Q1.

(1) $4R + 6G$

(2) $5R + 5G$

(3) $3R + 7G$

6 sided dice

$1 \,||\, 2 \Rightarrow \frac{2}{6} \rightarrow$ (1)

$2 \,||\, 4 \Rightarrow \frac{2}{6} \rightarrow$ (2)

$5 \,||\, 6 \Rightarrow \frac{2}{6} \rightarrow$ (3)

$$P(R) = P(R)(1) + P(R)2 + P(R)3$$

$$= \frac{2}{6} \times \frac{4}{10} + \frac{2}{6} \times \frac{5}{10} + \frac{2}{6} \times \frac{3}{10}$$

$$= \frac{1}{3}\left[\frac{4+5+3}{10}\right] = \frac{1}{\cancel{3}} \times \frac{\cancel{12}\,4}{10} = \frac{4}{10} = \frac{2}{5}$$

W

(2) $\boxed{4R,\ 10G,\ 6Y}$ → 3 balls without replacement

→ (1) all red
(2) 2-red & 1-green

$$P(\text{all Red}) = \frac{4}{20} \times \frac{3}{19} \times \frac{2}{18} =$$

(1) (2) (3)

$$= \frac{1}{5} \times \frac{1}{19} \times \frac{\cancel{2}\,1}{\cancel{6}\,3} = \frac{1}{19 \times 15} = \frac{1}{285}$$

P[2Red & 1 green].

R R G
G R R
R G R.

$$\Rightarrow \cancel{3} \times \left[\frac{\cancel{4}^{2}}{\cancel{20}} \times \frac{\cancel{3}}{19} \times \frac{\cancel{10}}{\cancel{18}_{4}} \right].$$

$$= \frac{1}{19}$$

stamp plots
done

(3). 100 / 365

W3.

$\frac{100}{365}$

P(RT) ✓

P

Let R be the event it rains

Let ~~R be~~ B be the event that it is predicted to rain.

Let $\overline{B}$ be the event that it is predicted not to rain

$$P(R|B) = \frac{P(B|R) \cdot P(R)}{P(B)}$$

$$P(B) = P(B|R)P(R) + P(B|\overline{R})P(\overline{R}).$$

$$= \frac{0.9 \times 100/365}{0.9 \times 100/365 + 0.1 \times 265/365}$$

$$= \frac{0.9 \times 100}{0.9 \times 100 + 0.1 \times 265}$$

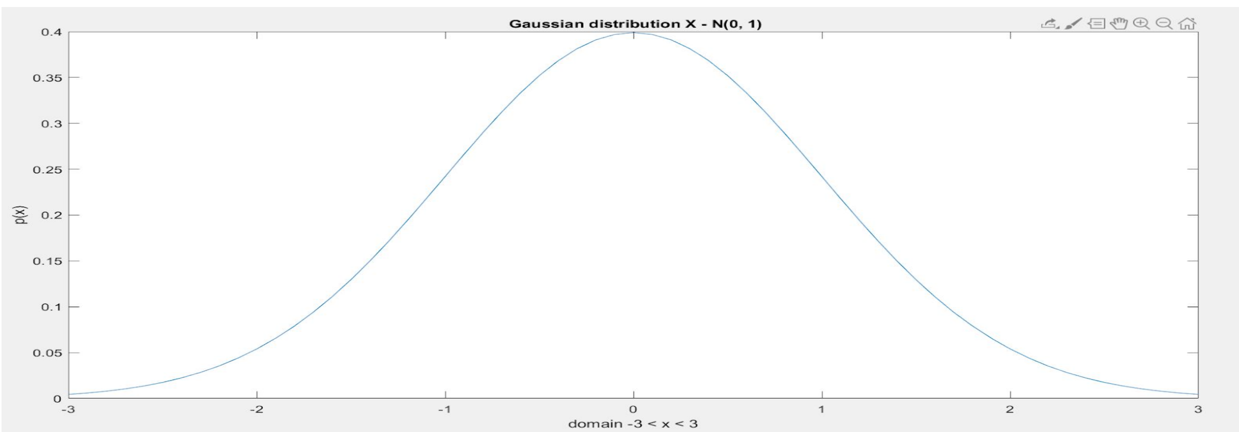
$$= \frac{90}{90 + \cancel{265}\, 26.5} = 77.253\%$$

