CMPE 362: Project 1 — Due:March 8st 23:59

Note: Prepare a report (pdf file) includes your code, explanations and comments of your code for each question. Compress the report and code files. Name it as YourNumber_CmpE362_HW1.rar. Upload the file by using canvas before the deadline. Deadline is strict. Do not send after deadline. When copying is detected, both parties will get zero.

Question 1:

This question ask us draw 5x2 subplot by using y1...y9 values for a given t vector. This y values:

y1= sin(2*pi*t);

y2= sin(2*pi*10*t);

y3= 10*y1;

y4= y1+10;

y5= sin(2*pi*(t-0.5));

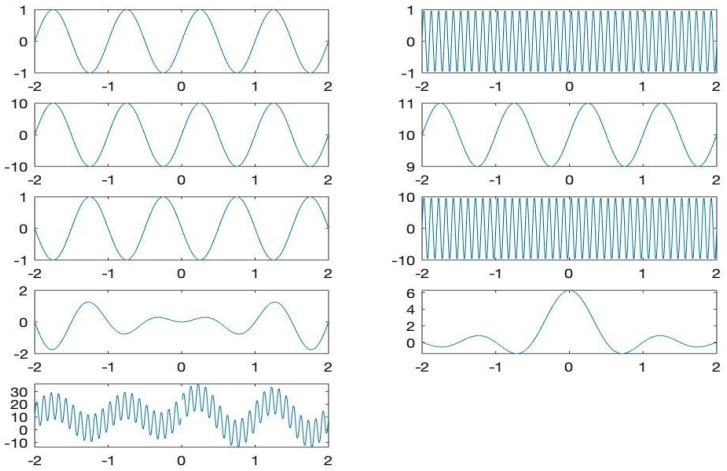
y6= 10*sin(y2);

y7= t.*y1;

y8= y1./t;

y9= y1+y2+y3+y4+y5+y6+y7+y8;

And I get this figure:



Question 2:

This question ask us draw 5x2 subplot by using y11...y19 values for a z vector with 401 random values which are generated by randn module. This y values:

y10= z;

y11 = z+t;

y12= z+y1;

y13= z.*y1;

y14=t.*sin(2*pi*z);

y15= sin(2*pi*(t+z));

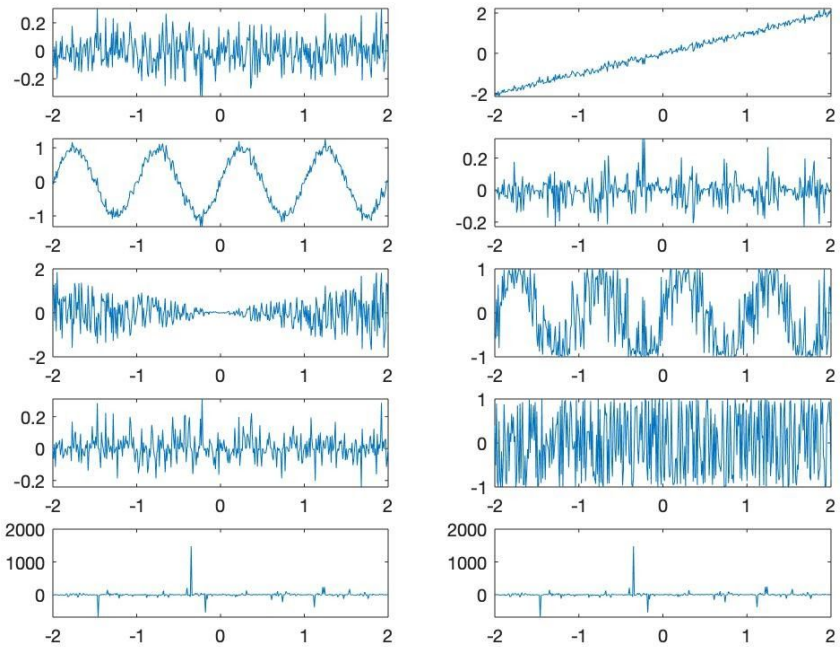
y16= z.*y2;

y17= sin(2*pi*(t+10*z));

y18= y1./z;

y19= y11+y12+y13+y14+y15+y16+y17+y18;

