CMPE 362

INTRO.TO SIGNAL PROC. FOR COMPUTER ENG.

MatLab

I. Project

BATURALP YÖRÜK

2015400036

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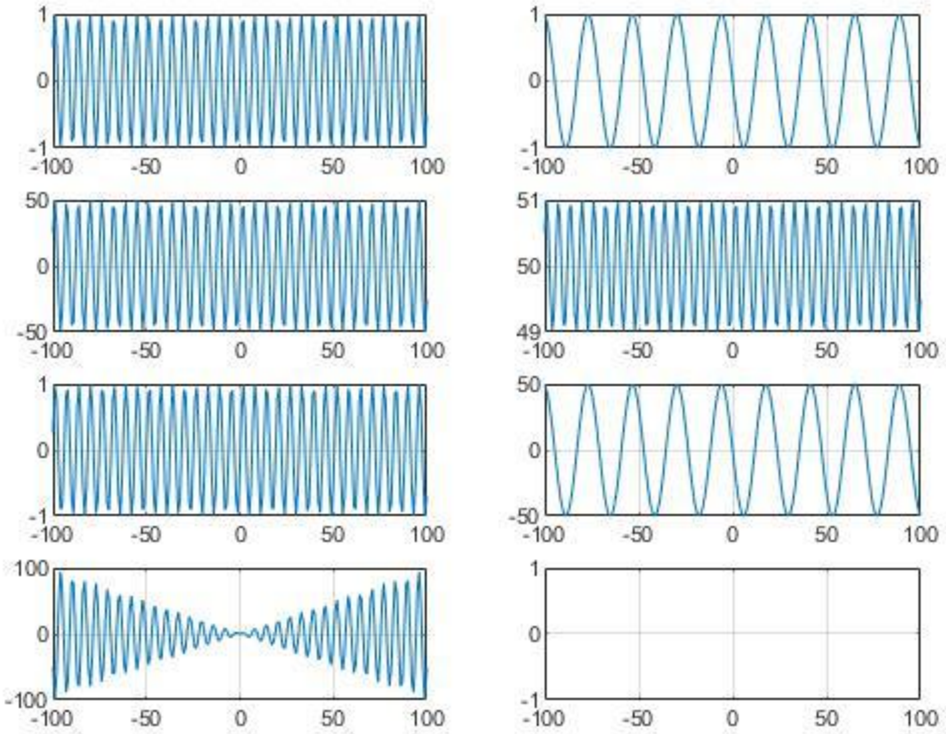
Problem 1



