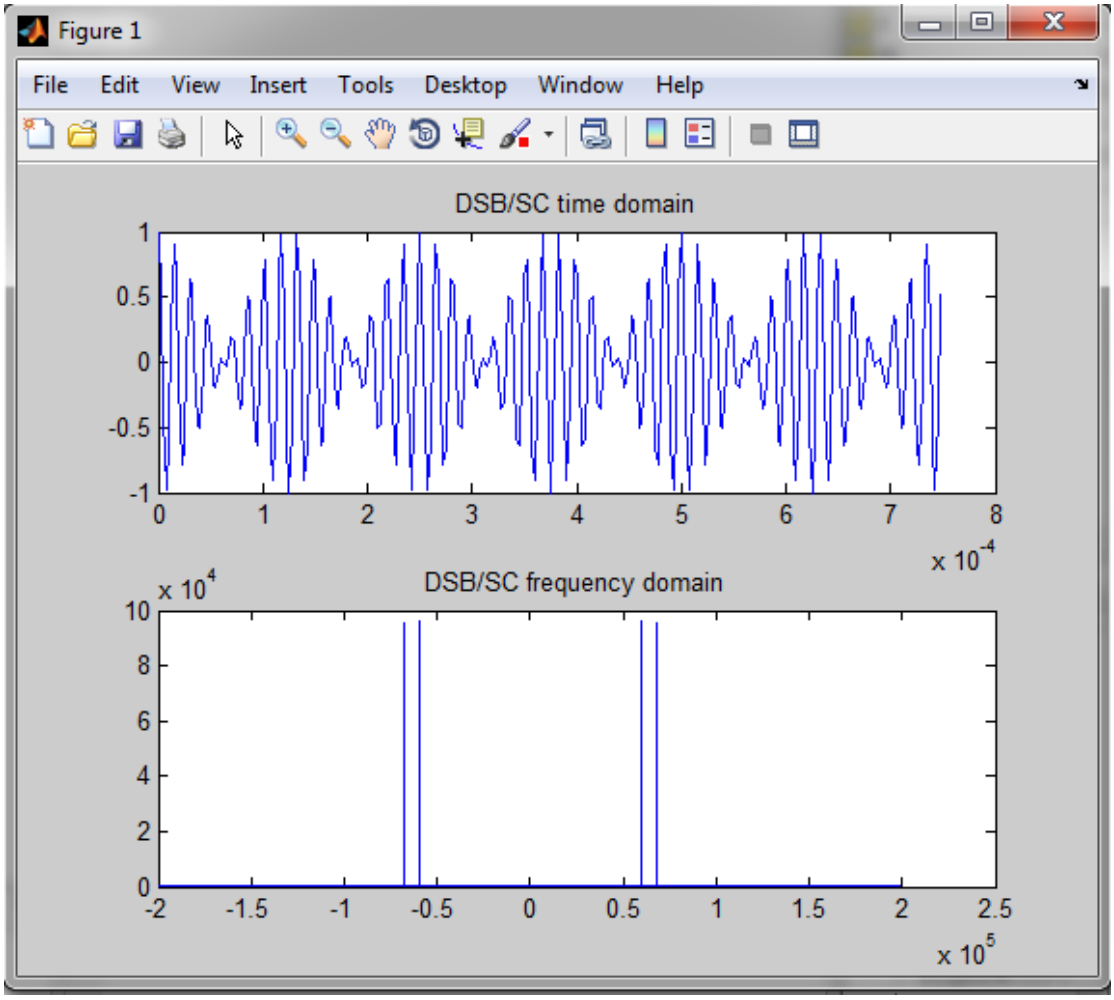
3TR4 Pre-Lab Lab#2

Part 2.a)

```
clear; clc;
f1 = 4000; f2 = 64000;
rate= 400e3;
t = 0:(1/400e3):1;
time_domain = cos(2*pi*f1*t).* cos(2*pi*f2*t);
frequency_domain = fftshift(fft(time_domain));
f=[-rate/2:(length(frequency_domain)/rate):(rate/2)+1];
figure(1);
subplot (2,1,1);
plot(t(1:300), time_domain(1:300));
title('DSB/SC time domain');
subplot (2,1,2);
plot(f,abs(frequency_domain));
title('DSB/SC frequency domain');
```