Homework 1 : Algorithmic robotics

1,2,3 - Written assignment

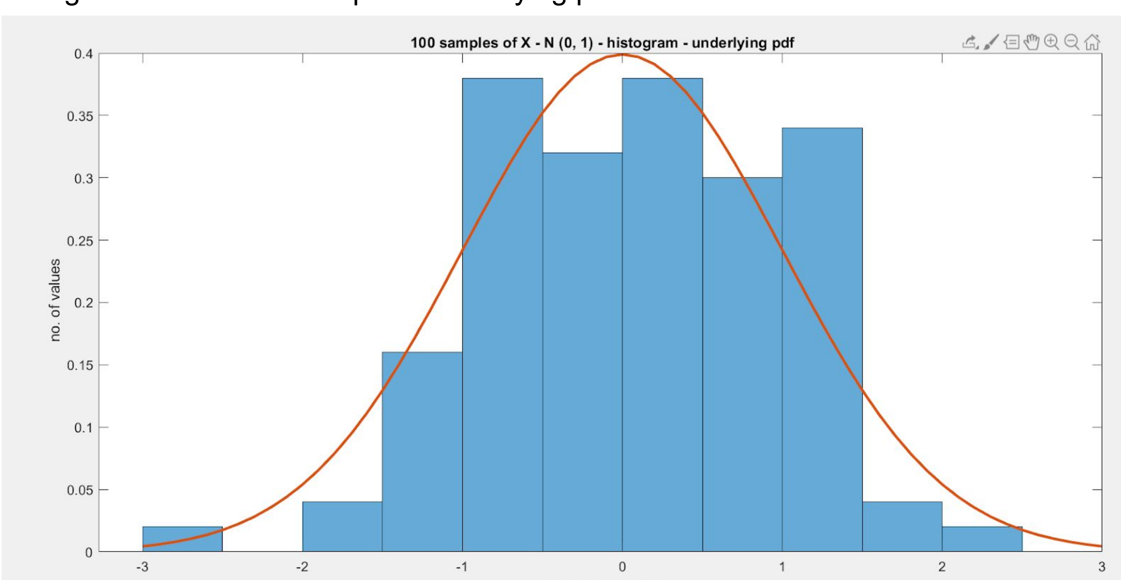
(P1)
Consider a Gaussian distribution X - N(0, 1).
Generate 3 different sets of samples from this distribution for each of the three sample sizes N = 100,N =1,000, and N =100,000,and construct the corresponding histograms. Plot the resulting histograms and the underlying probability density function.

Solution :
Gaussian distribution X - N(0, 1).

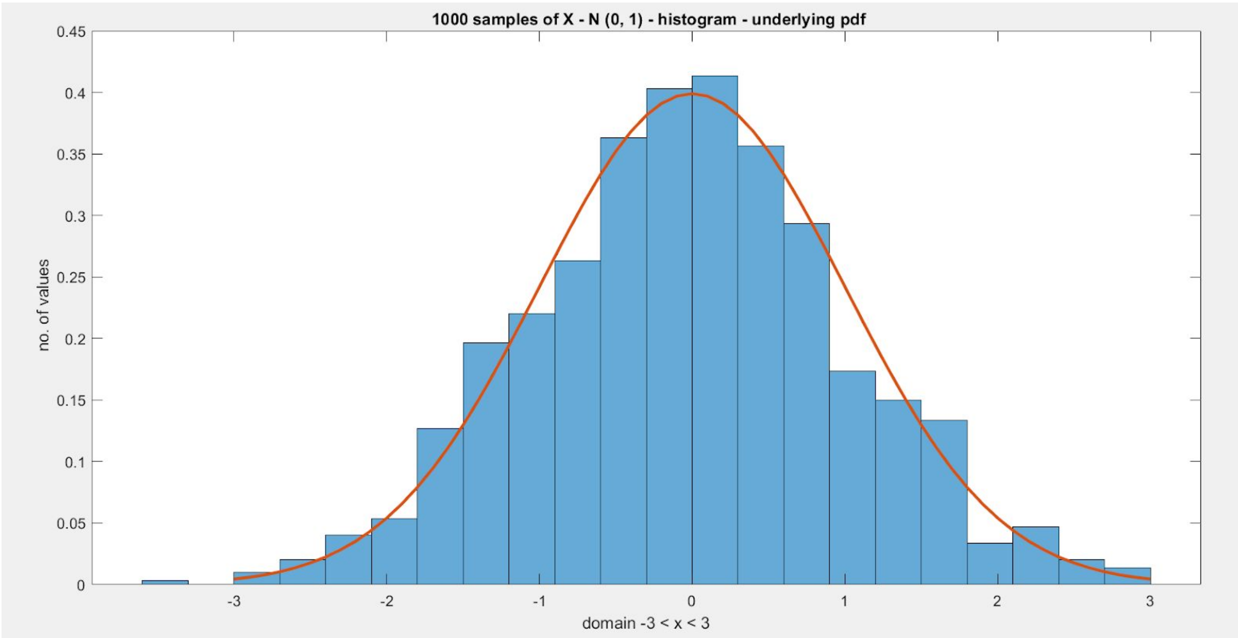


Generate 3 different sets of samples from this distribution for each of the three sample sizes N = 100,N =1,000, and N =100,000 ,and construct the corresponding histograms.

