CmpE 362- Homework 1
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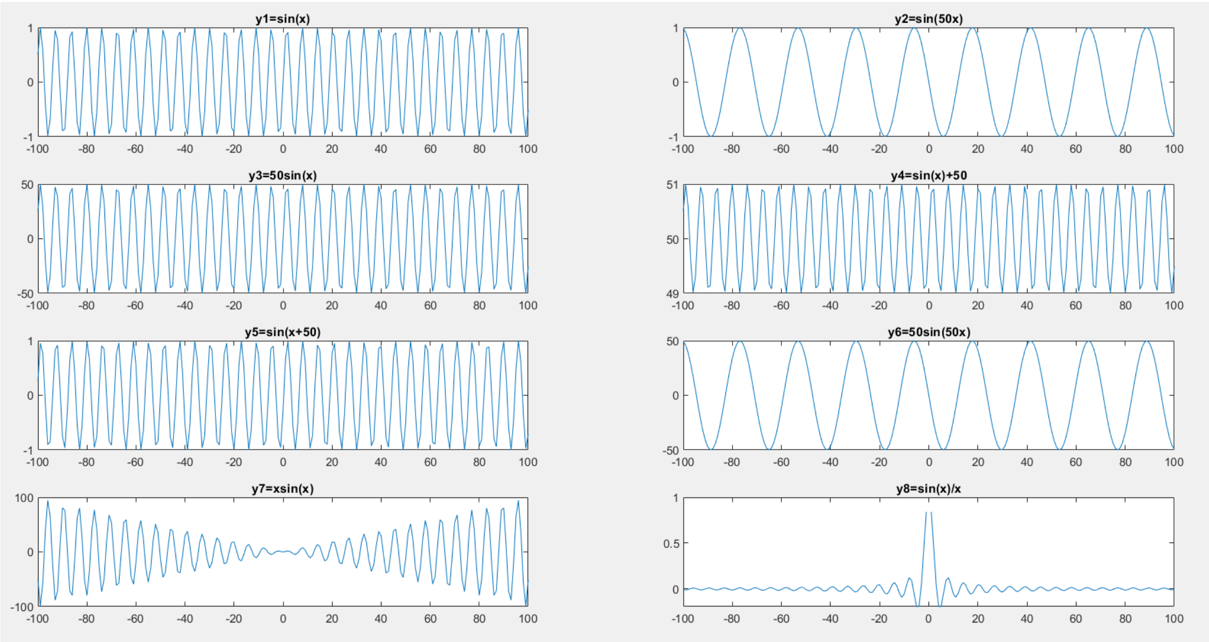
PROBLEM 1

```
%{
    Question 1
%}
%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding.
figure('Name','Question 1');

% Creates a vector from -100 to 100.
x=-100:100

% The functions to be plotted are created below.
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;

%{
 This part draws plots and puts the subplots into one window with their
 titles.
%}
subplot(4,2,1);
plot(x,y1)
title('y1=sin(x)')

subplot(4,2,2);
plot(x,y2)
title('y2=sin(50x)')

subplot(4,2,3);
plot(x,y3)
title('y3=50sin(x)')

subplot(4,2,4);
plot(x,y4)
title('y4=sin(x)+50')

subplot(4,2,5);
plot(x,y5)
title('y5=sin(x+50)')

subplot(4,2,6);
plot(x,y6)
```

```
title('y6=50sin(50x)')

subplot(4,2,7);
plot(x,y7)
title('y7=xsin(x)')

subplot(4,2,8);
plot(x,y8)
title('y8=sin(x)/x')
```