And I get this figure:



Question 3:

This question ask us draw 5x2 subplot by using y21...y29 values for a z vector with 401 random values which are generated by rand module. This y values:

y20 = z;

y21 = z+t ;

y23= z.*y1;

y24= t.*sin(2*pi*z);

y25= sin(2*pi*(t+z));

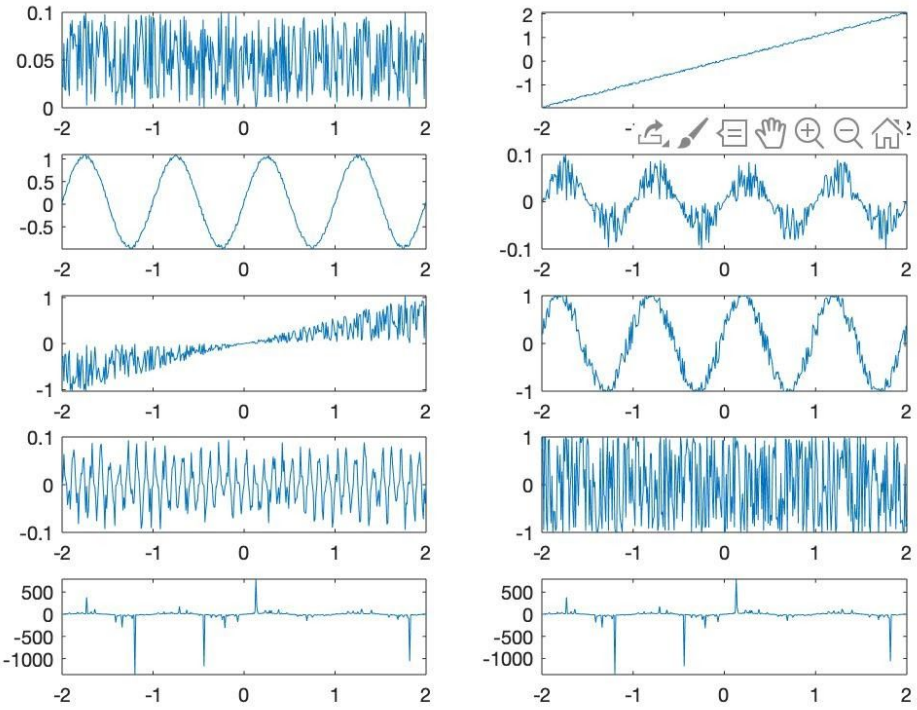
y26= z.*y2;

y27= sin(2*pi*(t+10*z));

y28= y1./z;

y29= y21+y22+y23+y24+y25+y26+y27+y28;

And I get this figure:

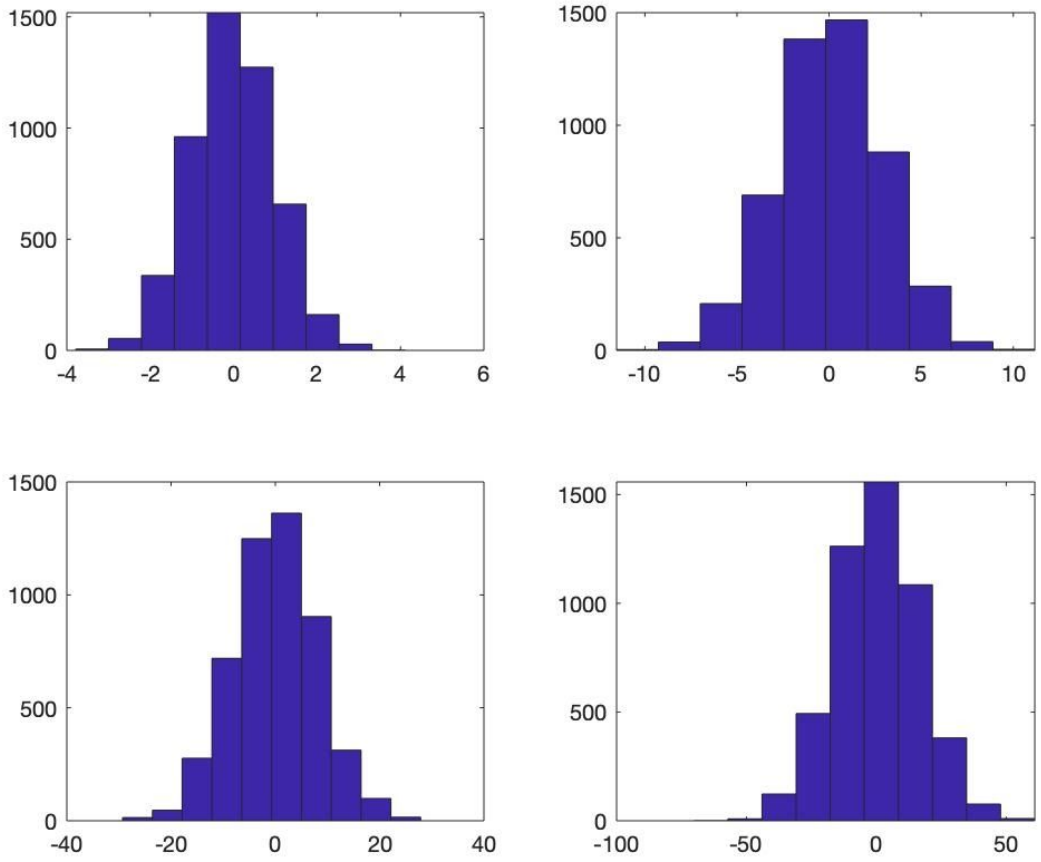


Question 4:

This question ask us draw 2x2 subplot by using r1...r4 values for a z vector with 5000 random values which are generated by randn module. I choose ‘a’ values for derivation and all r values are format of randn(5000,1).*a.

```
% a is derivation
% all r variables are format of randn(5000,1).*a
a = 1;
r1 = randn(5000,1).*a;
a = sqrt(8);
r2 = a.*randn(5000,1);
a = 8;
r3 = a.*randn(5000,1);
a = 16;
r4 = a.*randn(5000,1);
```

I get figure by using hist module.