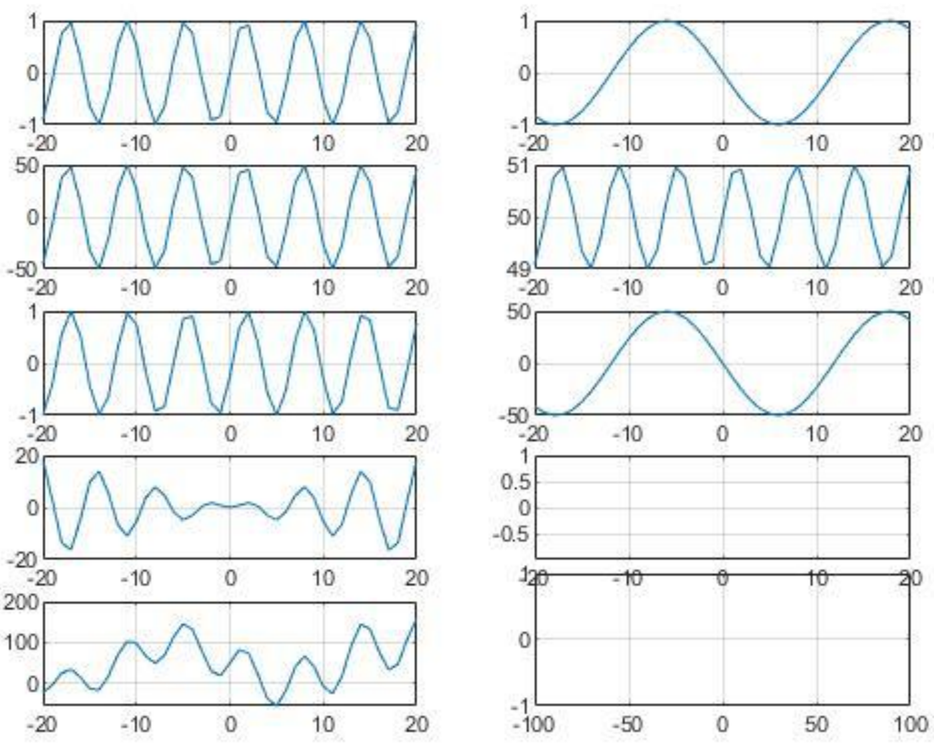

```
% Problem 1:
x=(-100:100);
y1= sin(x);
y2=sin(50*x);
y3=50*sin(x);
y4= sin(x)+50;
y5= sin(x+50);
y6= 50*sin(50*x);
y7= x.*sin(x);
y8 = sin(x) / x;
subplot(4,2,1)
plot(x,y1)
grid
subplot(4,2,2)
plot(x,y2)
grid
subplot(4,2,3)
plot(x,y3)
grid
subplot(4,2,4)
plot(x,y4)
grid
subplot(4,2,5)
plot(x,y5)
grid
```

```
subplot(4,2,6)
plot(x,y6)
grid
subplot(4,2,7)
plot(x,y7)
grid
subplot(4,2,8)
plot(x,y8)
grid
```

In this question, I used 4x2 subplot to fit all subfigures belong to a single figure.

- First plot’s frequency is different than second one.
- Third plot’s amplitude is higher than the first two plots.
- Fourth one is just adding 50 to sinx.
- Fifth one is changing phase due to adding 50 to x.
- Sixth one is mixture of third and fifth.
- Seventh one is multiplied with a vector and it grows when you are getting away from the 0.
- Last one’s values are so small that it doesn’t even seen in the figure.

Problem 2



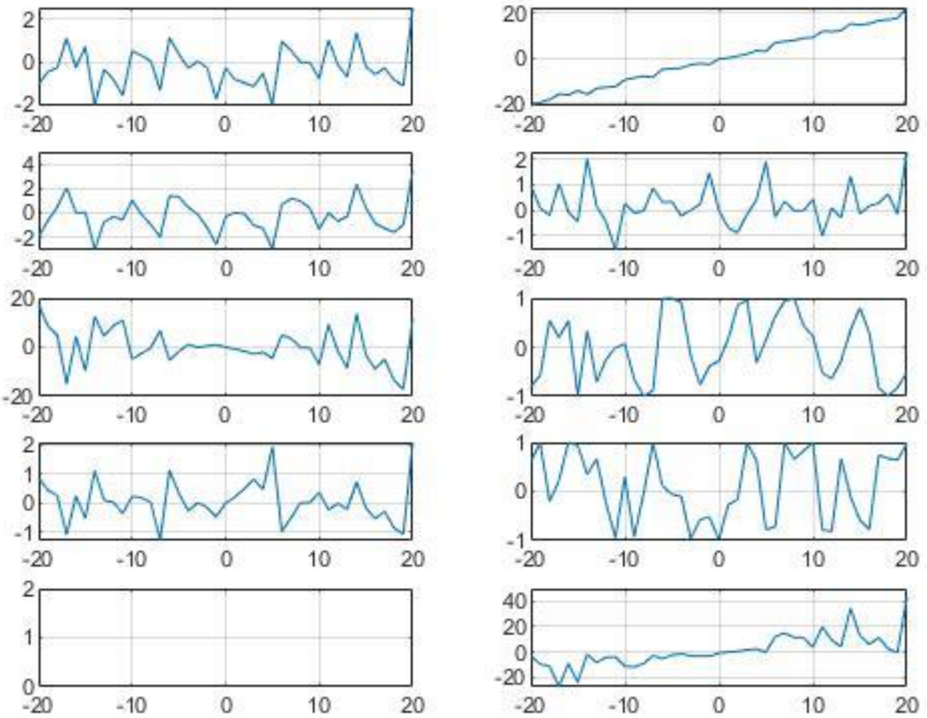
```
%Problem 2:
figure(2);
x=(-20:20);
y1 = sin(x);
y2=sin(50*x);
y3=50*sin(x);
y4= sin(x)+50;
y5= sin(x+50);
y6= 50*sin(50*x);
y7= x.*sin(x);
y8=sin(x)/x;
y9= y1+y2+y3+y4+y5+y6+y7+y8;
subplot(5,2,1)
plot(x,y1)
grid
subplot(5,2,2)
plot(x,y2)
grid
subplot(5,2,3)
plot(x,y3)
grid
subplot(5,2,4)
plot(x,y4)
grid
subplot(5,2,5)
plot(x,y5)
grid
subplot(5,2,6)
plot(x,y6)
grid
subplot(5,2,7)
plot(x,y7)
grid
subplot(5,2,8)
plot(x,y8)
grid
subplot(5,2,9)
plot(x,y9)
grid
```