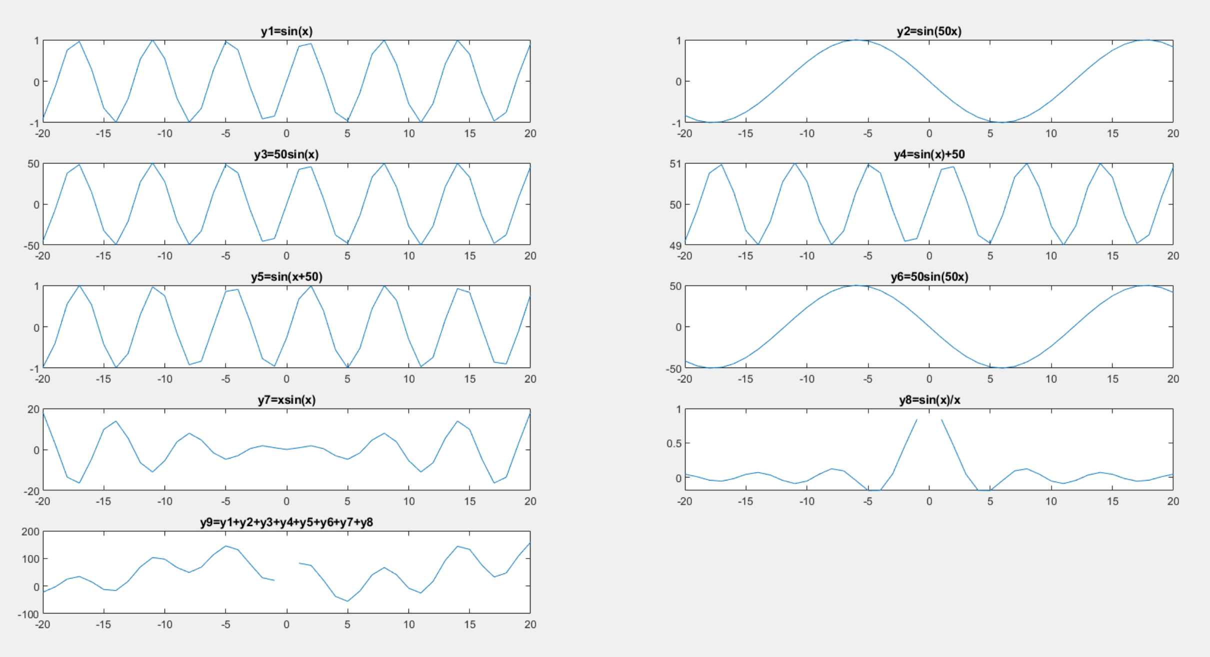
On Problem 1

By the figures created on MatLab, i observed the changes on the amplitude, frequency, both amplitude and frequency when the formula of the function differs. Theoritically, one should have been able to observe the changes of the figure when phase is changed, but in this case since the graphic of the sine function is symmetrical about the y-axis, observing the changes due to phase is difficult.

QUESTION 2

```
%{
    Question 2
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding.
figure('Name','Question 2');,

% Creates a vector from -20 to 20.
x=-20:20

% The functions to be plotted are created below.
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;

%{
 This part draws plots and puts the subplots into one window with their
 titles.
%}
subplot(5,2,1);
plot(x,y1)
title('y1=sin(x)')

subplot(5,2,2);
plot(x,y2)
title('y2=sin(50x)')

subplot(5,2,3);
plot(x,y3)
title('y3=50sin(x)')

subplot(5,2,4);
plot(x,y4)
title('y4=sin(x)+50')

subplot(5,2,5);
plot(x,y5)
title('y5=sin(x+50)')

subplot(5,2,6);
plot(x,y6)
title('y6=50sin(50x)')

subplot(5,2,7);
plot(x,y7)
title('y7=xsin(x)')

subplot(5,2,8);
```

```
plot(x,y8)
title('y8=sin(x)/x')

subplot(5,2,9);
plot(x,y9)
title('y9=y1+y2+y3+y4+y5+y6+y7+y8')
```



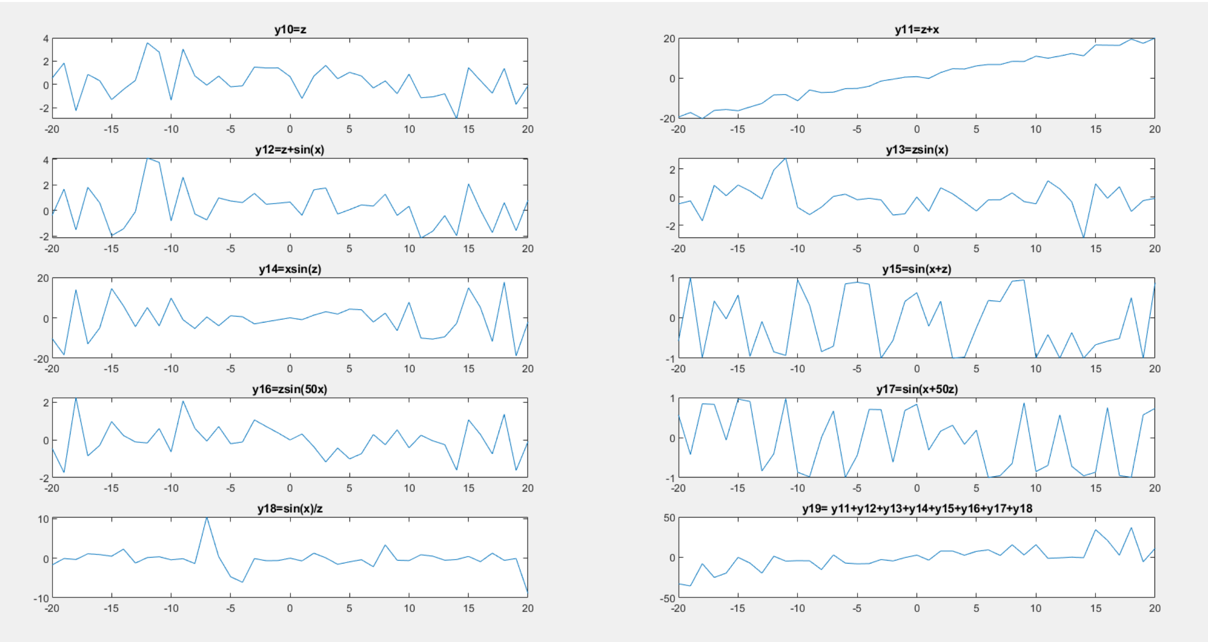
On Problem 2

Compared to the problem 1, since the vector contains 41 elements, the graps are less compressed. This enables a better monitoring. Plus, similar to the problem 1, one can observe the changes on the amplitude, the frequency, both the amplitude and the frequency by changing the coefficient of the sine function and the coefficient of x (the input of the sine function). In addition, we observe a missing part on the last 2 graphics due to division by zero value of x in the graph of y8 (which also causes a missing part in the graph of y9).