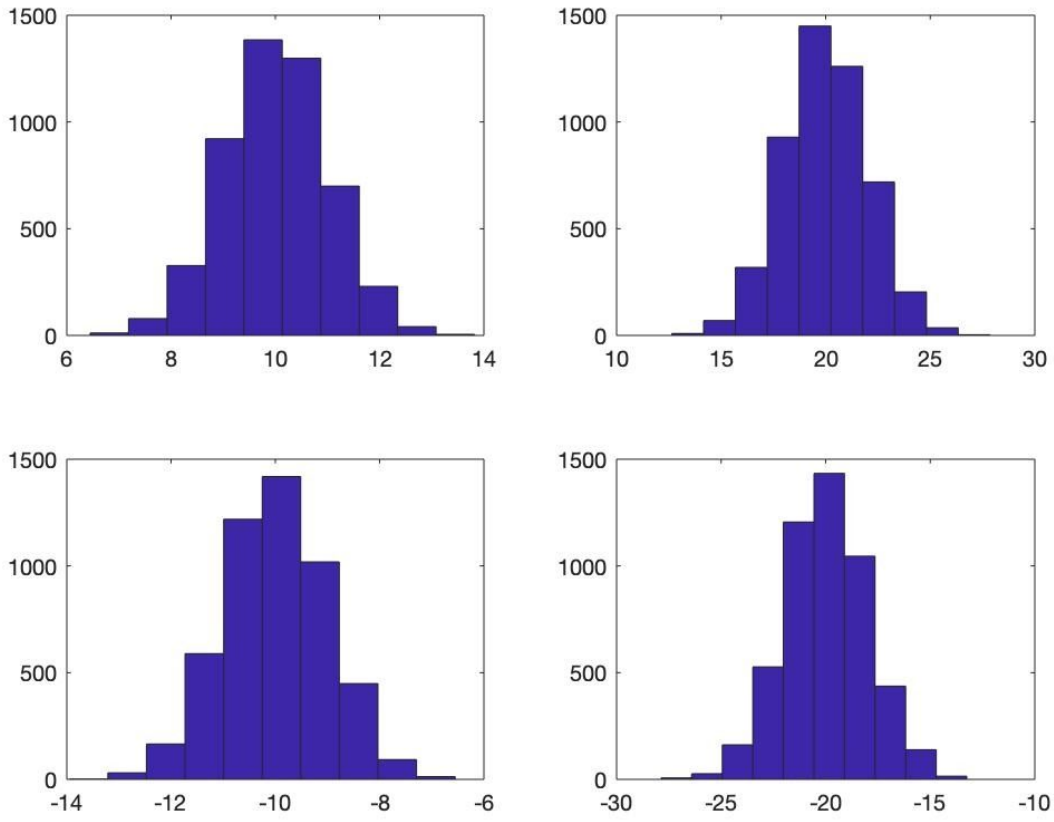


Question 5:

This question ask us draw 2x2 subplot by using r6...r9 values for a z vector with 5000 random values which are generated by randn module. I choose ‘a’ values for derivation, ‘b’ values for mean and all ‘r’ values are format of randn(5000,1).*a+b.

```
% a is derivation
% b is mean
% all r variables are format of randn(5000,1).*a+b
a = 1;
b = 10;
r6 = randn(5000,1).*a + b;
a = 2;
b = 20;
r7 = a.*randn(5000,1) + b;
a = 1;
b = -10;
r8 = a.*randn(5000,1) + b;
a = 2;
b = -20;
r9 = a.*randn(5000,1) + b;
```

I get figure by using hist module.