In this question, I used 5x2 subplot to fit all subfigures belong to a single figure.

- First plot’s frequency is different than second one.
- Third plot’s amplitude is higher than the first two plots.
- Fourth one is just adding 50 to sinx.
- Fifth one is changing phase due to adding 50 to x.
- Sixth one is mixture of third and fifth.
- Seventh one is multiplied with a vector and it grows when you are getting away from the 0.
- Eighth one’s values are so small that it doesn’t even seen in the figure.

- Nineth figure is sum of other eight ones.
- Last figure is empty because there is not tenth subfigure.

Problem 3

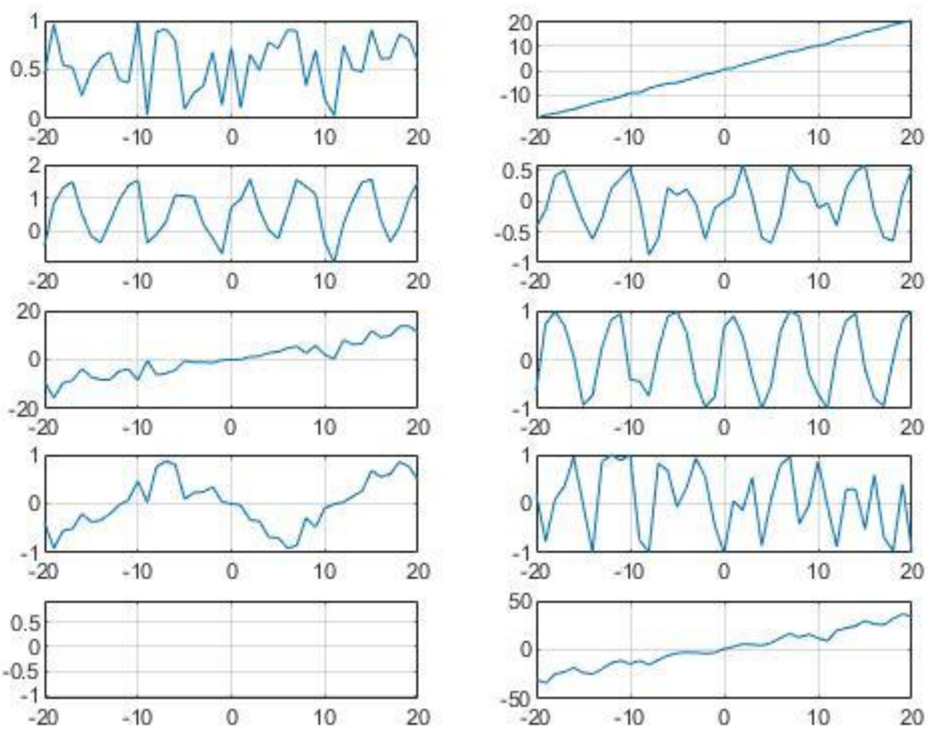


```
%Problem 3:
figure(3);
s = rng;
z= randn(1,41);
y10= z;
y11 = z+x;
y12= z+sin(x);
y13= z.*sin(x);
y14=x.*sin(z);
y15= sin(x+z);
y16= z.*sin(50*x);
y17=sin(x+50*z);
y18=sin(x/z);
y19 = y11+y12+y13+y14+y15+y16+y17+y18;

subplot(5,2,1)
plot(x,y10)
grid
subplot(5,2,2)
plot(x,y11)
grid
```

```
subplot(5,2,3)
plot(x,y12)
grid
subplot(5,2,4)
plot(x,y13)
grid
subplot(5,2,5)
plot(x,y14)
grid
subplot(5,2,6)
plot(x,y15)
grid
subplot(5,2,7)
plot(x,y16)
grid
subplot(5,2,8)
plot(x,y17)
grid
subplot(5,2,9)
plot(x,y18)
grid
subplot(5,2,10)
plot(x,y19)
grid
```