QUESTION 3

```
%{
    Question 3
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 3');

% Creates a vector from -20 to 20
x=-20:20;

% Generates 41 Gaussian distributed random numbers.
z=randn(1,41)

% The functions to be plotted are created below.
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;

%{
 This part draws plots and puts the subplots into one window with their
 titles.
%}
subplot(5,2,1);
plot(x,y10)
title('y10=z')

subplot(5,2,2);
plot(x,y11)
title('y11=z+x')

subplot(5,2,3);
plot(x,y12)
title('y12=z+sin(x)')

subplot(5,2,4);
plot(x,y13)
title('y13=zsin(x)')

subplot(5,2,5);
plot(x,y14)
title('y14=xsin(z)')

subplot(5,2,6);
plot(x,y15)
title('y15=sin(x+z)')

subplot(5,2,7);
```

```
plot(x,y16)
title('y16=zsin(50x)')

subplot(5,2,8);
plot(x,y17)
title('y17=sin(x+50z)')

subplot(5,2,9);
plot(x,y18)
title('y18=sin(x)/z')

subplot(5,2,10);
plot(x,y19)
title('y19= y11+y12+y13+y14+y15+y16+y17+y18')
```



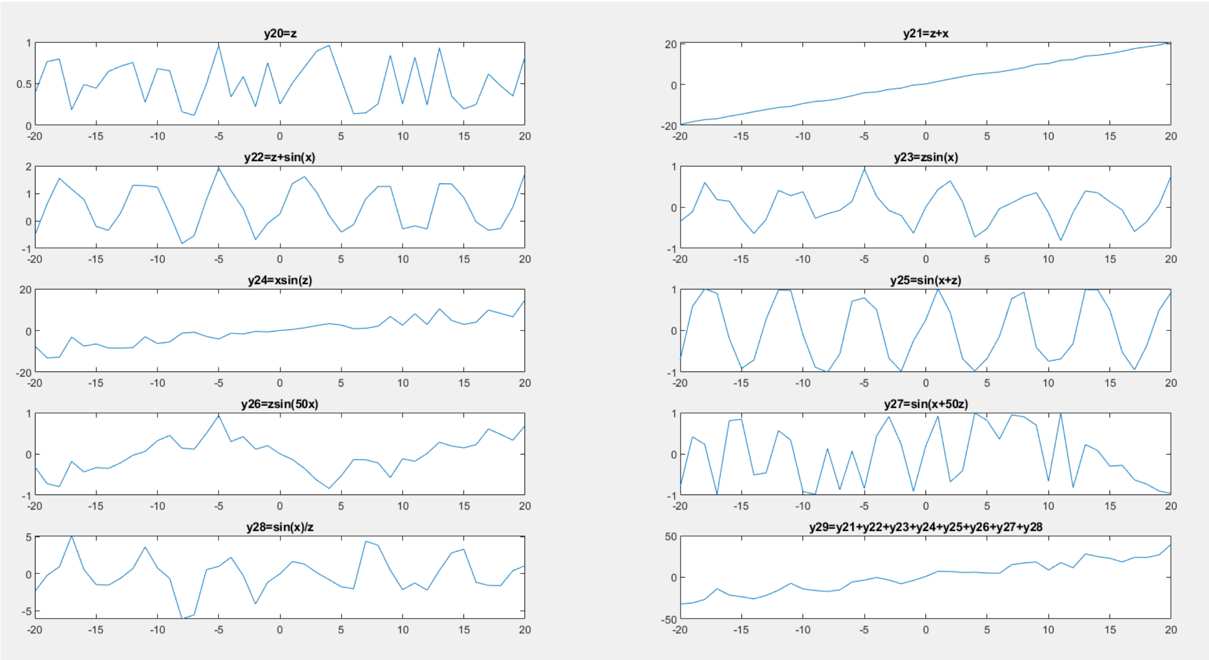
On Problem 3

In this part, deriving conclusions about the graphics are harder that the previous ones since we generated 41 Gaussian distributed random numbers.