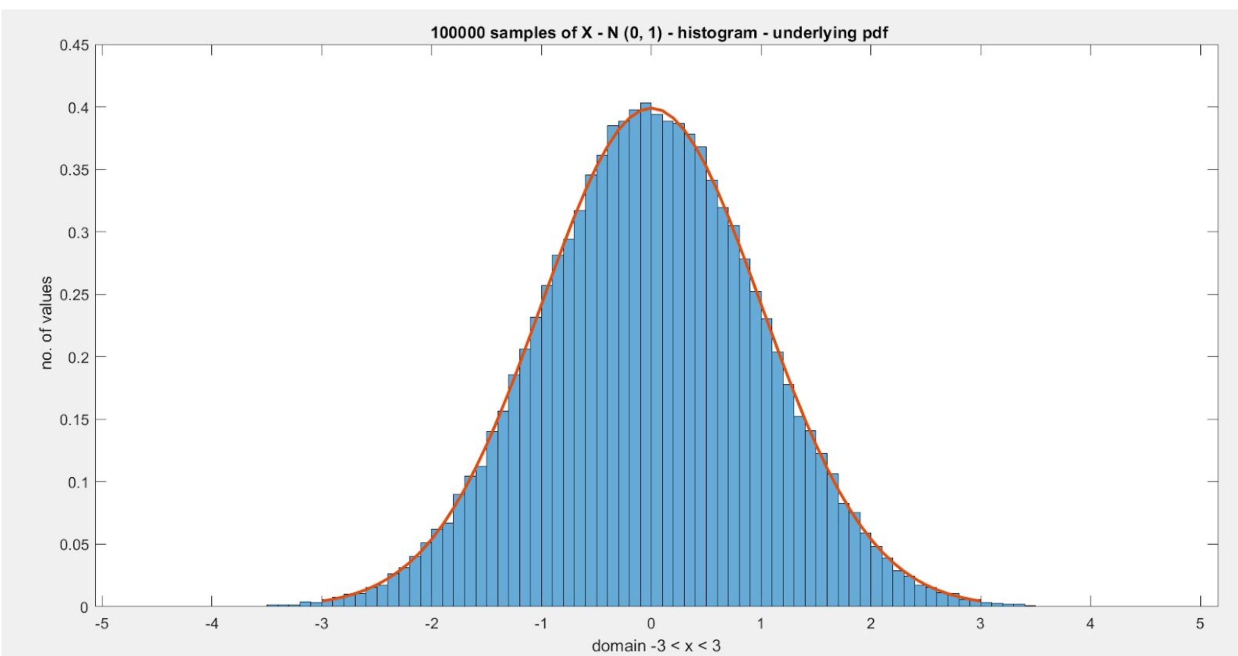
Histogram for hundred samples - underlying pdf in red



Histogram for thousand samples - underlying pdf in red



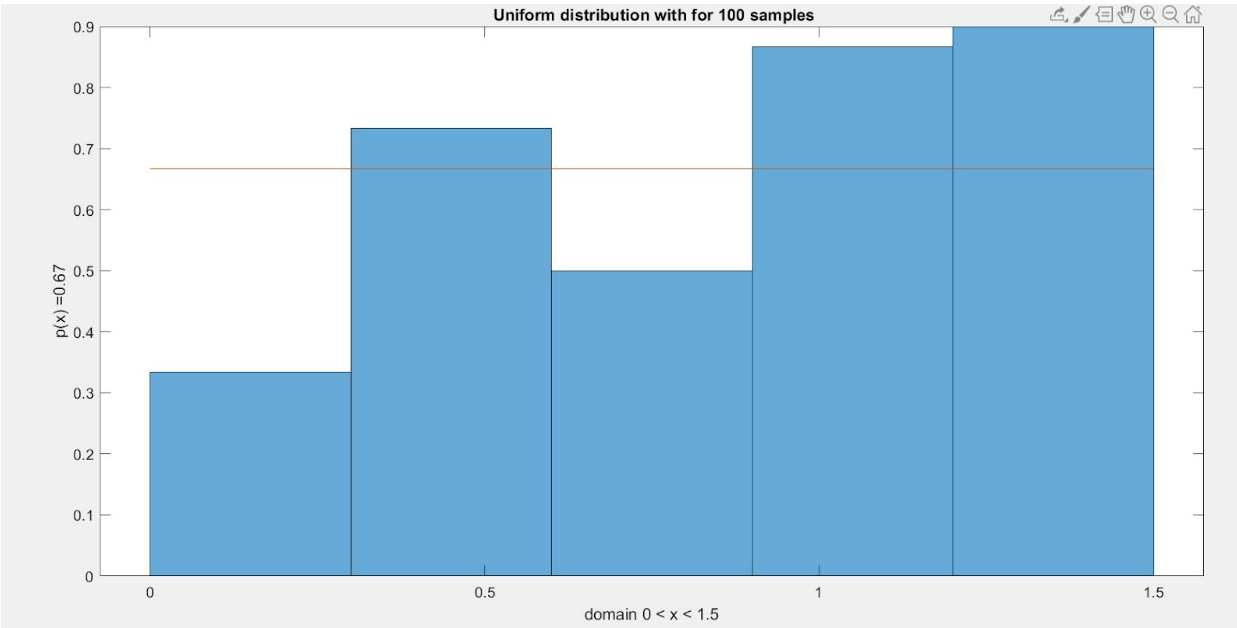
Histogram for hundred- thousand samples - underlying pdf in red



