CMPE 362

Homework 1 Report

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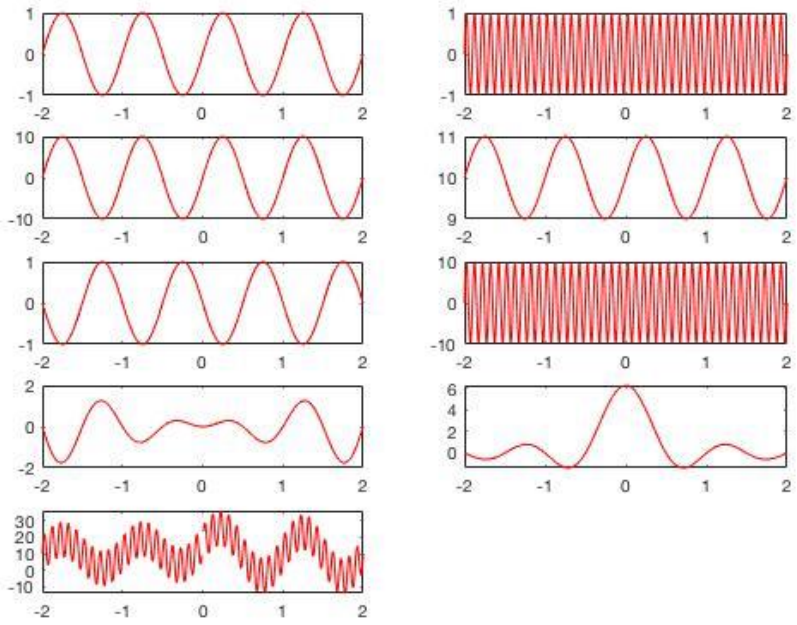
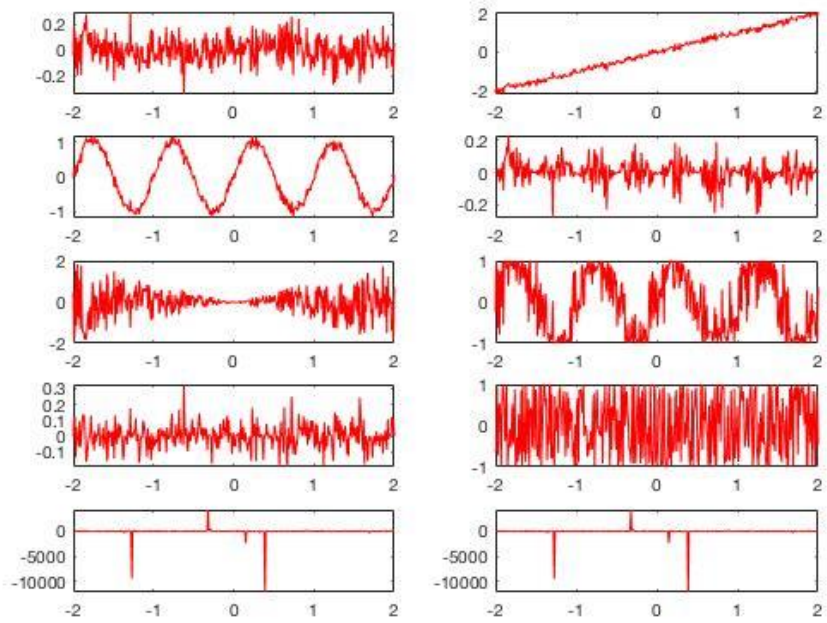
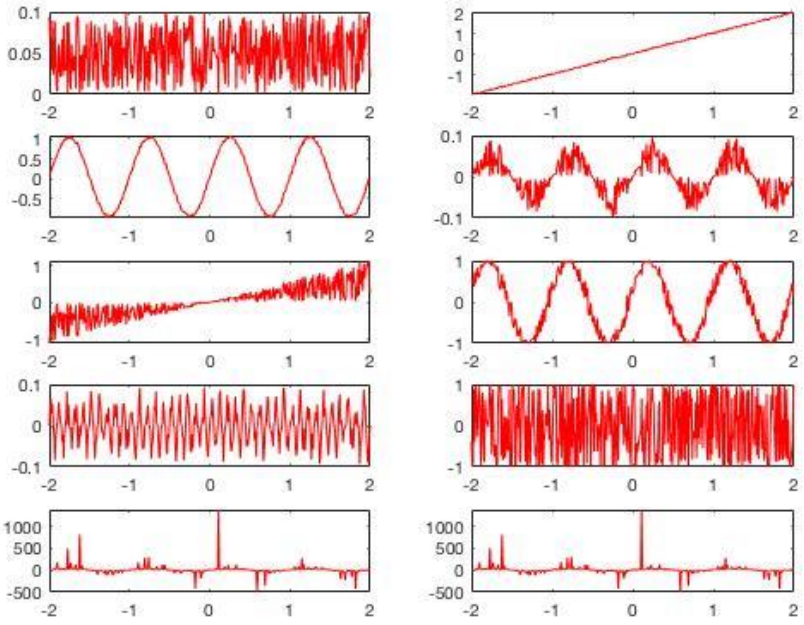
Problem 1