QUESTION 4

```
%{
    Question 4
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 4');

% Creates a vector from -20 to 20
x=-20:20

% Generates 41 uniformly distributed random numbers.
z=rand(1,41);

% The functions to be plotted are created below.
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;

%{
 This part draws plots and puts the subplots into one window with their
 titles.
%}
subplot(5,2,1);
plot(x,y20)
title('y20=z')

subplot(5,2,2);
plot(x,y21)
title('y21=z+x')

subplot(5,2,3);
plot(x,y22)
title('y22=z+sin(x)')

subplot(5,2,4);
plot(x,y23)
title('y23=zsin(x)')

subplot(5,2,5);
plot(x,y24)
title('y24=xsin(z)')

subplot(5,2,6);
plot(x,y25)
title('y25=sin(x+z)')
```

```
subplot(5,2,7);
plot(x,y26)
title('y26=zsin(50x)')

subplot(5,2,8);
plot(x,y27)
title('y27=sin(x+50z)')

subplot(5,2,9);
plot(x,y28)
title('y28=sin(x)/z')

subplot(5,2,10);
plot(x,y29)
title('y29=y21+y22+y23+y24+y25+y26+y27+y28')
```

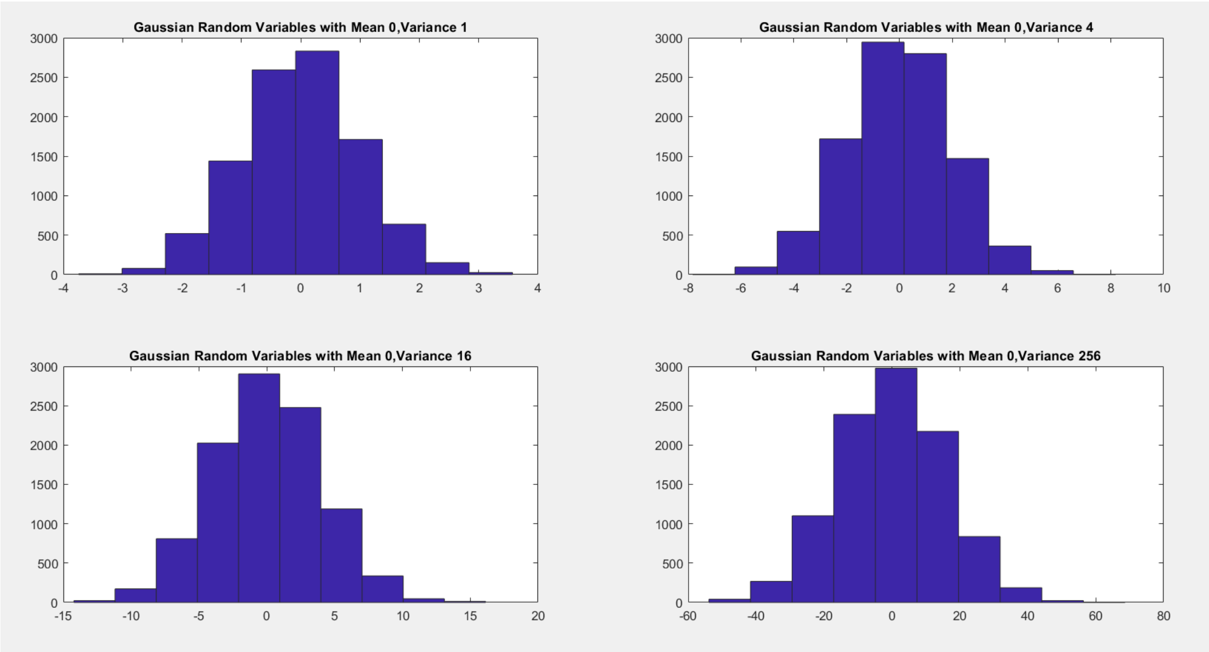


On Problem 4

In this part, just as the previous one, deriving conclusions about the graphics are harder that the previous ones since we generated 41 uniformly distributed random numbers.

QUESTION 5

```
%{
    Question 5
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 5');

%{
  This part generates 10000 gaussian distributed random variables with
given mean and
  standard deviation (recall that std deviation is the square root of the
  variance) values.
%}
std1 = 1;
mean = 0;
r1 = std1.*randn(10000,1) + mean;

std2 = 2;
mean = 0;
r2 = std2.*randn(10000,1) + mean;

std3 = 4;
mean = 0;
r3 = std3.*randn(10000,1) + mean;

std4 = 16;
mean = 0;
r4 = std4.*randn(10000,1) + mean;


%{
 This part draws histograms and puts the subplots into one window with
their
 titles.
%}
subplot(2,2,1);
hist(r1)
title('Gaussian Random Variables with Mean 0,Variance 1')

subplot(2,2,2);
hist(r2)
title('Gaussian Random Variables with Mean 0,Variance 4')

subplot(2,2,3);
hist(r3)
title('Gaussian Random Variables with Mean 0,Variance 16')

subplot(2,2,4);
hist(r4)
title('Gaussian Random Variables with Mean 0,Variance 256')
```