In this question, I used 5x2 subplot to fit all subfigures belong to a single figure. All of the graphs are looking very random, since all of the formulas contain Gaussian distrubited random numbers. I generated the Gaussian distributed random numbers with randn() function.

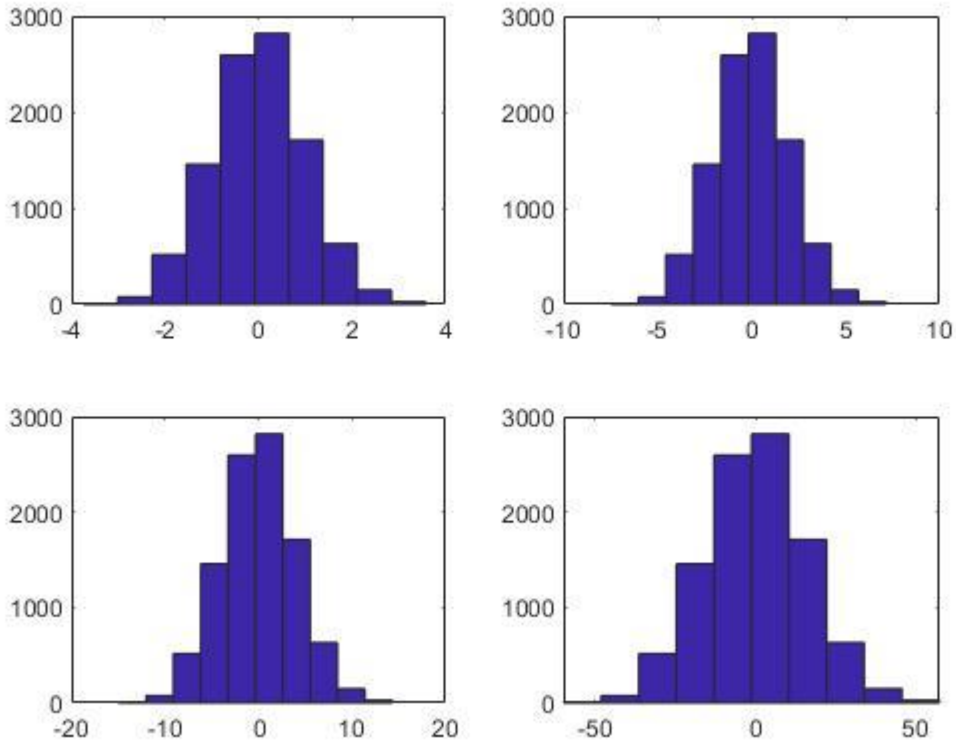
Problem 4



```
% Problem 4;
figure(4);
rng(s);
z = rand(1,41);
y20= z;
y21 = z+x;
y22= z+sin(x);
y23= z.*sin(x);
y24=x.*sin(z);
y25= sin(x+z);
y26= z.*sin(50*x);
y27=sin(x+50*z);
y28=sin(x)/z;
y29= y21+y22+y23+y24+y25+y26+y27+y28;

subplot(5,2,1)
plot(x,y20)
grid
subplot(5,2,2)
plot(x,y21)
grid
subplot(5,2,3)
plot(x,y22)
grid
subplot(5,2,4)
plot(x,y23)
grid
subplot(5,2,5)
plot(x,y24)
grid
subplot(5,2,6)
plot(x,y25)
grid
subplot(5,2,7)
plot(x,y26)
grid
subplot(5,2,8)
plot(x,y27)
grid
subplot(5,2,9)
plot(x,y28)
grid
subplot(5,2,10)
plot(x,y29)
grid
```