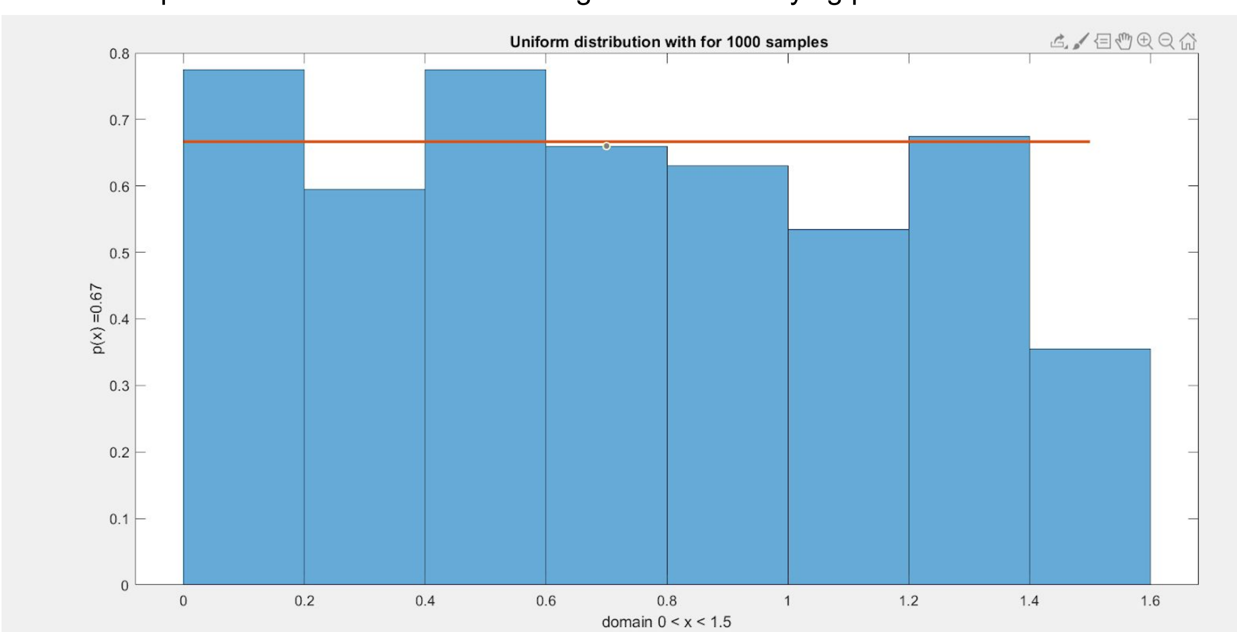
(P2)
Consider a Uniform distribution X - U (0,1.5). Generate 3 different sets of samples from this distribution for each of the three sample sizes N =100,N =1,000,and N =100,000,and construct the corresponding histograms. Plot the resulting histograms and the underlying probability density function.

Generate 3 different sets of samples from this distribution for each of the three sample sizes N =100,N =1,000,and N =100,000

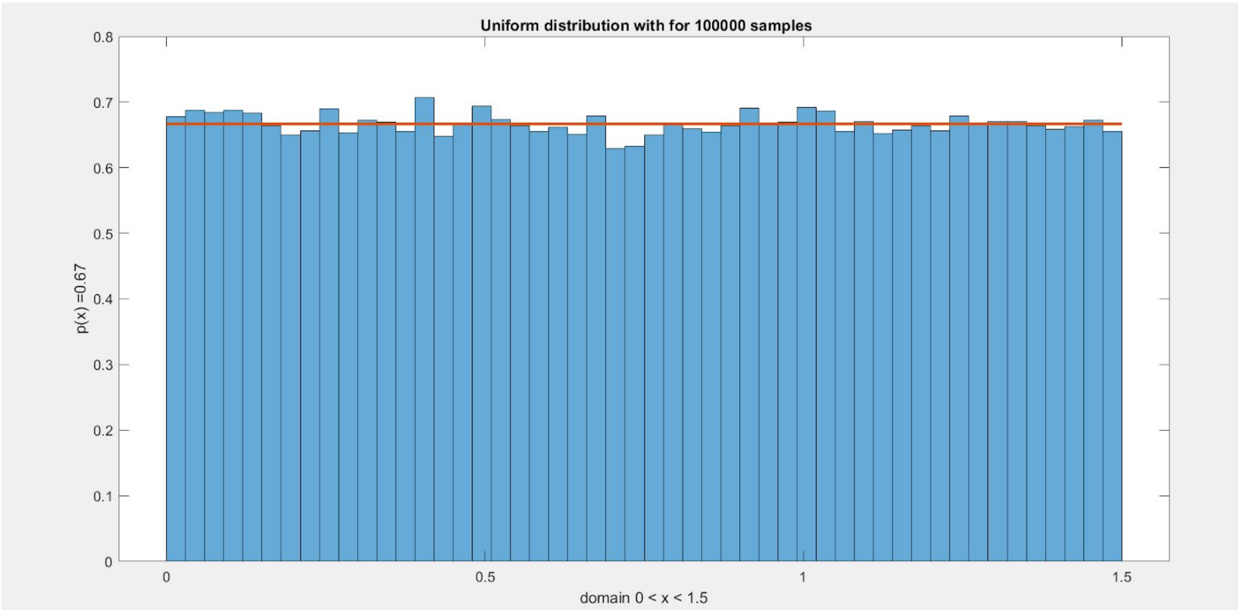
1- 100 samples - uniform distribution - histogram and underlying pdf