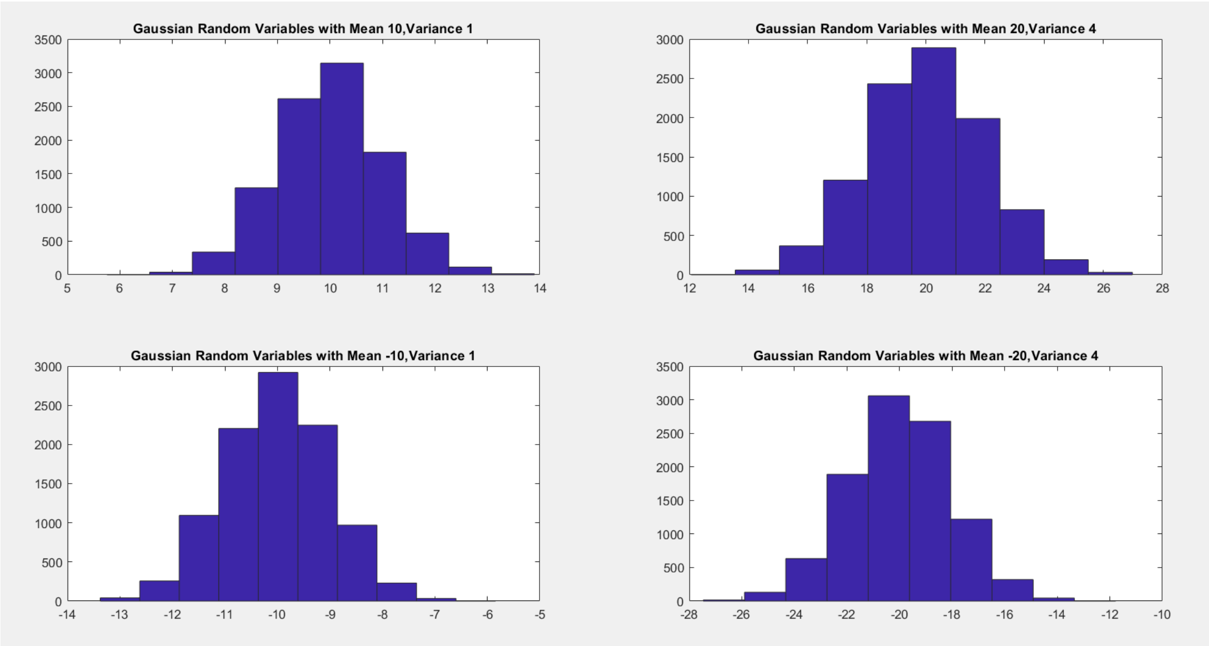


On Problem 5

Observing the graphic above, we can conclude that an increasing variance caused an increase on the index values on the vertical axis.

QUESTION 6

```
%{
    Question 6
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 6');

%{
  This part generates 10000 gaussian distributed random variables with
given mean and
  standard deviation (recall that std deviation is the square root of the
  variance) values.
%}
std1 = 1;
mean1 = 10;
r6 = std1.*randn(10000,1) + mean1;

std2 = 2;
mean2 = 20;
r7 = std2.*randn(10000,1) + mean2;

std3 = 1;
mean3 = -10;
r8 = std3.*randn(10000,1) + mean3;

std4 = 2;
mean4 = -20;
r9 = std4.*randn(10000,1) + mean4;

%{
 This part draws histograms and puts the subplots into one window with
their
 titles.
%}
subplot(2,2,1);
hist(r6)
title('Gaussian Random Variables with Mean 10,Variance 1')

subplot(2,2,2);
hist(r7)
title('Gaussian Random Variables with Mean 20,Variance 4')

subplot(2,2,3);
hist(r8)
title('Gaussian Random Variables with Mean -10,Variance 1')

subplot(2,2,4);
hist(r9)
title('Gaussian Random Variables with Mean -20,Variance 4')
```