In this question, I used 5x2 subplot to fit all subfigures belong to a single figure. In this question, most of the plots are not looking as much random as the third problem's plots, since the random numbers are generated with uniform distribution. I generated the uniformly distributed random numbers with rand() function.

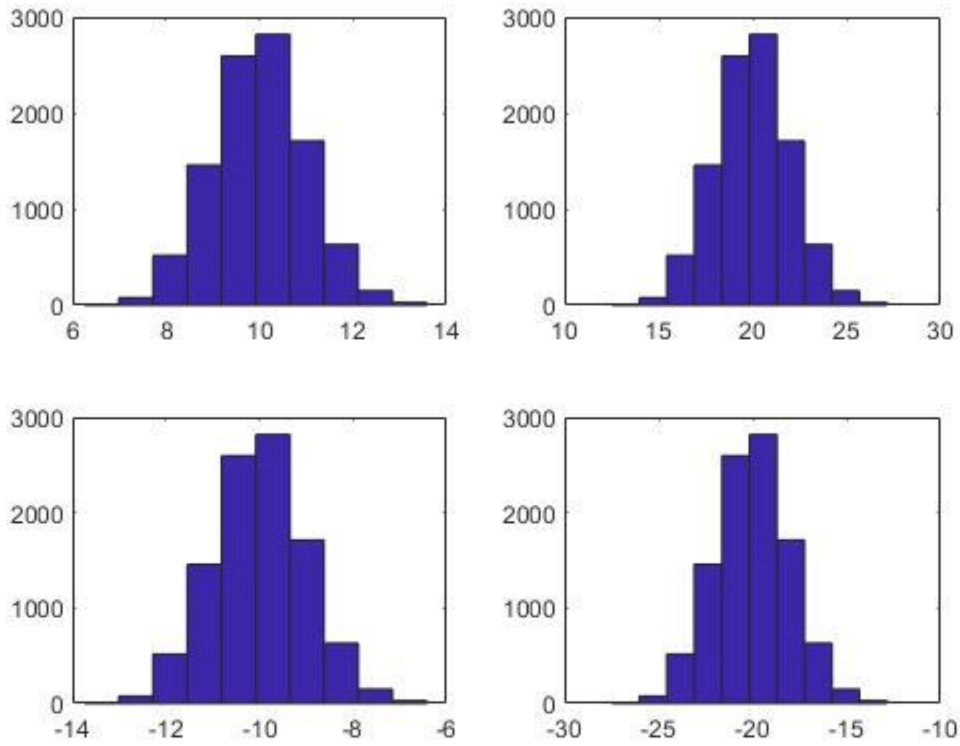
Problem 5




```
% Problem 5:
figure(5);
rng(s);
r1 = randn(10000,1);
subplot(2,2,1)
hist(r1)

rng(s);
r2 = 2.*randn(10000,1);
subplot(2,2,2)
hist(r2)

rng(s);
r3 = 4.*randn(10000,1);
subplot(2,2,3)
hist(r3)

rng(s);
r4 = 16.*randn(10000,1);
subplot(2,2,4)
hist(r4)
```

In this figure, we can observe that all of the subplots look like the normal distributions. Also, to increase variance, I multiplied the formulas with the root of the given numbers.