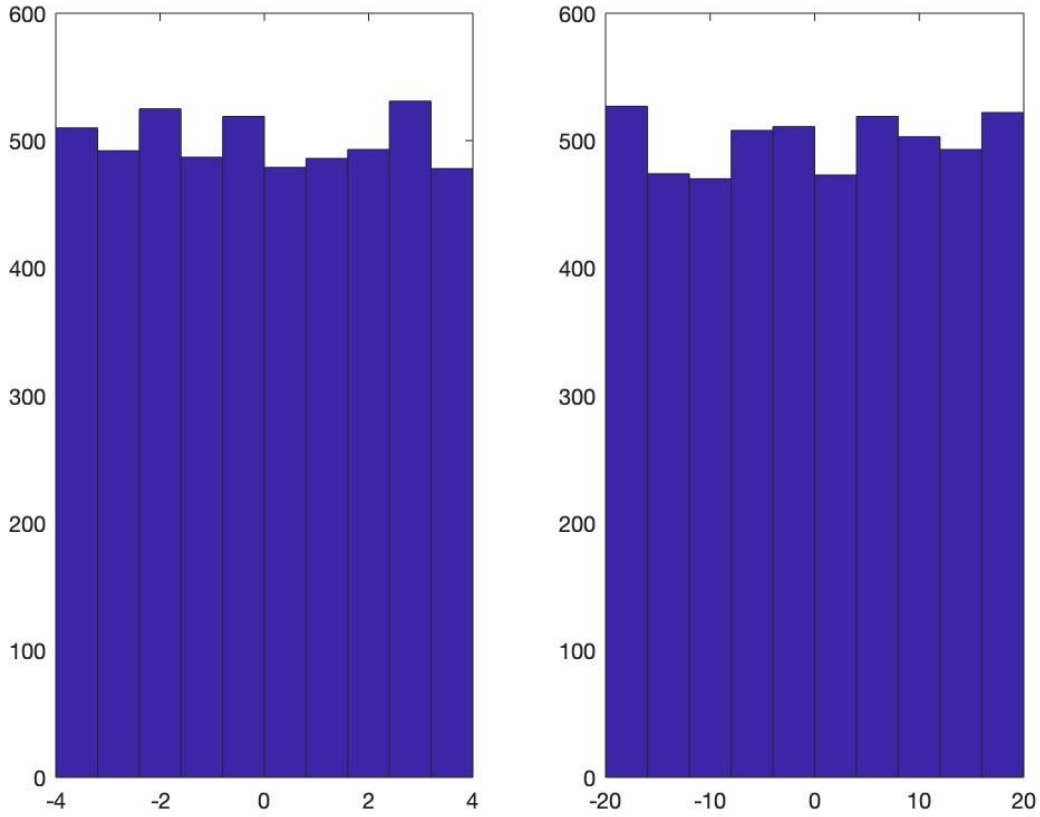


Question 6:

This question ask us draw 1x2 subplot by using r11 and r21 values for a z vector with 5000 random values which is generated by randn module. I choose ‘a’ values for lower value, ‘b’ values for upper value and all ‘r’ values are format of a + (b-a) .* rand(5000,1)

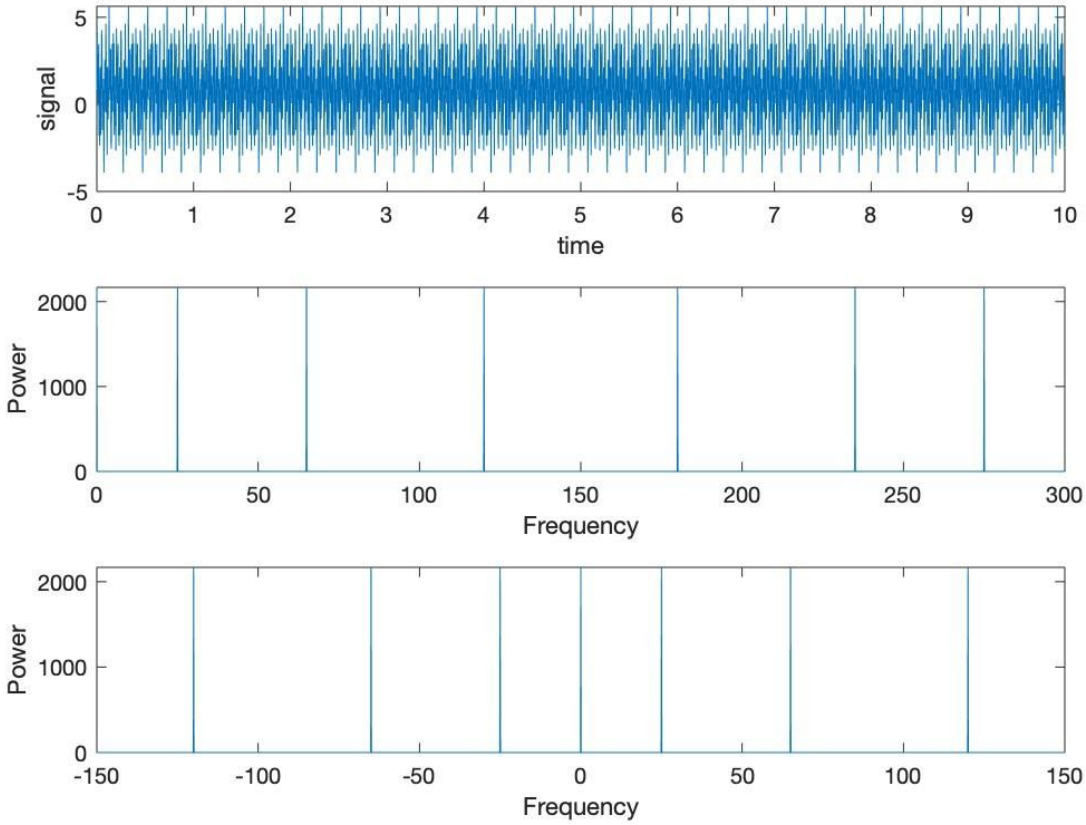
```
% a is lower value
% b is higher value
% all r variables are format of a+(b-a).*randn(5000,1)
a = -4;
b = 4;
r11 = a + (b-a) .* rand(5000,1);
a = -20;
b = 20;
r21 = a + (b-a) .* rand(1,5000);
```