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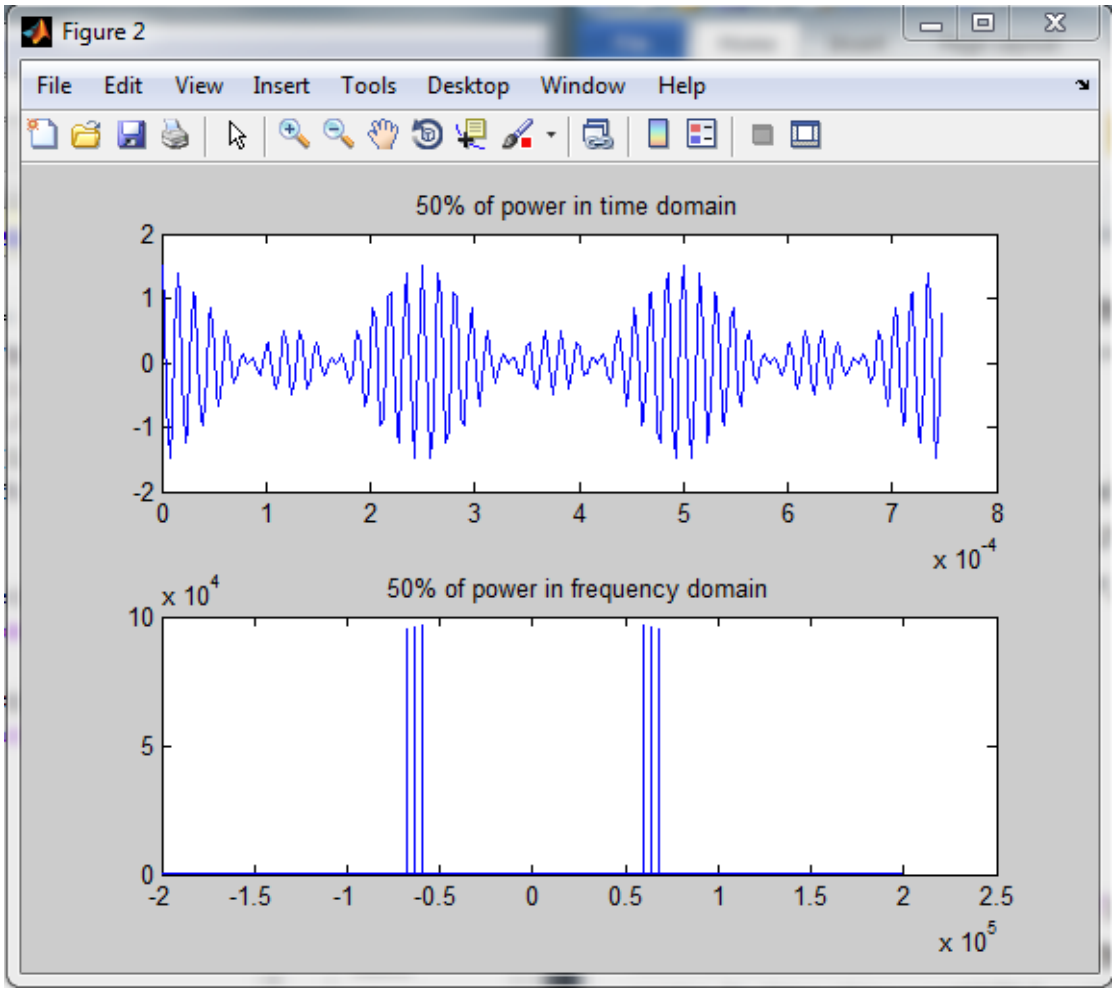
Part 2.b)

Case 1 (The carrier power is 50% of the total power in the two sidebands):

```
f1 = 4000;f2 = 64000; rate= 400e3; range = 1:300;t = 0:(1/rate):1;
time = cos(2*pi*f1*t).* cos(2*pi*f2*t);
frequency = fftshift(fft(time));
f= [-rate/2:(length(frequency)/rate):(rate/2)+1];
carrier_50_time = time + sqrt(1/4) * cos(2*pi*f2*t);
carrier_50_frequency = fftshift(fft(carrier_50_time));
figure(2);
subplot (2,1,1);
plot(t(range), carrier_50_time(range));
title('50% of power in time domain');
subplot (2,1,2);
plot(f,abs(carrier_50_frequency));
title('50% of power in frequency domain');
```