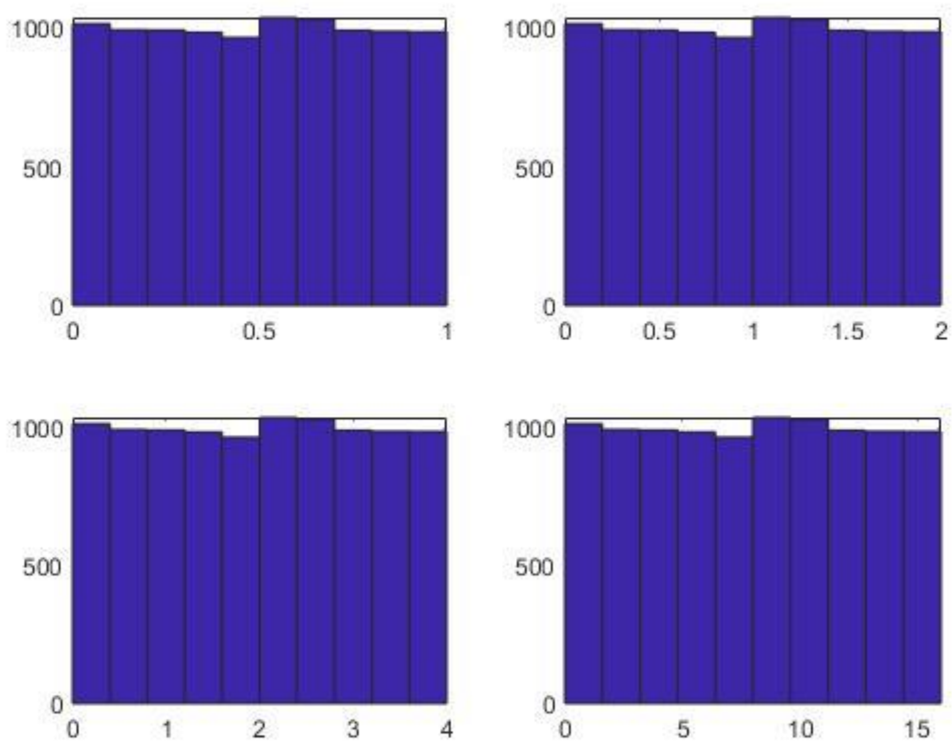
Problem 6




```
% Problem 6:
figure(6);
rng(s);
r5 = 1.*randn(10000,1) + 10;
subplot(2,2,1)
hist(r5)

rng(s);
r6 = 2.*randn(10000,1) + 20;
subplot(2,2,2)
hist(r6)

rng(s);
r7 = 1.*randn(10000,1) + -10;
subplot(2,2,3)
hist(r7)

rng(s);
r8 = 2.*randn(10000,1) + -20;
subplot(2,2,4)
hist(r8)
```

In this figure, we can observe that all of the subplots look like the normal distributions. Also, to increase variance, I multiplied the formulas with the square root of the given numbers. Lastly, I added some numbers according to their desired mean values.