I get figure by using hist module.



Question 7:

By loading 'mysignal.mat', I find x-signal, time and frequency. Later, I use them to get time-signal, frequency-power diagrams.

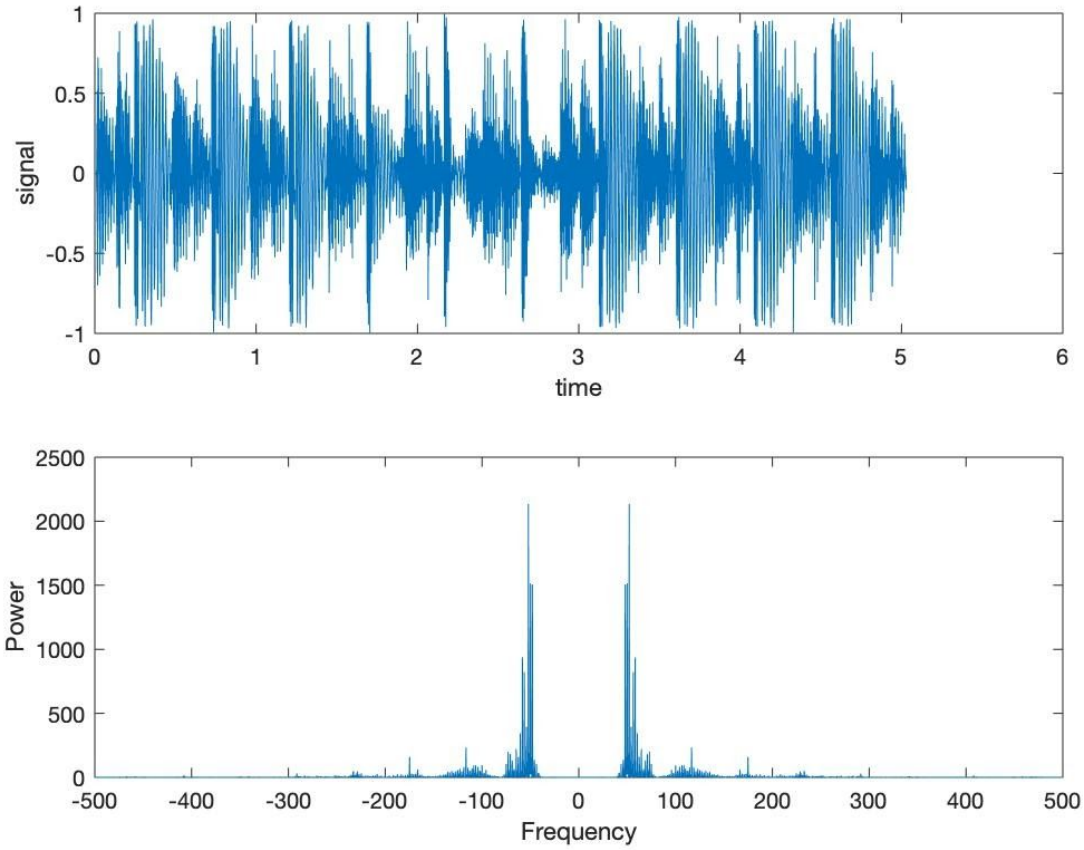


Using final plot, I write mathematical formula of 'mysignal.mat'