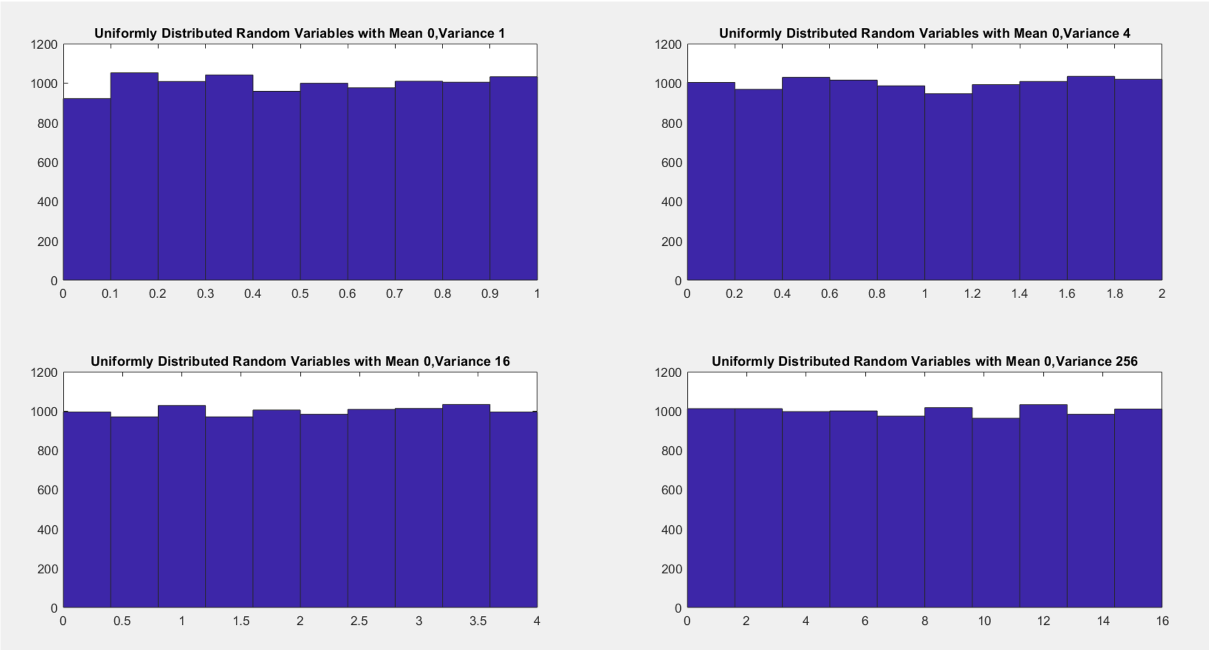


On Problem 6

Observing the graphic above, we can conclude that an increasing variance caused an increase on the index values on the vertical axis. In addition, the mean determines the dominant side of the graphic. (Left Side of the 0-value or Right Side of the 0-value)

QUESTION 7

```
%{
    Question 7
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 7');

%{
  This part generates 10000 uniformly distributed random variables with
given mean and
  standard deviation (recall that std deviation is the square root of the
  variance) values.
%}
std1 = 1;
mean = 0;
r11 = std1.*rand(10000,1) + mean;

std2 = 2;
mean = 0;
r21 = std2.*rand(10000,1) + mean;

std3 = 4;
mean = 0;
r31 = std3.*rand(10000,1) + mean;

std4 = 16;
mean = 0;
r41 = std4.*rand(10000,1) + mean;

%{
 This part draws histograms and puts the subplots into one window with
their
 titles.
%}
subplot(2,2,1);
hist(r11)
title('Uniformly Distributed Random Variables with Mean 0,Variance 1')

subplot(2,2,2);
hist(r21)
title('Uniformly Distributed Random Variables with Mean 0,Variance 4')

subplot(2,2,3);
hist(r31)
title('Uniformly Distributed Random Variables with Mean 0,Variance 16')

subplot(2,2,4);
hist(r41)
title('Uniformly Distributed Random Variables with Mean 0,Variance 256')
```