2- 1000 samples - uniform distribution - histogram and underlying pdf

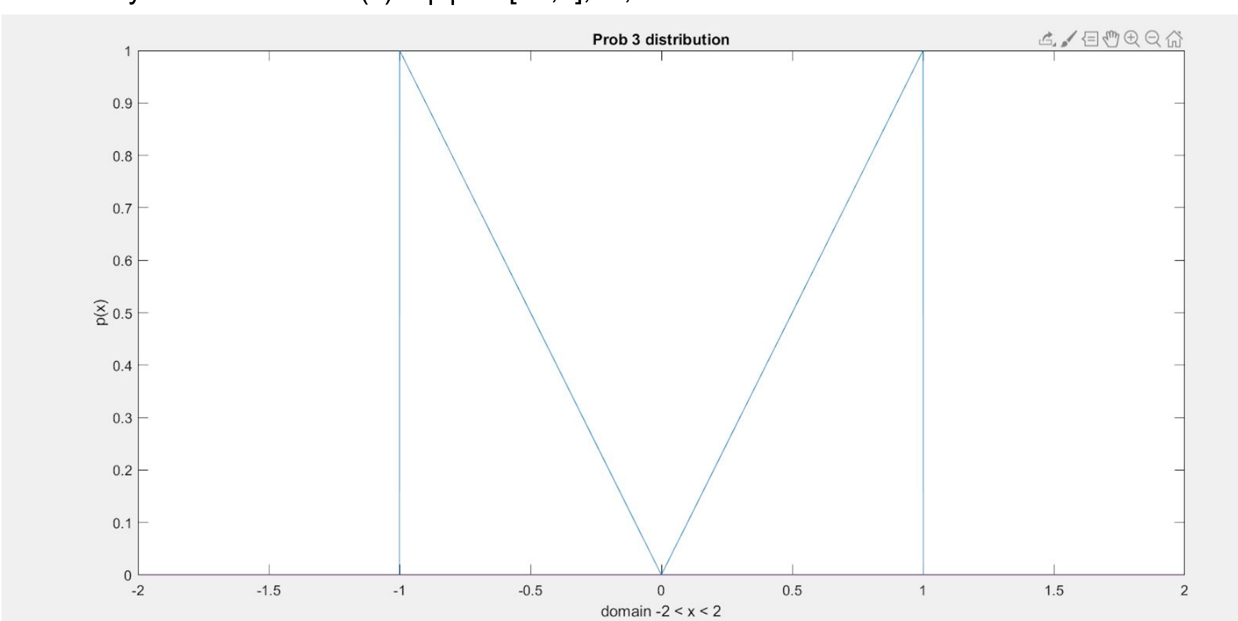


3- 100000 samples - uniform distribution - histogram and underlying pdf

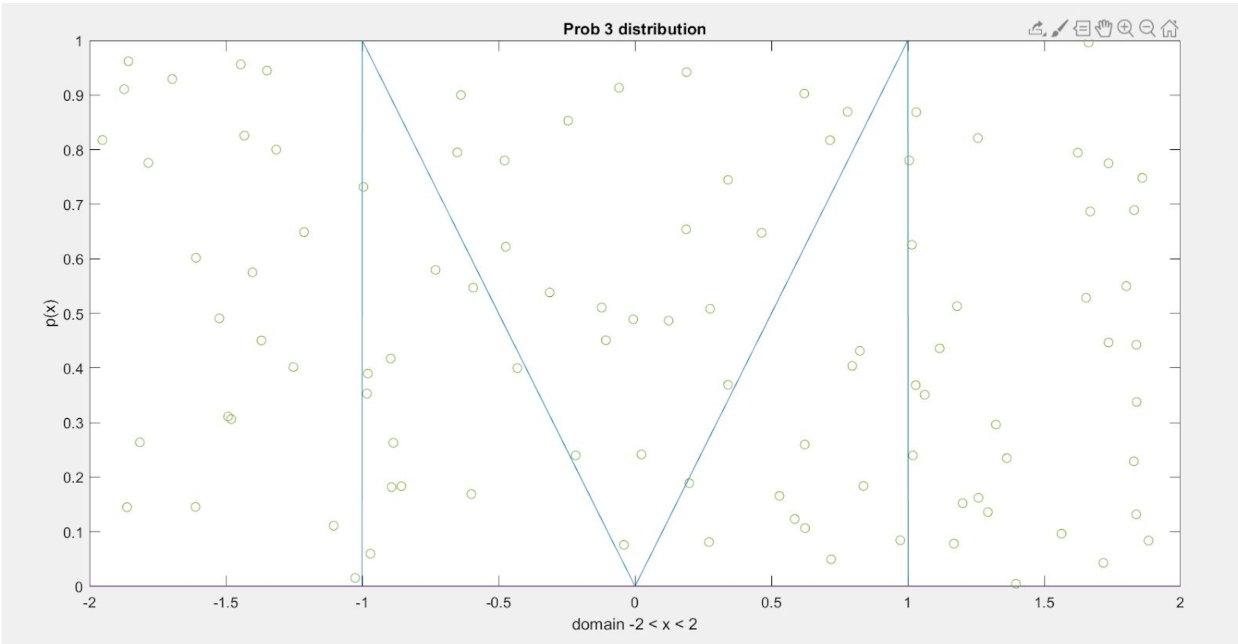


(P3)
Consider the probability distribution X ~ f(x) = |x| x∈[−1,1], 0 otherwise
With a domain of [−2, 2]. Generate a set of samples from this