Problem 7

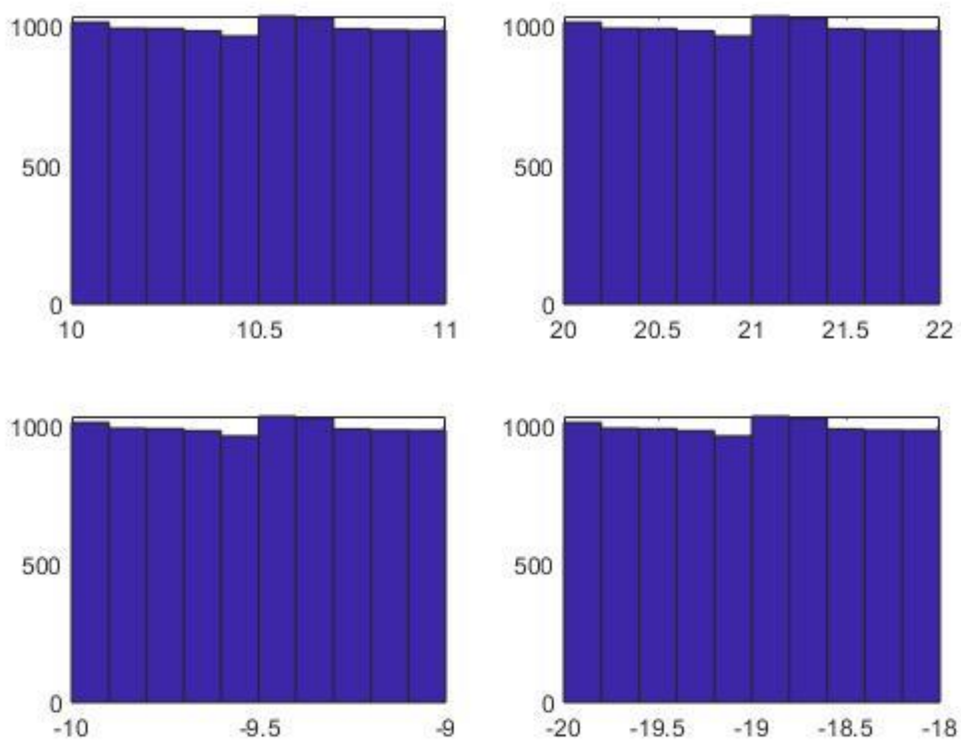



```
% Problem 7:
figure(7);
rng(s);
r11 = rand(10000,1);
subplot(2,2,1)
hist(r11)

rng(s);
r21 = 2.*rand(10000,1);
subplot(2,2,2)
hist(r21)

rng(s);
r31 = 4.*rand(10000,1);
subplot(2,2,3)
hist(r31)

rng(s);
r41 = 16.*rand(10000,1);
subplot(2,2,4)
hist(r41)
```

In this figure, we can observe that all of the subplots look like the uniform distribution, since they are distributed equally likely.

Also, to increase variance, I multiplied the formulas with the root of the given numbers.