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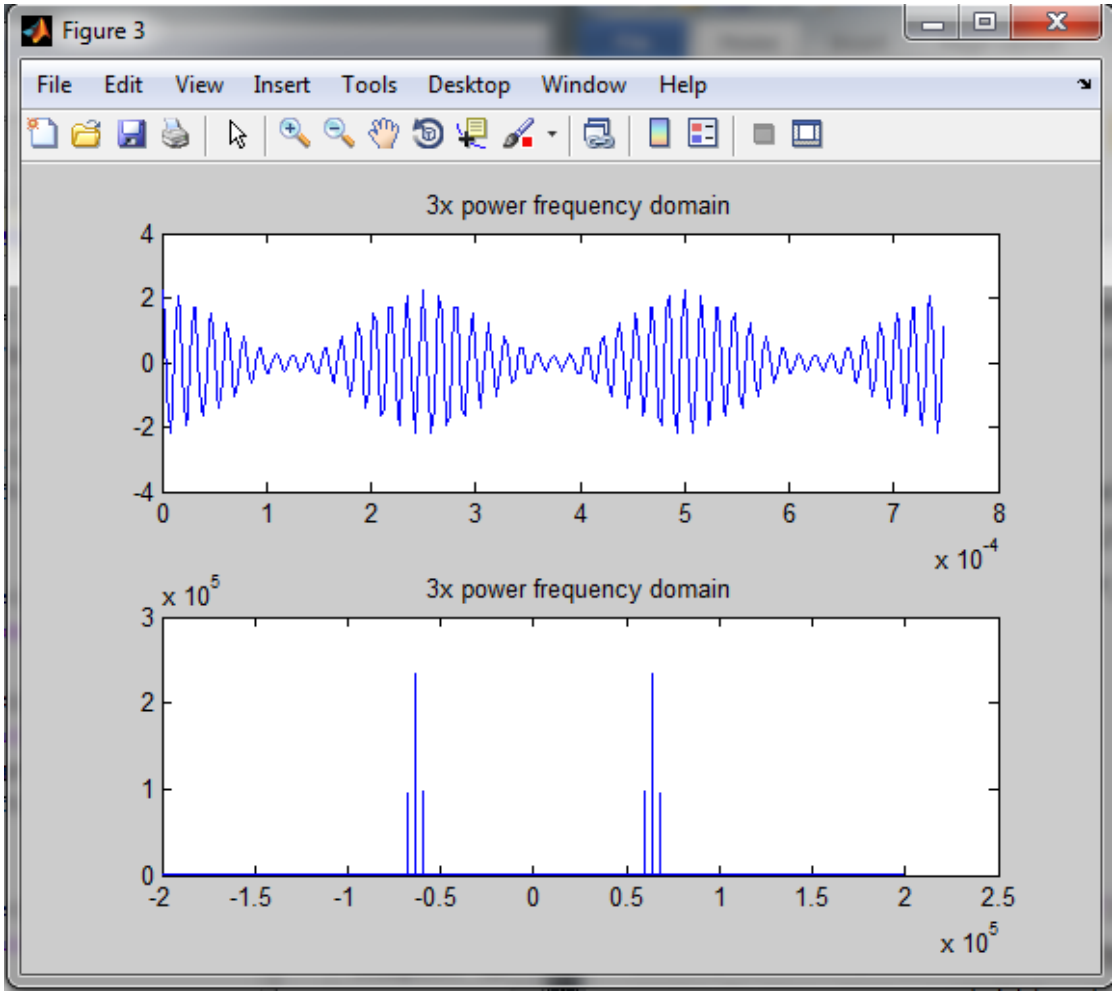
Case 2 (The carrier power is 3 times the total power in the two sidebands:

```
carrier_3x_time = time + sqrt(3/2) * cos(2*pi*f2*t);
carrier_3x_frequency = fftshift(fft(carrier_3x_time));
figure(3);
subplot (2,1,1);
plot(t(range), carrier_3x_time(range));
title('3x power frequency domain');
subplot(2,1,2);
plot(f,abs(carrier_3x_frequency));
title('3x power frequency domain');
```



Case 3 (The carrier power is more than 3 times the total power in the two sidebands:

```
greaterthan3x_time =  time + 3*cos(2*pi*f2*t);
greaterthan3x_frequency = fftshift(fft(greaterthan3x_time));
figure(4);
subplot (2,1,1);
plot(t(range), greaterthan3x_time(range));
title('More than 3x power frequency domain');
```