distribution for a sample size of N =100,000 using rejection sampling, and construct the corresponding histograms. Plot the resulting histogram and the underlying probability density function.

Solution:
Probability distribution X ~ f(x) = |x| x∈[−1,1], 0 , otherwise



Inserted randomly generated uniform distribution points

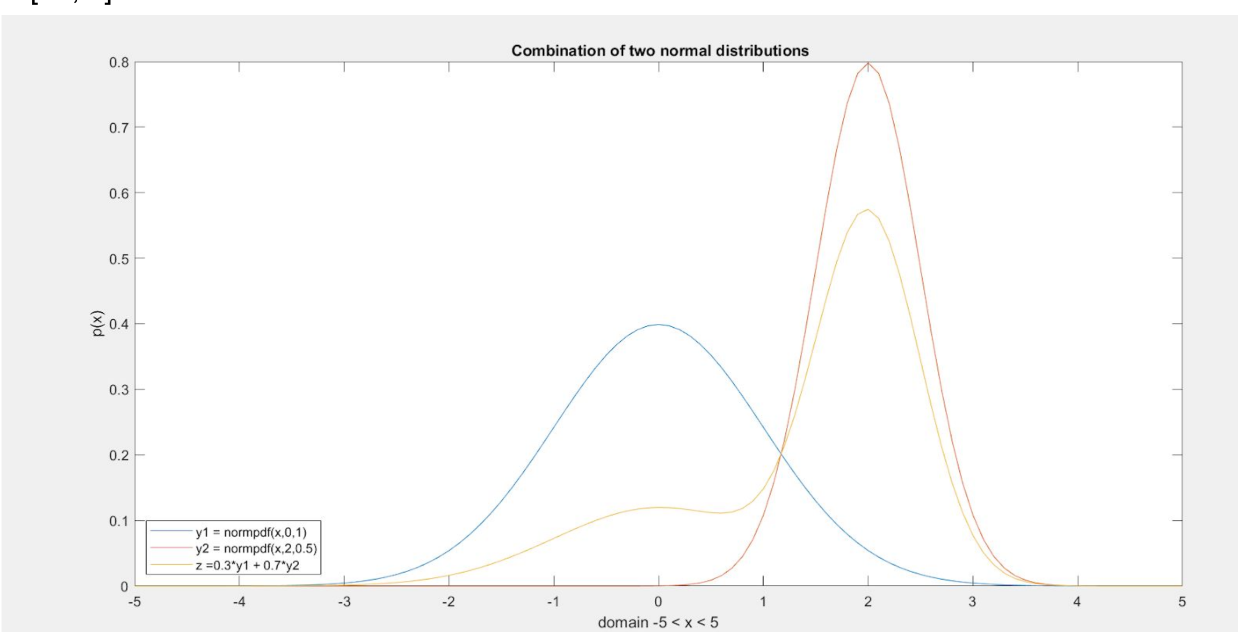


(P4)