Y = 2167*(1 + 2*cos(2*pi*25*t) + 2*cos(2*pi*65*t) + 2*cos(2*pi*120*t))

Question 8:

By loading my favourite signal Boris-Gravity with audioread, I find x-signal, time and frequency. Later, I use them to get time-signal, frequency-power diagrams.



Question 9:

First read the image, 'lena.png',with imread function. After that, convert this rgb image into a grayscale image by using rgb2gray method. Then you will compute the mean, standard deviation, maximum (and location of maximum), minimum (and location of minimum) of the matrix you obtained from the image.

```
Mean of the image:124.0425
Standard derivation of the image:47.8557
Min value of the image:25
Min value coordinate of the image:72   4
Max value of the image:245
Max value coordinate of the image:274  396
```

CODE:

```
% Problem 1
% Using 5x2 subplot to fit all subfigures
% belong to a single figure.

t=(-2:0.01:2);
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;

figure(1);
subplot(5,2,1);
plot(t,y1);
subplot(5,2,2);
plot(t,y2);
subplot(5,2,3);
plot(t,y3);
subplot(5,2,4);
plot(t,y4);
subplot(5,2,5);
plot(t,y5);
subplot(5,2,6);
plot(t,y6);
subplot(5,2,7);
plot(t,y7);
subplot(5,2,8);
plot(t,y8);
subplot(5,2,9);
plot(t,y9);
```

```
% Problem 2
% Using 5x2 subplot to fit all subfigures
% belong to a single figure.

figure(2);
z = randn(1,401).*0.1;   % z is vector which is generated by randn with 401 random numbers.
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;
subplot(5,2,1);
plot(t,y10);
subplot(5,2,2);
plot(t,y11);
subplot(5,2,3);
plot(t,y12);
subplot(5,2,4);
```

```
plot(t,y13);
subplot(5,2,5);
plot(t,y14);
subplot(5,2,6);
plot(t,y15);
subplot(5,2,7);
plot(t,y16);
subplot(5,2,8);
plot(t,y17);
subplot(5,2,9);
plot(t,y18);
subplot(5,2,10);
plot(t,y19);



% Problem 3
% Using 5x2 subplot to fit all subfigures
% belong to a single figure.

figure(3);
z = rand(1,401).*0.1;  % z is vector which is generated by rand with 401 random numbers.
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;
subplot(5,2,1);
plot(t,y20);
subplot(5,2,2);
plot(t,y21);
subplot(5,2,3);
plot(t,y22);
subplot(5,2,4);
plot(t,y23);
subplot(5,2,5);
plot(t,y24);
subplot(5,2,6);
plot(t,y25);
subplot(5,2,7);
plot(t,y26);
subplot(5,2,8);
plot(t,y27);
subplot(5,2,9);
plot(t,y28);
subplot(5,2,10);
plot(t,y29);



% Problem 4
% Using hist to fit all subfigures
% belong to a single figure.

figure(4);
% a is derivation
```

```
% all r variables are format of randn(5000,1).*a
a = 1;
r1 = randn(5000,1).*a;
subplot(2,2,1);
hist(r1);
a = sqrt(8);
r2 = a.*randn(5000,1);
subplot(2,2,2);
hist(r2);
a = 8;
r3 = a.*randn(5000,1);
subplot(2,2,3);
hist(r3);
a = 16;
r4 = a.*randn(5000,1);
subplot(2,2,4);
hist(r4);



% Problem 5
% Using hist to fit all subfigures
% belong to a single figure.

figure(5);
% a is derivation
% b is mean
% all r variables are format of randn(5000,1).*a+b
a = 1;
b = 10;
r6 = randn(5000,1).*a + b;