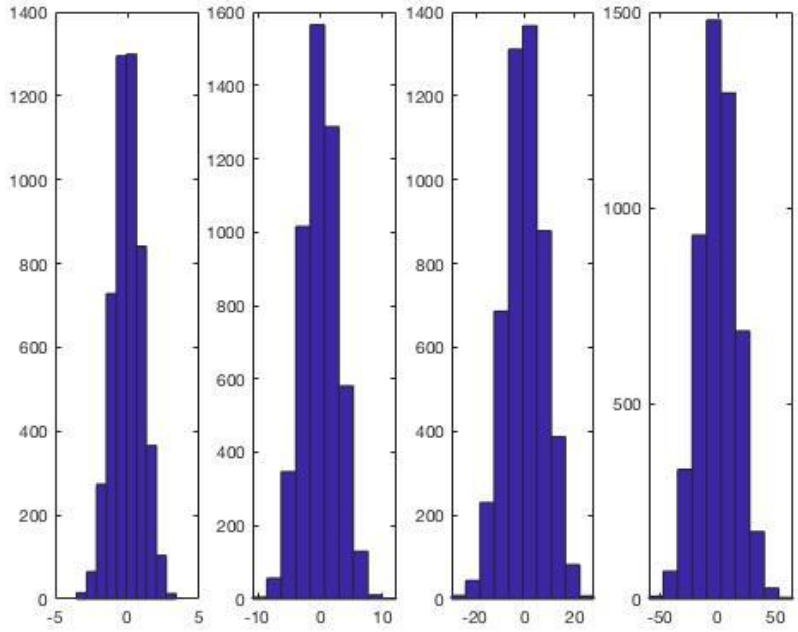
Problem 2



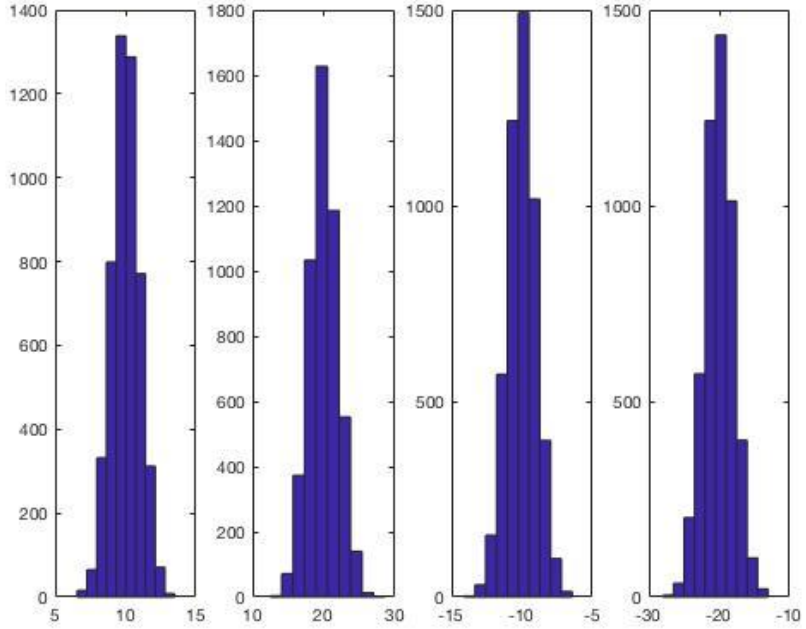
Problem 3



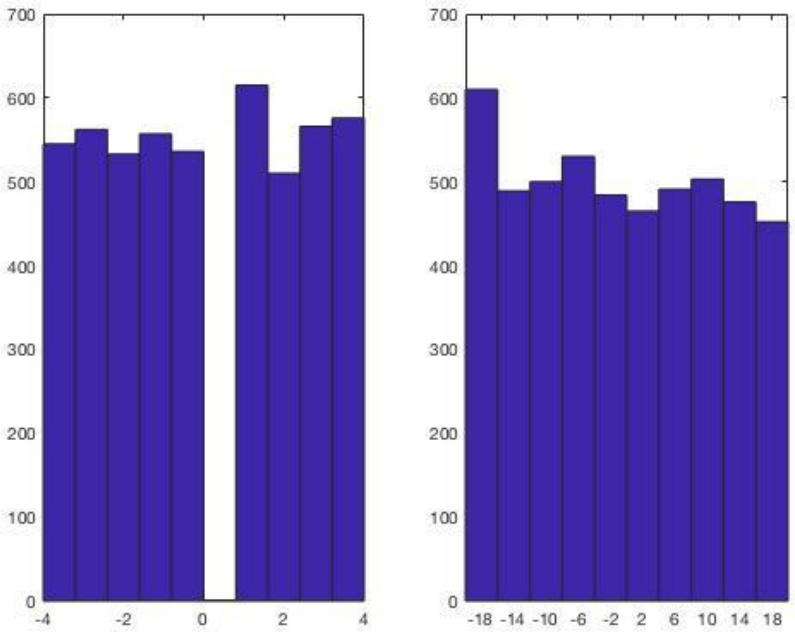
Problem 4



Problem 5



Problem 6



From the above plots, I learned how frequency, amplitude and phase changes effecting signals. In addition to that, when we add or multiply signals into one signal I realized that its plots are getting complicated in time domain. I also learned effect of changing variance and mean on distrubution.

Matlab code for problems 1-6:

```
%Problem 1
figure(1);
t=-2:0.01:2; %duration
%signals
y1 = sin(2*pi*t);
y2= sin(2*pi*10*t);
y3=10*sin(2*pi*t);
y4= sin(2*pi*t)+10;
y5= sin(2*pi*(t- 0.5));
y6= 10*sin(2*pi*10*t);
y7= t.*sin(2*pi*t);
```

```
y8= sin(2*pi*t)./t ;
y9= y1+y2+y3+y4+y5+y6+y7+y8;
%plots
subplot(5,2,1);
plot(t,y1,'r');
subplot(5,2,2);
plot(t,y2,'r');
subplot(5,2,3);
plot(t,y3,'r');
subplot(5,2,4);
plot(t,y4,'r');
subplot(5,2,5);
plot(t,y5,'r');
subplot(5,2,6);
plot(t,y6,'r');
subplot(5,2,7);
plot(t,y7,'r');
subplot(5,2,8);
