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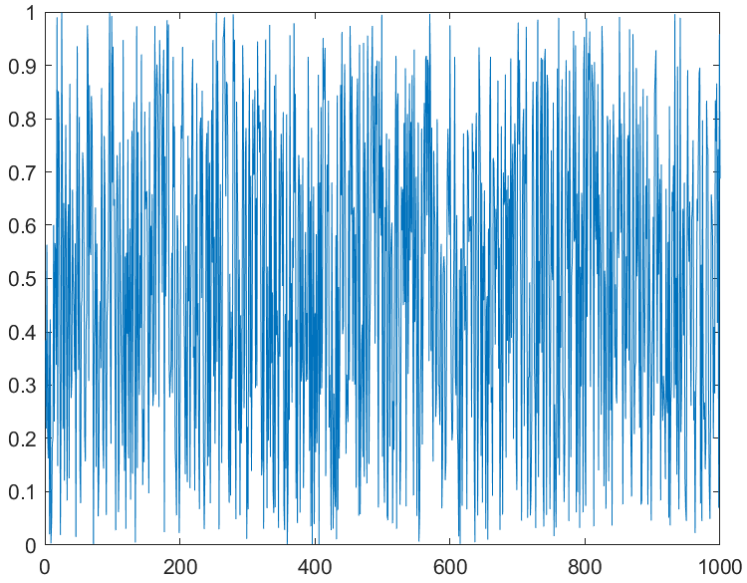
ENGR-120-01 SU

Computer Assignment 01

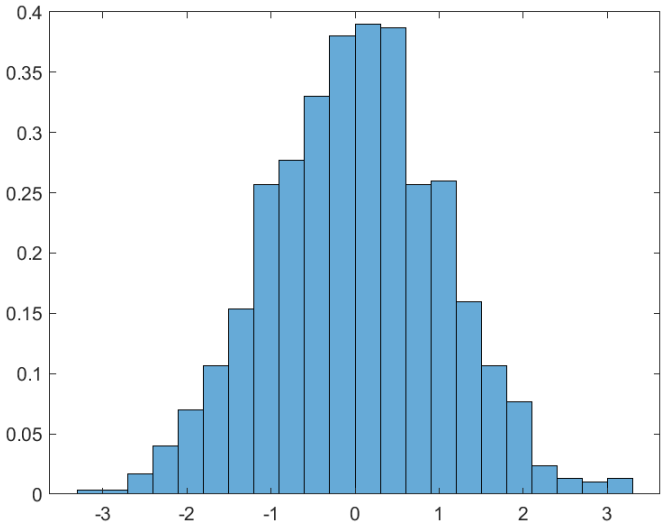
Task 1: Use Matlab to generate a standard Gaussian random X, i.e. a sufficiently large vector of normally distributed random variables. Use the generated data to plot the random variable X.

```
% Task 1
X = rand(1000,1);
figure(1)
plot(X)
```



Task 2: Use the generated data in Task 1 to plot the PDF of X.
Hint: you may find these Matlab functions helpful for Task 1 and Task 2, randn(.) and histogram(.).

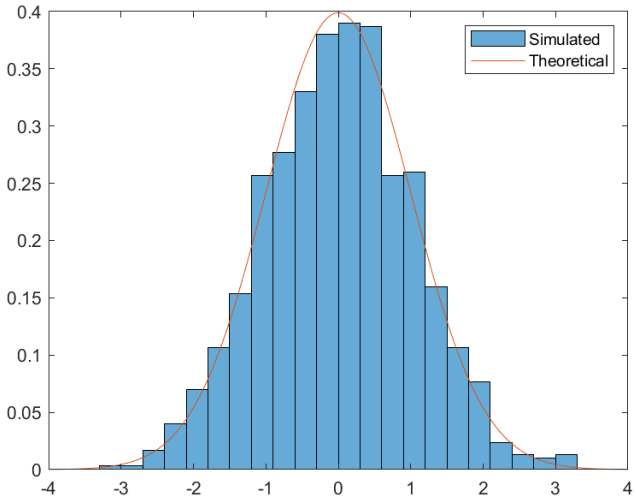
```
% Task 2
X = randn(1000,1);
figure(2)
histogram(X,'Normalization','pdf')
```



Task 3: Plot the theoretical PDF of this random variable – use suitable values for x. Overlap the theoretical plot with the simulated plot generated in Task 2. Recall the PDF of X is

$$f_X(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$$

```
% Task 3
x = -5:0.001:5;
f = (1/sqrt(2*pi))*exp(-0.5*(x.^2));
figure(2)
hold on
plot(x,f)
legend('Simulated','Theoretical')
```



Task 4: Use Matlab to calculate the total area under the plotted curve in Task 3. This should represent the total area (or probability) under the PDF. Hint: you may find this function helpful for this step trapz(.,.). For this task, simply write down the output of this function.

```
a = trapz(x,f)

a =

    0.9999
```

Task 5 (optional): Use the Matlab function trapz(.,.) along with the theoretical PDF plotted in Task 3 to calculate the probability P (X>2). Use the Q-function to verify this result. For this task, simply compare the two results. Are they the same?

```
>> x2=find(x>2);
num = trapz(x(x2),f(x2))

num =

    0.0227

>> y = 1-qfunc(-2)

y =

    0.0228
```