DATA COMMUNICATION

(CEECC12)

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Semester: 4

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1.) Matrix Computation

Code:

```
clc;
clear;


matrix1 = [1 2 3; 4 5 6; 7 8 9];
matrix2 = [9 8 7; 6 5 4; 3 2 1];


matrix1
matrix2


add = matrix1 + matrix2;
add


sub = matrix1 - matrix2;
sub


mul = matrix1*matrix2;
mul


transposeOfMatrix1 = matrix1';
transposeOfMatrix1


inverseOfMatrix1 = inv(matrix1);
inverseOfMatrix1


elemul = matrix1 .*matrix2;
elemul


concat = [matrix1, matrix2];
concat
```

Output:

```
matrix1 =


    1     2     3
    4     5     6
    7     8     9



matrix2 =


    9     8     7
    6     5     4
    3     2     1



add =


   10    10    10
   10    10    10
   10    10    10



sub =


   -8    -6    -4
   -2     0     2
    4     6     8



mul =


   30    24    18
   84    69    54
  138   114    90
```

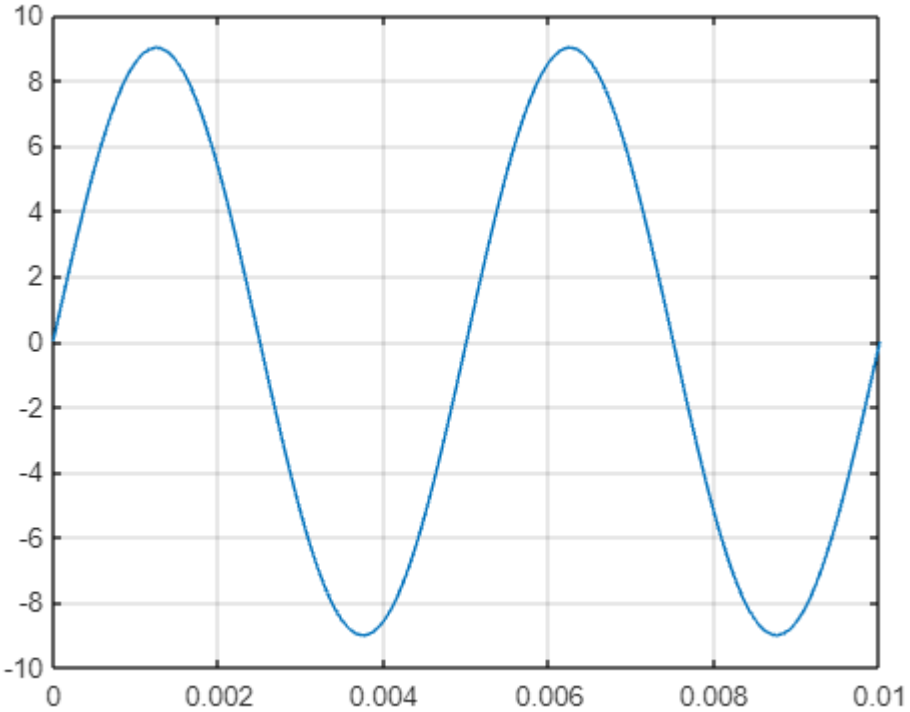
```
transposeOfMatrix1 =

     1     4     7
     2     5     8
     3     6     9

inverseOfMatrix1 =

   1.0e+16 *

    0.3153   -0.6305    0.3153
   -0.6305    1.2610   -0.6305
    0.3153   -0.6305    0.3153



elemul =

     9    16    21
    24    25    24
    21    16     9



concat =

     1     2     3     9     8     7
     4     5     6     6     5     4
     7     8     9     3     2     1
```

2.) To Plot Sine Wave of frequency 200 Hz.

Code:

```
frequency = 200;
time = 0:1/(100*frequency):2/frequency;
amplitude = 9;


signal = amplitude*sin(2*pi*frequency*time);


plot(time, signal);
grid on;
```

Output:

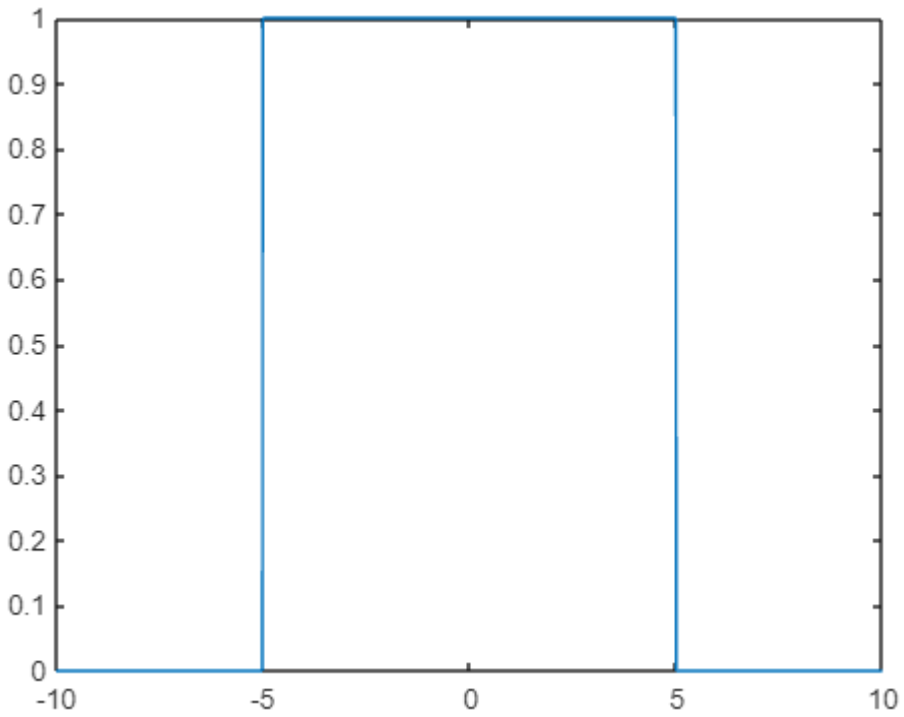


3.) Plot a pulse of width 10

Code:

```
clc;
clear;
Ts = 0.01;
N = 1000;
t= -10:Ts:(N-1)*Ts;
T = 10;
fs=1/Ts;
x1 = rectpuls(t, T);
plot(t,x1);
```

Output:

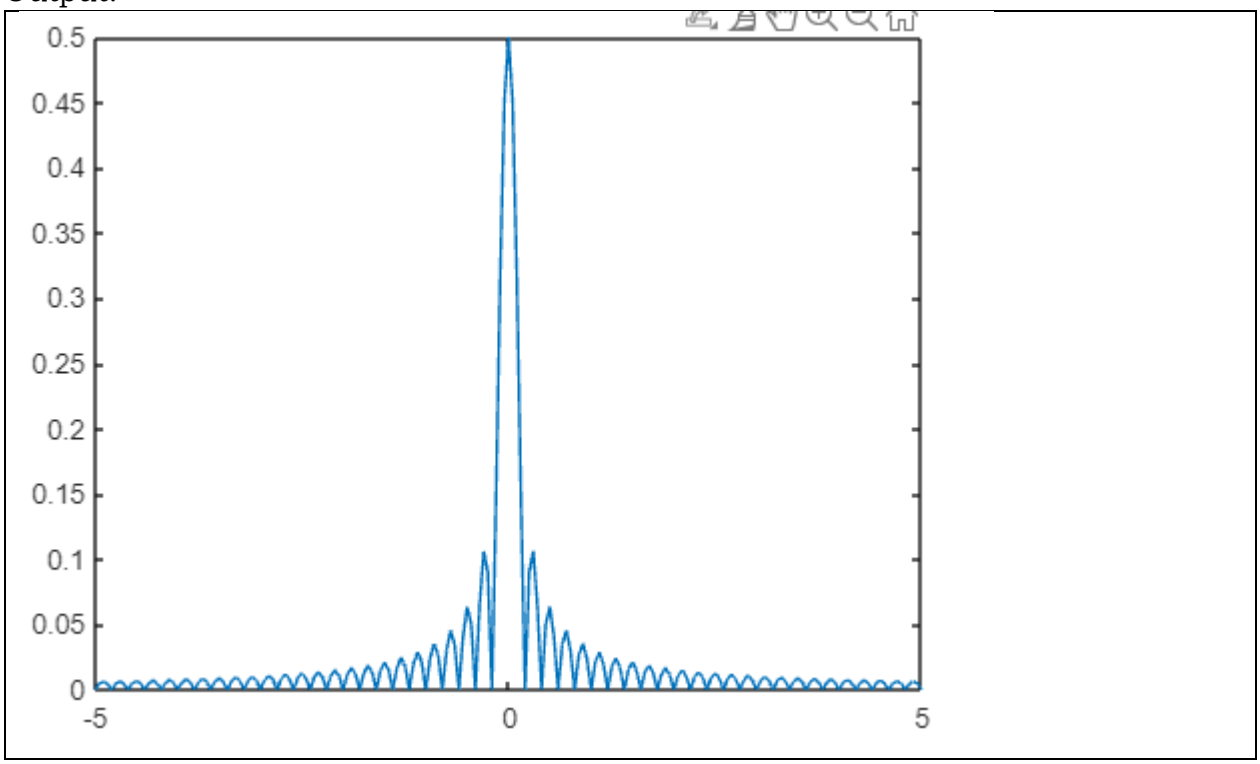


4.) Plot the spectrum of pulse of width 10

Code:

```
Ts = 0.01; N=2000; t=-20:Ts:(N-1)*Ts;
T = 10;
fs=1/Ts;
f=-1*(N)/(N)*fs:fs/N:(N-1)/(N)*fs;
length(f)
x1 = rectpuls(t, T);
xk=fft(x1);
yk=fftshift(xk);
length(xk)
plot(f, 1/N*abs(yk));
xlim([-5,5]);
```

Output:



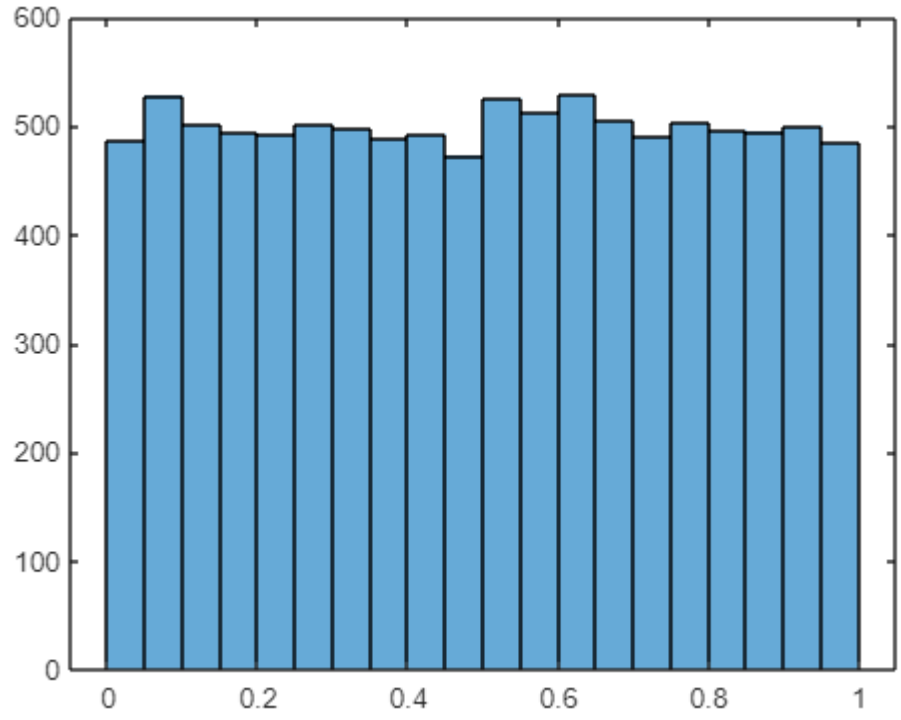
5.) Plot the PDF of uniform random variable and find its mean and variance

Code:

```
x = rand(1, 10000);
histogram(x);


meanOfx = mean(x);
varianceOfx = var(x);
meanOfx
varianceOfx
```

Output:

Pdf:



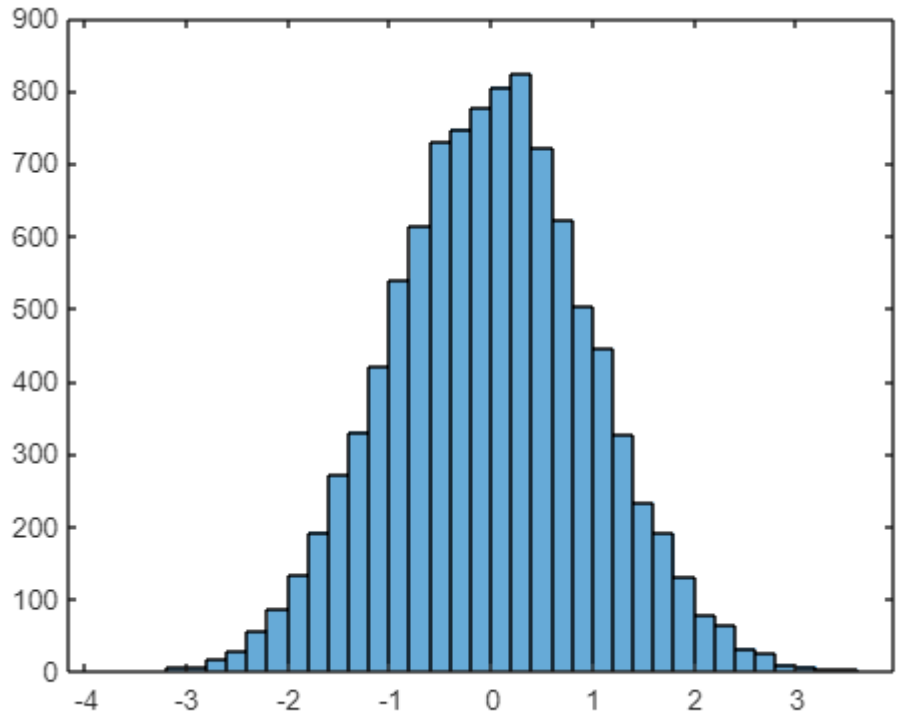

```
meanOfx =

    0.4996


varianceOfx =

    0.0829
```