plot(t,y8,'r');
subplot(5,2,9);
plot(t,y9,'r');
    %Problem 2
figure(2);
%signals
z=0.1*randn(1,401);
y10= z;
y11 = z+t;
y12= z+y1;
y13= z.*y1;
y14=t.*sin(2*pi*z);
y15= sin(2*pi*(t+z));
y16= z.*y2;
y17= sin(2*pi*(t+10*z));
y18= y1./z;
y19= y11+y12+y13+y14+y15+y16+y17+y18;
%plots
subplot(5,2,1);
plot(t,y10,'r');
subplot(5,2,2);
plot(t,y11,'r');
subplot(5,2,3);
```

```
plot(t,y12,'r');
subplot(5,2,4);
plot(t,y13,'r');
subplot(5,2,5);
plot(t,y14,'r');
subplot(5,2,6);
plot(t,y15,'r');
subplot(5,2,7);
plot(t,y16,'r');
subplot(5,2,8);
plot(t,y17,'r');
subplot(5,2,9);
plot(t,y18,'r');
subplot(5,2,10);
plot(t,y19,'r');
    %Problem 3
figure(3);
%signals
z=0.1*rand(1,401);
y20= z;
y21 = z+t ;
y22= z+y1;
y23= z.*y1;
y24=t.*sin(2*pi*z);
y25= sin(2*pi*(t+z));
y26= z.*y2;
y27= sin(2*pi*(t+10*z));
y28=y1./z;
y29=y21+y22+y23+y24+y25+y26+y27+y28;
%plots
subplot(5,2,1);
plot(t,y20,'r');
subplot(5,2,2);
plot(t,y21,'r');
subplot(5,2,3);
plot(t,y22,'r');
subplot(5,2,4);
plot(t,y23,'r');
subplot(5,2,5);
plot(t,y24,'r');
subplot(5,2,6);
```