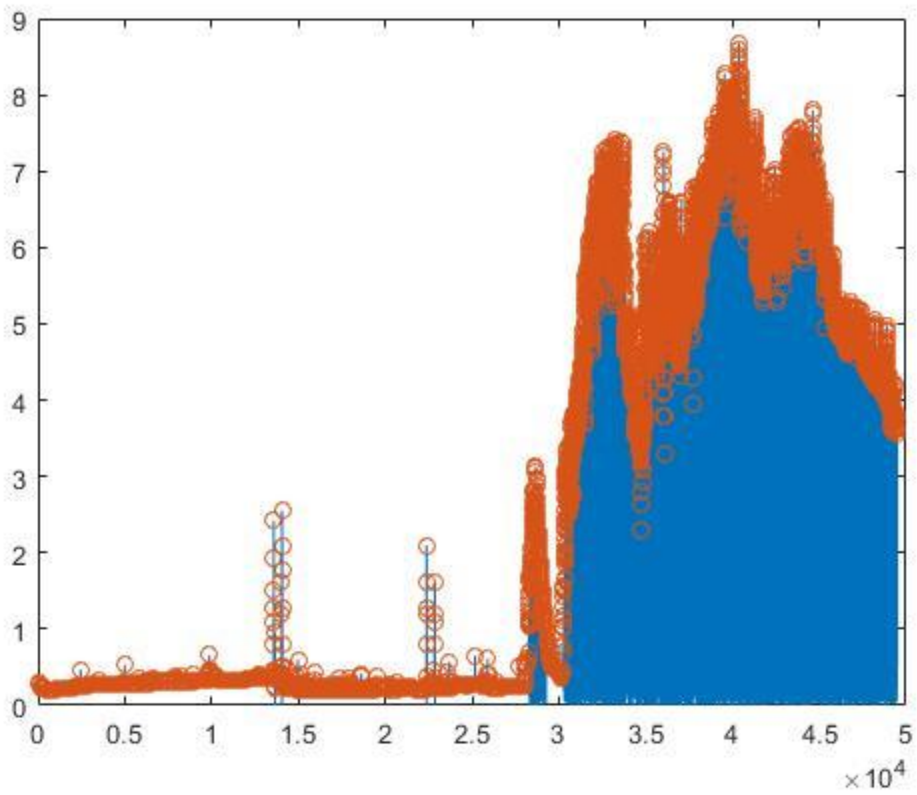
Problem 8




```
% Problem 8:
figure(8);
rng(s);
r51 = 1.*rand(10000,1) + 10;
subplot(2,2,1)
hist(r51)

rng(s);
r61 = 2.*rand(10000,1) + 20;
subplot(2,2,2)
hist(r61)

rng(s);
r71 = 1.*rand(10000,1) + -10;
subplot(2,2,3)
hist(r71)

rng(s);
r81 = 2.*rand(10000,1) + -20;
subplot(2,2,4)
hist(r81)
```

In this figure, we can observe that all of the subplots look like the uniform distributions, since they are distributed equally likely. Also, to increase variance, I multiplied the formulas with the square root of the given numbers. Lastly, I added some numbers according to their desired mean values.

Problem 9




```
%Problem 9
clc;
clear;
clear all;

M = csvread("exampleSignal.csv");
[pks, locs] = findpeaks(M);
plot(M)
hold on;
plot(locs, pks, 'o')
```

In this figure, I used ‘o’ to mark the peaks. We can observe that all of the peaks are obtained with findpeaks method. However, when I look closer to the graph, at some points, there are straight line parallel to the x axis. At those lines, it only marks the one of the corners of that line. As a final note, as can be seen, there are so many peaks, thus the graph looks weird.

Problem 10

```
%Problem 10
clc;
clear;
clear all;

lena = imread('lena.png');
graylena = rgb2gray(lena);
mean(mean(graylena))
std2(graylena)
maxim = max(max(graylena, [], 1) , [] , 2)
minim = min(min(graylena, [], 1) , [] , 2)
[maxx,maxy]=find(graylena==maxim)
[minx,miny]=find(graylena==minim)
```

Output

ans =

124.0425

ans =

47.8556

maxim =

uint8

245

minim =

uint8

25

maxx =

274

maxy = 396

minx = 72

miny = 4

In this question, I found the values which are above. I found the mean by calling mean method twice. I found the standart deviation by using std2 method. I found the maximum of the matrix by calling the max method twice and also found the minimum of the matrix with the same way. Lastly, I found the x and y coordinates of max and min elements of the matrix by using the find method.

What I Have Learned From MatLab

- How to plot a graph
- How to plot more than one graph to same figure with subplot.
- How to use hist method
- How to find the peaks in a graph
- How to read an image file and convert it to grayscale
- How to find mean, standart deviation, maximum, minimum and their index in a matrix.

The Challenges That I Have Faced While Learning MatLab

- Learning the difference between using the command window and writing into a file.
- Getting used to the ide.
- How to draw more than one graph to a single figure.
- How to open more than one figure with a single code block.

The differences (advantages and disadvantages) between MATLAB and the other programming languages

- It is not even like the other programming languages like Java, C.
- It has more different properties like plotting a graph.
- Almost everything is about mathematics, unlike the other programming languages.