subplot(2,2,1);
hist(r6);
a = 2;
b = 20;
r7 = a.*randn(5000,1) + b;
subplot(2,2,2);
hist(r7);
a = 1;
b = -10;
r8 = a.*randn(5000,1) + b;
subplot(2,2,3);
hist(r8);
a = 2;
b = -20;
r9 = a.*randn(5000,1) + b;
subplot(2,2,4);
hist(r9);



% Problem 6
% Using hist to fit all subfigures
% belong to a single figure.

figure(6);
% a is lower value
% b is higher value
% all r variables are format of a+(b-a).*randn(5000,1)
a = -4;
b = 4;
```

```
r11 = a + (b-a) .* rand(5000,1);
subplot(1,2,1);
hist(r11);
a = -20;
b = 20;
r21 = a + (b-a) .* rand(1,5000);
subplot(1,2,2);
hist(r21);



% Problem 7
% By loading 'mysignal.mat', I find x-signal,
% time and frequency. Later, I use them to get
% time-signal, frequency-power diagrams.

figure(7);
load("mysignal.mat");
subplot(3,1,1)
plot(t,x)
xlabel('time')
ylabel('signal')

Y = fft(x);           %discrete fourier transform

n = length(x);        % number of samples
f = (0:n-1)*(fs/n);    % frequency range
power = abs(Y).^2/n;   % power of the DFT
subplot(3,1,2)
plot(f,power)
xlabel('Frequency')
ylabel('Power')

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

subplot(3,1,3)

plot(f0,power0)
xlabel('Frequency')
ylabel('Power')



% Problem 8
% I record my favourite song 'Boris-Gravity'
% for 5 seconds and analyze it using fft and
% fftshift.

figure(8);
%time-signal plot
[y,fs] = audioread('cut_boris.wav'); %y=sampled data and Fs is the sampling rate
yTmp = y(:,1);
N = length(yTmp);
t = (0:N-1)/fs;
subplot(2,1,1);
plot(t,yTmp);
xlabel('time');
ylabel('signal');
```

```
%frequency-power plot
y1 = y(:,1);
Y = fft(y1);
l=length(y1);

Y0 = fftshift(Y);       % shift y values
f0 = (-l/2:l/2-1)*(fs/l); % 0-centered frequency range
power0 = abs(Y0).^2/l;    % 0-centered power

subplot(2,1,2)
plot(f0,power0)
xlabel('Frequency')
ylabel('Power')
xlim([-500 500])



% Problem 9
% First read the image, 'lena.png',
% with imread function.
% After that, convert this rgb image into a
% grayscale image by using rgb2gray method.
% Then you will compute the mean, standard
% deviation, maximum (and location of maximum),
% minimum (and location of minimum) of the
% matrix you obtained from the image.

figure(9);
I = imread('lena.png');
J = rgb2gray(I);
imshow(J);
meanIntensity = mean(mean(J));
disp(strcat('Mean of the image: ', num2str(meanIntensity)));
standardDeviation = std(double(J(:)));
disp(strcat('Standard derivation of the image: ', num2str(standardDeviation)));
minValue = min(J(:));
[rowsOfMines, colsOfMines] = find(J == minValue);
disp(strcat('Min value of the image: ', num2str(minValue)));
disp(strcat('Min value coordinate of the image: ', num2str([rowsOfMines, colsOfMines])));
maxValue = max(J(:));
[rowsOfMaxes, colsOfMaxes] = find(J == maxValue);
disp(strcat('Max value of the image: ', num2str(maxValue)));
disp(strcat('Max value coordinate of the image: ', num2str([rowsOfMaxes, colsOfMaxes])));
```