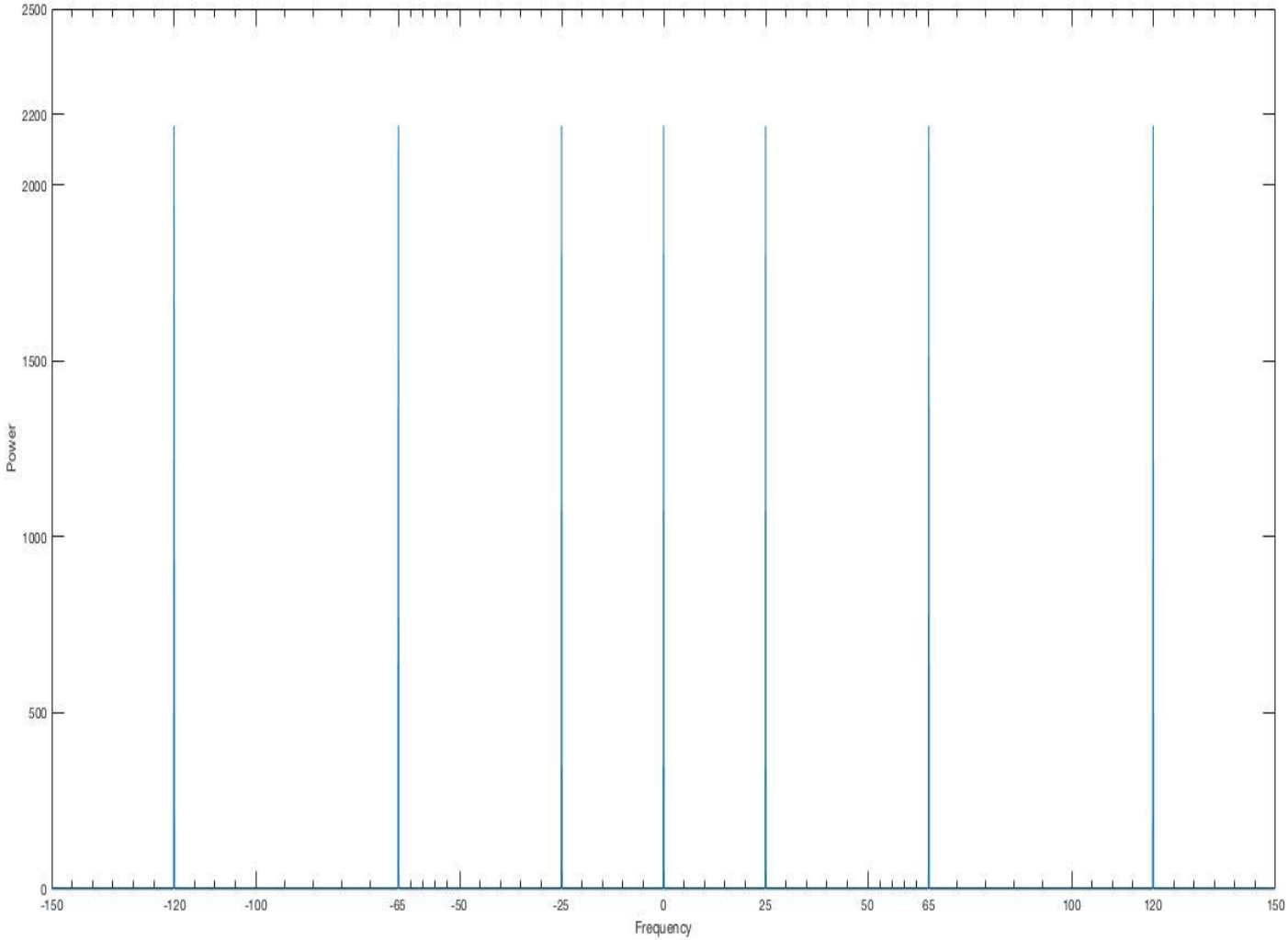
```
plot(t,y25,'r');
subplot(5,2,7);
plot(t,y26,'r');
subplot(5,2,8);
plot(t,y27,'r');
subplot(5,2,9);
plot(t,y28,'r');
subplot(5,2,10);
plot(t,y29,'r');
    %Problem 4
figure(4);    %Gaussian(Normal) Random variables
r1 = sqrt(1).*randn(5000,1) + 0; %variance 1 and mean 0
r2 = sqrt(8).*randn(5000,1) + 0; %variance 8 and mean 0
r3 = sqrt(64).*randn(5000,1) + 0; %variance 64 and mean 0
r4 = sqrt(256).*randn(5000,1) + 0; %variance 256 and mean 0
subplot(1,4,1);
hist(r1);
subplot(1,4,2);
hist(r2);
subplot(1,4,3);
hist(r3);
subplot(1,4,4);
hist(r4);
    %Problem 5
figure(5);    %Gaussian(Normal) Random variables
r5 = sqrt(1).*randn(5000,1) + 10; %variance 1 and mean 10
r6 = sqrt(4).*randn(5000,1) + 20; %variance 4 and mean 20
r7 = sqrt(1).*randn(5000,1) - 10; %variance 1 and mean -10
r8 = sqrt(4).*randn(5000,1) - 20; %variance 4 and mean -20
subplot(1,4,1);
hist(r5);
subplot(1,4,2);
hist(r6);
subplot(1,4,3);
hist(r7);
subplot(1,4,4);
hist(r8);
    %Problem 6
figure(6);     %uniformly distributed random variables
r11=randi([-4 4],1,5000); %between -4 and 4
r21=randi([-20 20],1,5000); %between -20 and 20
```

```
subplot(1,2,1);
hist(r11);
subplot(1,2,2);
hist(r21);
```