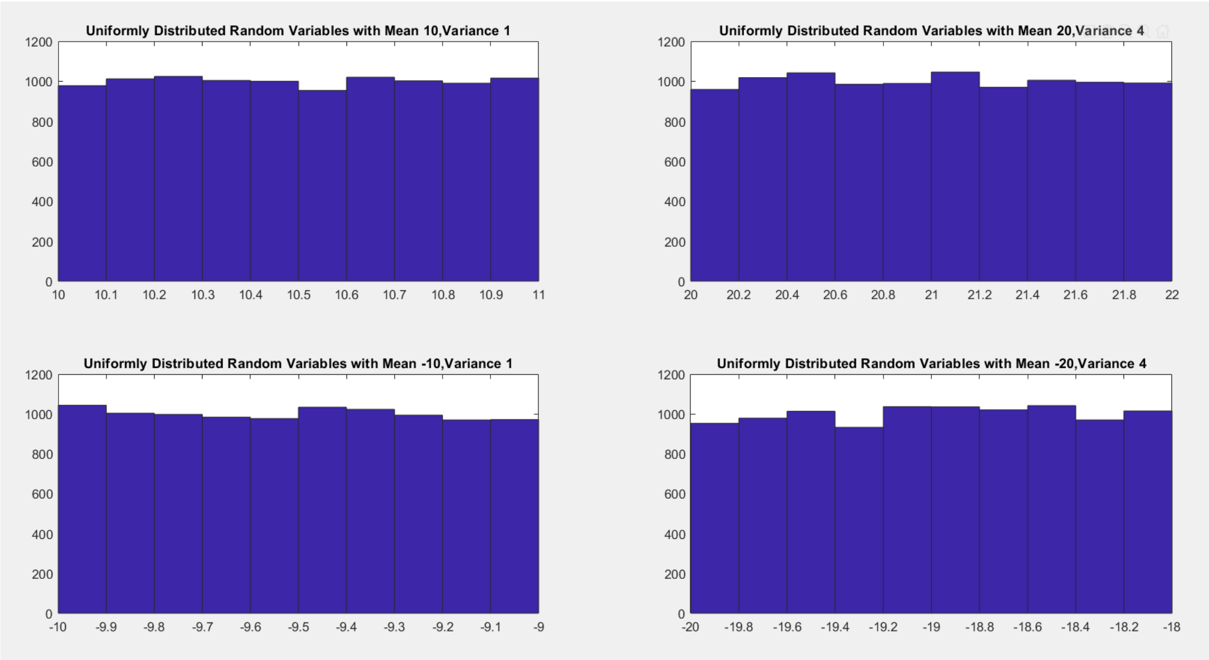


On Problem 7

Observing the graphic above, we can conclude that an increasing variance caused an increase on the index values on the vertical axis. In addition, since the variables are uniformly distributed in this case, one can observe a more smooth graphic than the gaussian distributed which means that the variables are more equivalently seperated in volume.

QUESTION 8

```
%{
    Question 8
%}

%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear; clc;

% Sets the title of the figure to provide better understanding
figure('Name','Question 8');

%{
  This part generates 10000 uniformly distributed random variables with
given mean and
  standard deviation (recall that std deviation is the square root of the
  variance) values.
%}
std1 = 1;
mean1 = 10;
r61 = std1.*rand(10000,1) + mean1;

std2 = 2;
mean2 = 20;
r71 = std2.*rand(10000,1) + mean2;

std3 = 1;
mean3 = -10;
r81 = std3.*rand(10000,1) + mean3;

std4 = 2;
mean4 = -20;
r91 = std4.*rand(10000,1) + mean4;

%{
 This part draws histograms and puts the subplots into one window with
their
 titles.
%}
subplot(2,2,1);
hist(r61)
title('Uniformly Distributed Random Variables with Mean 10,Variance 1')

subplot(2,2,2);
hist(r71)
title('Uniformly Distributed Random Variables with Mean 20,Variance 4')

subplot(2,2,3);
hist(r81)
title('Uniformly Distributed Random Variables with Mean -10,Variance 1')

subplot(2,2,4);
hist(r91)
title('Uniformly Distributed Random Variables with Mean -20,Variance 4')
```

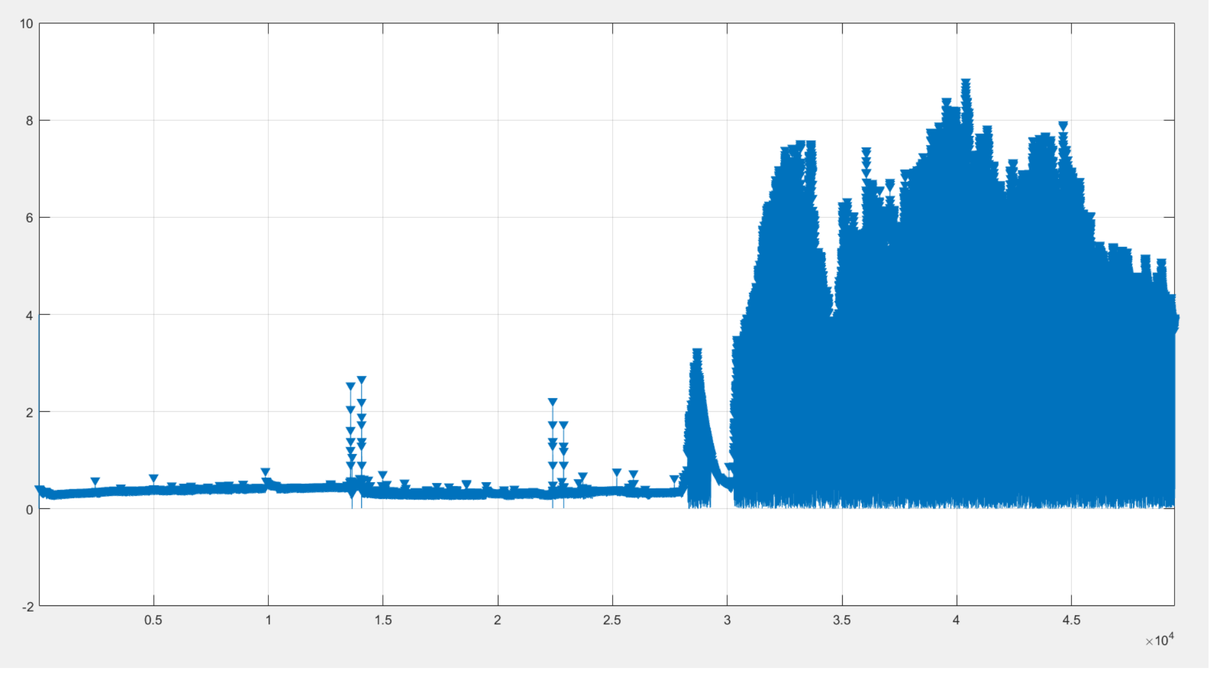


On Problem 8

Observing the graphic above, we can conclude that an increasing variance caused an increase on the index values on the vertical axis. In addition, since the variables are uniformly distributed in this case, one can observe a more smooth graphic than the gaussian distributed which means that the variables are more equivalently seperated in volume. Finally, the mean determines the dominant side of the graphic. (Left Side of the 0-value or Right Side of the 0-value)