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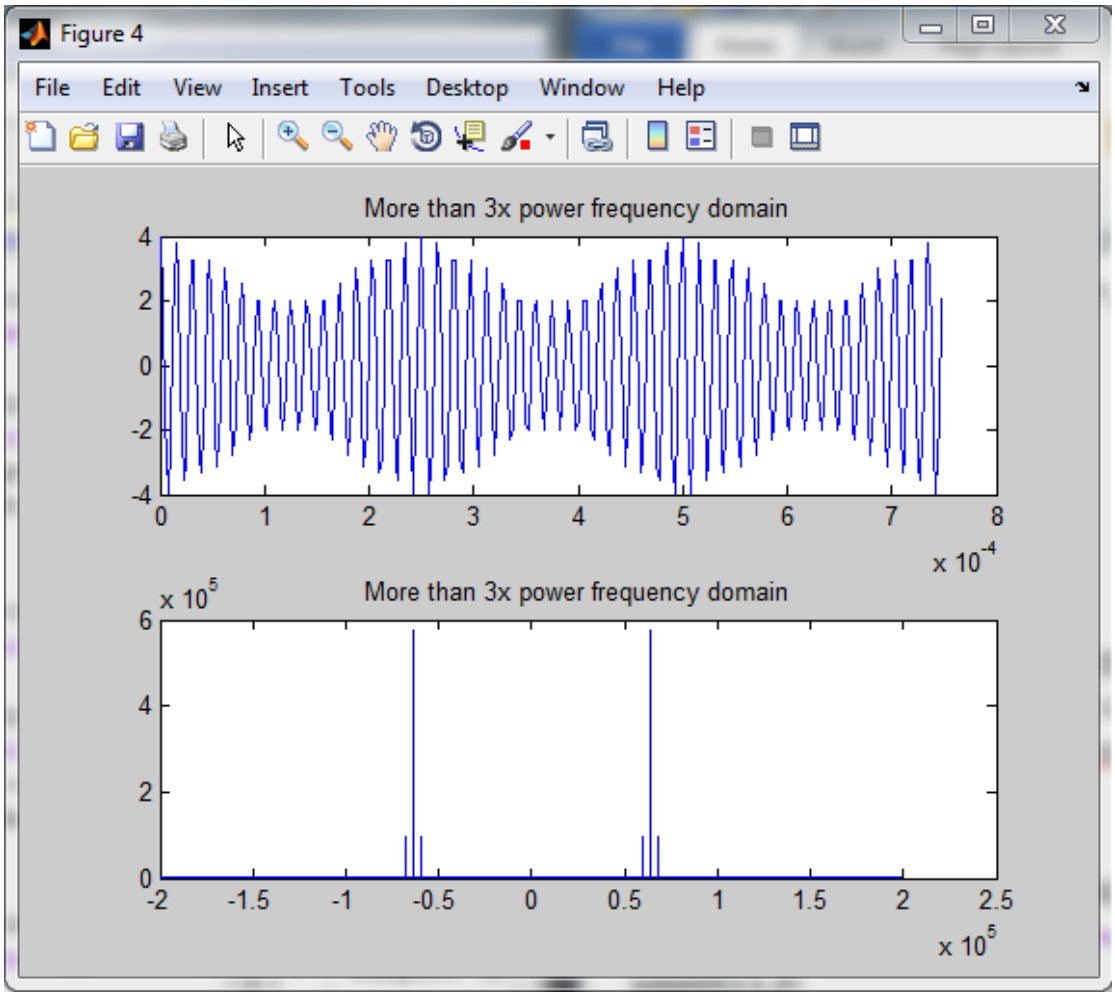
```
subplot(2,1,2);
plot(f,abs(greaterthan3x_frequency));
title('More than 3x power frequency domain');
```



Part 2.c)

```
rate= 400e3;f1 = 4000;f2 = 64000;range = 1:300;t = 0:(1/ rate):1;
time = cos(2*pi*f1*t).* cos(2*pi*f2*t);frequency = fftshift(fft(time));
f=[- rate/2:(length(frequency)/ rate):(rate/2)+1];
Demod_message_time = cos (2*pi*f2*t).* time;
Demod_message_frequency = fftshift(fft(Demod_message_time));
figure(5);
subplot(2,1,1);
plot (t(range), Demod_message_time (range));
title('Demodulated message in Time Domain');
subplot(2,1,2);
plot (f, abs(Demod_message_frequency));
title('Demodulated message in Frequency Domain');
```