Problem 7

As we can see from below plot, we can decompose signal into signals at frequencies 25,65,120 .So,

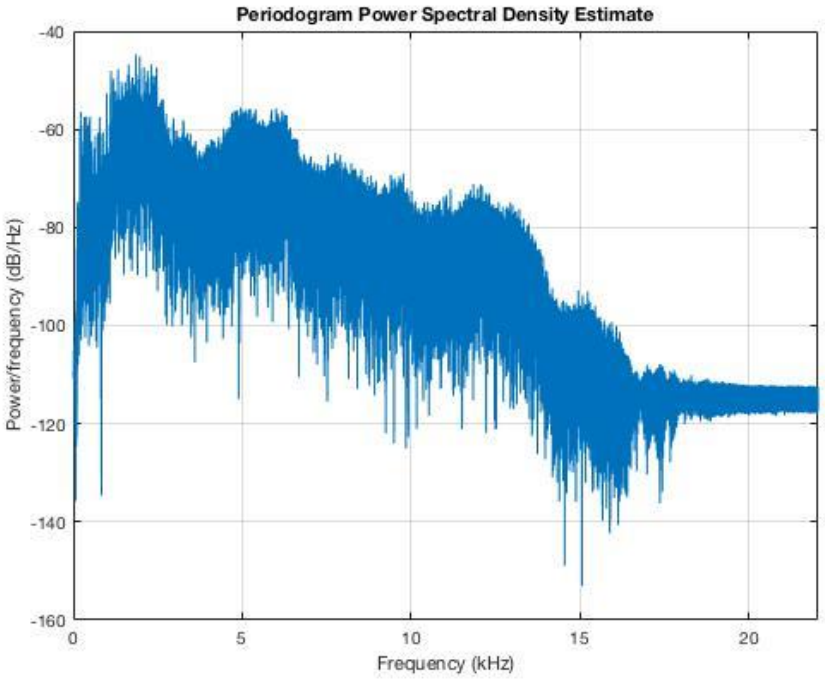
Signal=X0+ X1.cos(2*pi*25*t) + X2.cos(2*pi*65*t)+ X3.cos(2*pi*120*t)


2500
2200
2000
1500
1000
500
0
Power
-150
-120
-100
-65
-50
-25
0
25
50
65
100
120
150
Frequency

Matlab code for problem 7:

```
y = fft(x);
n = length(x);          % number of samples
f = (0:n-1)*(fs/n);     % frequency range
power = abs(y).^2/n;    % power of the DFT
y0 = fftshift(y);         % shift y values
f0 = (-n/2:n/2-1)*(fs/n); % 0-centered frequency range
power0 = abs(y0).^2/n;    % 0-centered power
plot(f0,power0)
xlabel('Frequency')
ylabel('Power')
```

Problem 8(Bonus)



Problem 9

Mean:

124.0425

Std:

47.8556

max:

245

max loc

274 396

min:

25

min loc

72 4

MatLab Code for problem 9:

```
rgb = imread('lena.png');
A = rgb2gray(rgb);
M = mean2(A);
disp("Mean:");
disp(M)
S = std2(A);
disp("Std:");
disp(S)
maximum = max(max(A));
disp("max:");
disp(maximum)
[x,y]=find(A==maximum);
disp("max loc");
disp([x,y])
minimum = min(min(A));
disp("min:");
disp(minimum)
```

```
[x,y]=find(A==minimum);
disp("min loc");
disp([x,y])
```