QUESTION 9

```
%{
    Question 9
%}
%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear;clc;

% Sets the file name in order to be able to read it via csvread command.
file='exampleSignal.csv';

% Reads the csv file.
mySignal=csvread(file);


% Sets the title of the figure to provide better understanding. The 'off'
% option enables that the resulting title does not include the figure
% number.
figure('Name','Problem 9','NumberTitle','off');

% Plots the data.
plot(mySignal);

% Marks the peaks of the data.
findpeaks(mySignal);
```



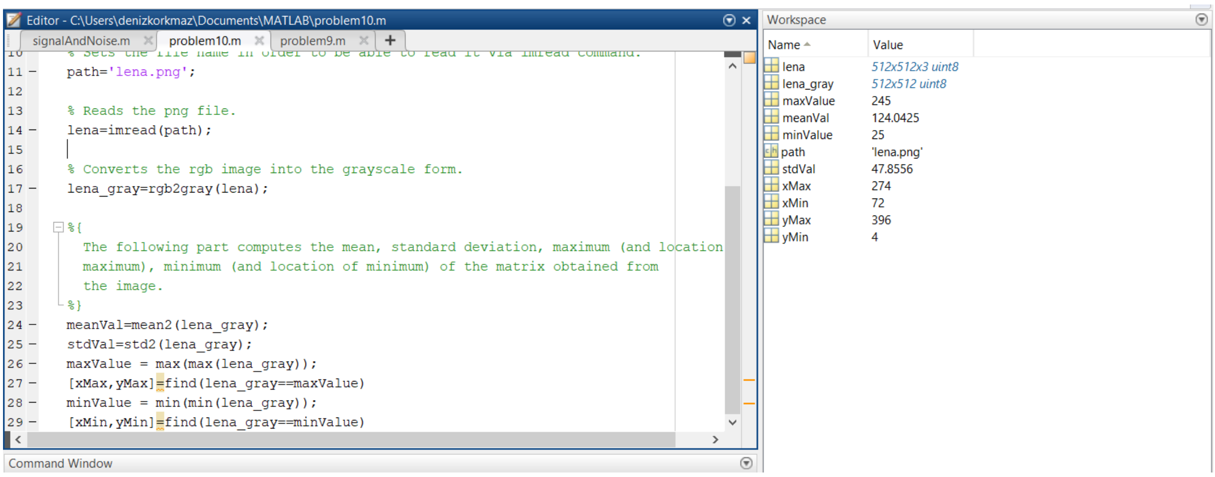
On Question 9 (Important Note)

1- The first input of the csv file has been deleted as instructed by the assistant.

2- I hope that i coded it the way you asked, but somehow my graphic might have been plotted in a way that it's more complicated. I tried to make the graph more clear, but since we are fresh learners of MatLab, i couldn't manage to solve the issue.

QUESTION 10

```
%{
    Question 10
%}
%{
   Clears old variables from console and workspace to avoid some
   possible errors.
%}
clear;clc;

% Sets the file name in order to be able to read it via imread command.
path='lena.png';

% Reads the png file.
lena=imread(path);

% Converts the rgb image into the grayscale form.
lena_gray=rgb2gray(lena);

%{
  The following part computes the mean, standard deviation, maximum (and
location of
  maximum), minimum (and location of minimum) of the matrix obtained from
  the image.
%}
meanVal=mean2(lena_gray);
stdVal=std2(lena_gray);
maxValue = max(max(lena_gray));
[xMax,yMax]=find(lena_gray==maxValue)
minValue = min(min(lena_gray));
[xMin,yMin]=find(lena_gray==minValue)
```



On Question 10

The assigned variable names are as follows:

```
The Mean -> meanVal
The Standard Deviation -> stdVal
The Maximum, The Location of Maximum -> maxValue, [xMax,yMax]
The Minimum, The Location of Minimum -> minValue, [xMin,yMin]
```

ABOUT MATLAB

First observations on MatLab for me was experiencing a highly useful tool to build and utilize systems that are quite common in Mathematics, Statistics, and Physics. Easily monitoring and comparing the graphics that are developed by the contents that we previously learned from the courses of CMPE,MATH,PHYS depts was like a magic. MatLab also provides an useful syntax system which allows an easier coding process. Especially creating and filling arrays (matrices) were much more easier than the programming languages that i utilized before.

CHALLENGES

* In my first trials, since i did not clear the workspace, i encountered some errors caused due to previously remaining variables.

* Using * instead of .* caused some problems indicating a prerequisite of match between the size of the variables before i realised the reason of the problems.