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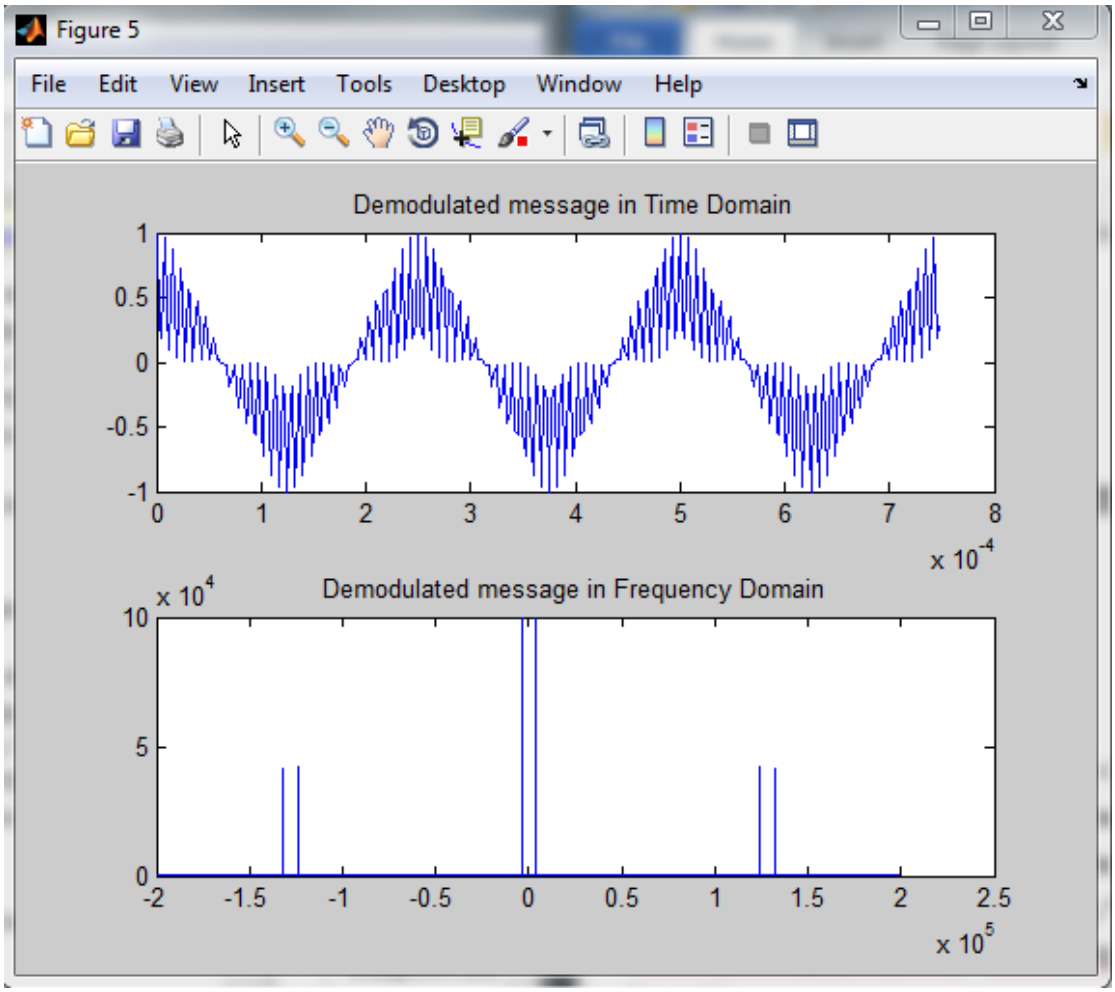

Part 3)

i) In part 2.(a) the message signal is multiplied by cos(2*Pi*f*t) therefore in time domain we get the envelope multiplied by cos(2*Pi*f*t). So the message signal is just shifted up and down by frequency f in the frequency domain.

ii) In part 2.(b part 1) the carrier component (with frequency f1) was added and multiplied by cos(2*Pi*f2*t) in the time domain which means that in the frequency domain the signal gets shifted up and down by f2. Also the carrier impulses are found at f2 +/- f1, and at –f2 +/- f1.

iii) In part 2.(b part 2) the power of the carrier is increased by 3x the original. Therefore in the frequency domain the carrier is more dominant then the side bands.

iv) In part 2.(b part 3) the power of the carrier is increased furthermore, thus resulting in an even more dominant presence of the carrier pulse in the frequency domain.