6.) Plot the PDF of gaussian random variable and find its mean and variance

code:

```
clc;
clear;
x = randn(1, 10000);
histogram(x);
meanOfx = mean(x);
varianceOfx = var(x);
meanOfx
varianceOfx
```

Output:



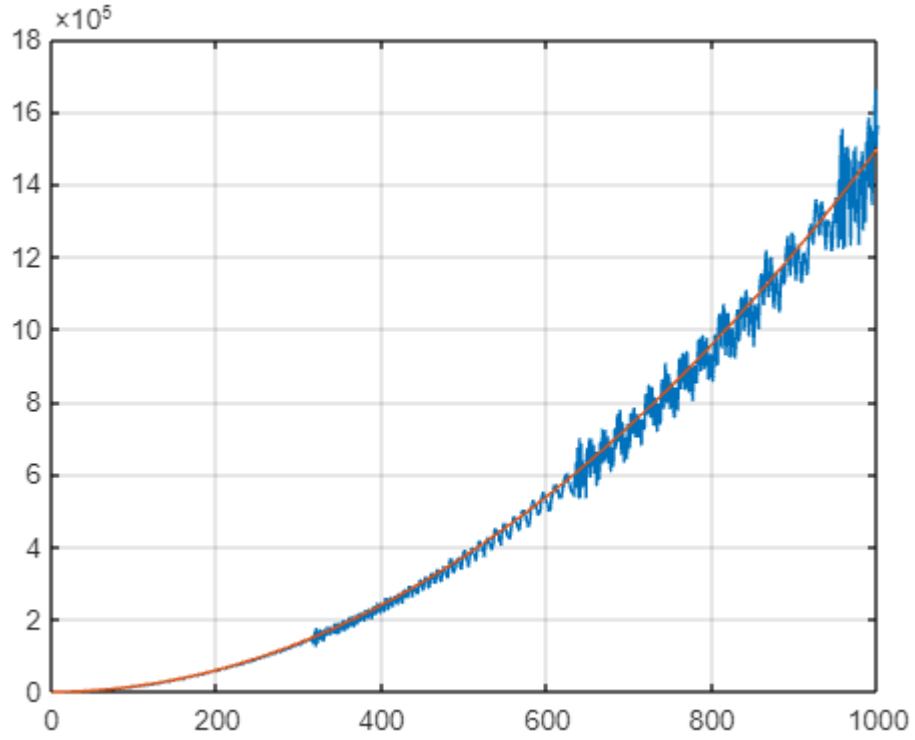

```
meanOfx =

    0.0017


varianceOfx =

    0.9830
```

7.) Compute the Signal to quantization Noise ratio of Uniform Quantization. Plot SNQR versus Quantization levels.

Code:

```
clear;
clc;


levels = 1:1000;
amplitude = 5;
frequency = 1;
time = 0:0.001:1;
x = amplitude*sin(2*pi*frequency*time);
mx = max(x);
mn = min(x);
step = (mx-mn)./levels;
for i=levels
    in= floor((x-mn)/step(i));
    xq = mn+in*step(i) + step(i)/2;
    noise = xq-x;
    rmsofnoise = var(noise);
    power = amplitude*amplitude/2;
    sqnr(i) = power/rmsofnoise;
end
sqnrTheoretical= levels.*levels;
sqnrTheoretical = sqnrTheoretical*(3/2);
sqnrPractical = sqnr;
plot(levels, sqnrPractical);
hold on;
plot(levels, sqnrTheoretical);
hold off;
grid on;
```

Output:



Orange line: theoretical
Blue line: practical