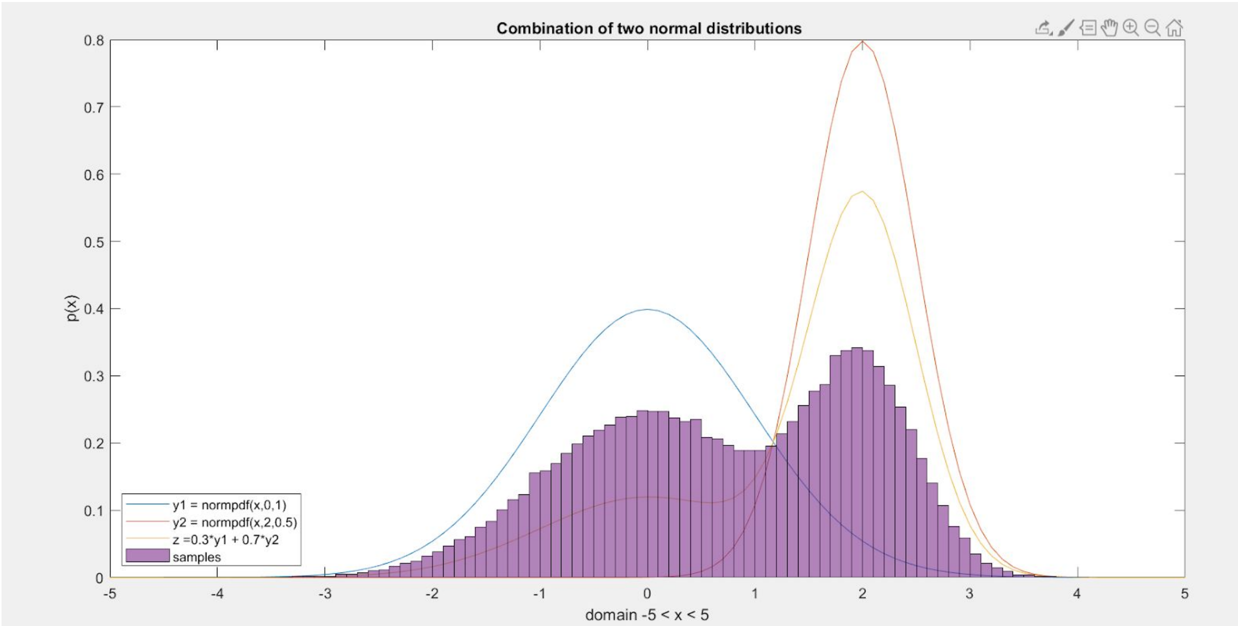
Consider a mixture of two Gaussians, f(x) = ∑2 i=1 pi * fi, where p1 = 0.3, p2 = 0.7 and f1 ~N(0, 1), f2 ~ N(2, 0.5), with the domain of [−5, 5]. Generate the samples from this distribution using the sample size of N = 100,000, then construct the resulting histogram. Plot the resulting histogram and the underlying probability density function.

Solutions:

f(x) = ∑2 i=1 pi * fi, where p1 = 0.3, p2 = 0.7 and f1 ~N (0, 1), f2 ~ N (2, 0.5), with the domain of [−5, 5].



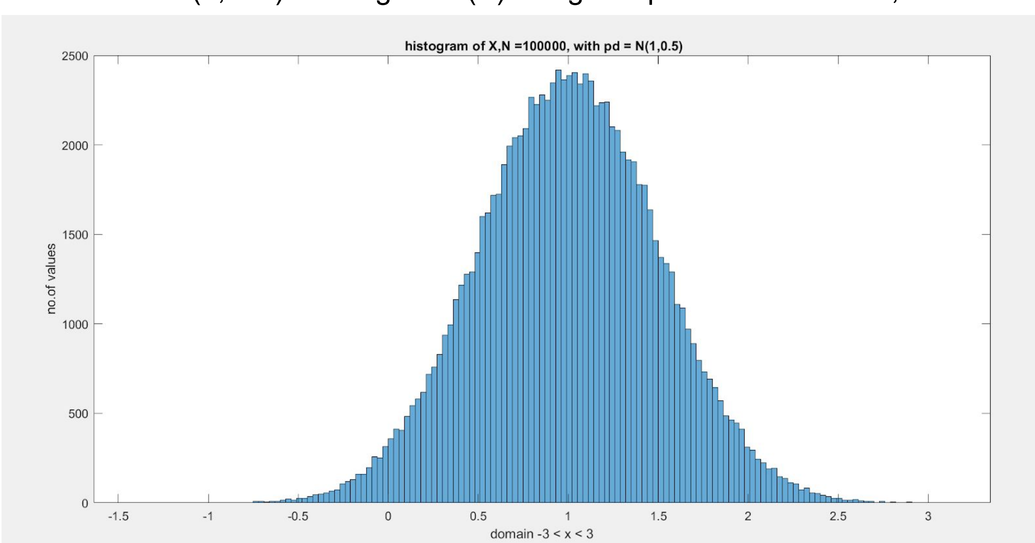
Generate 100000 samples from this distribution:



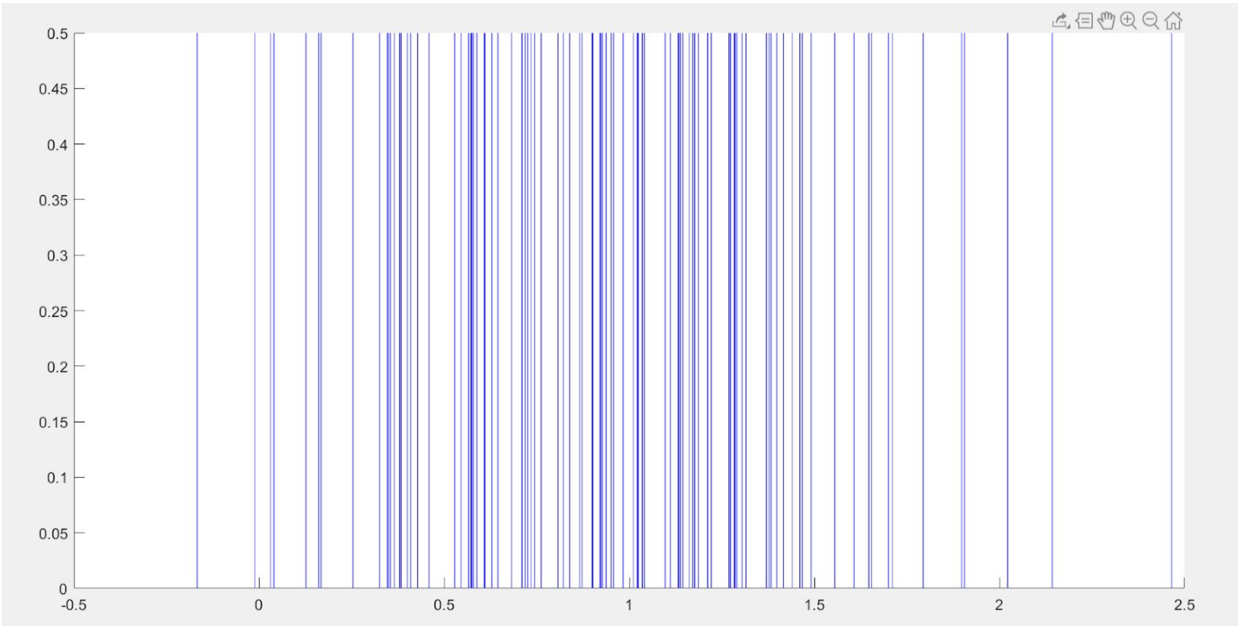
(P5) Consider a Gaussian distribution X~N(1, 0.5) with the domain of [−3, 3],generate its histogram h(X) using sample size of N = 100,000. For any x∈X, there is a nonlinear transformation y = x^2, what is the histogram of Y? Show your results of the histogram of X and the histogram ofY. Set the sample size N = 1,000, generate the histogram of X and the histogram ofY, then plot their corresponding density distribution based on the samples of X andY (you can use ”line” function to mark the density distribution, an example is given below).

Solution:

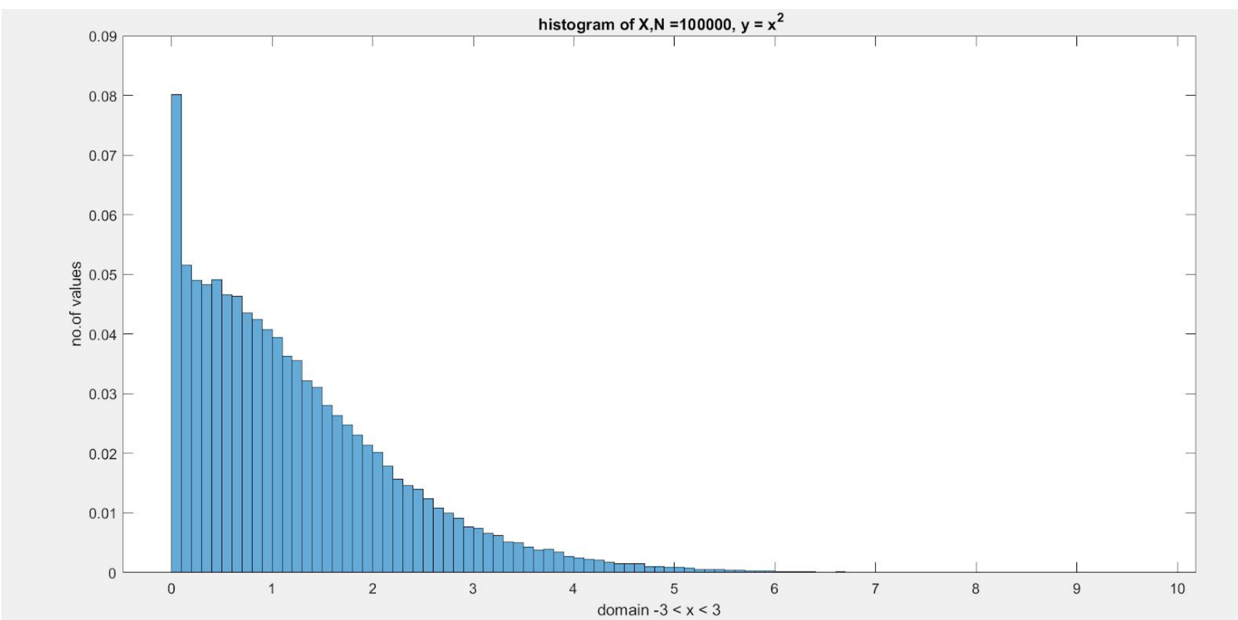
Generate X~N(1, 0.5)’s histogram h(X) using sample size of N = 100,000



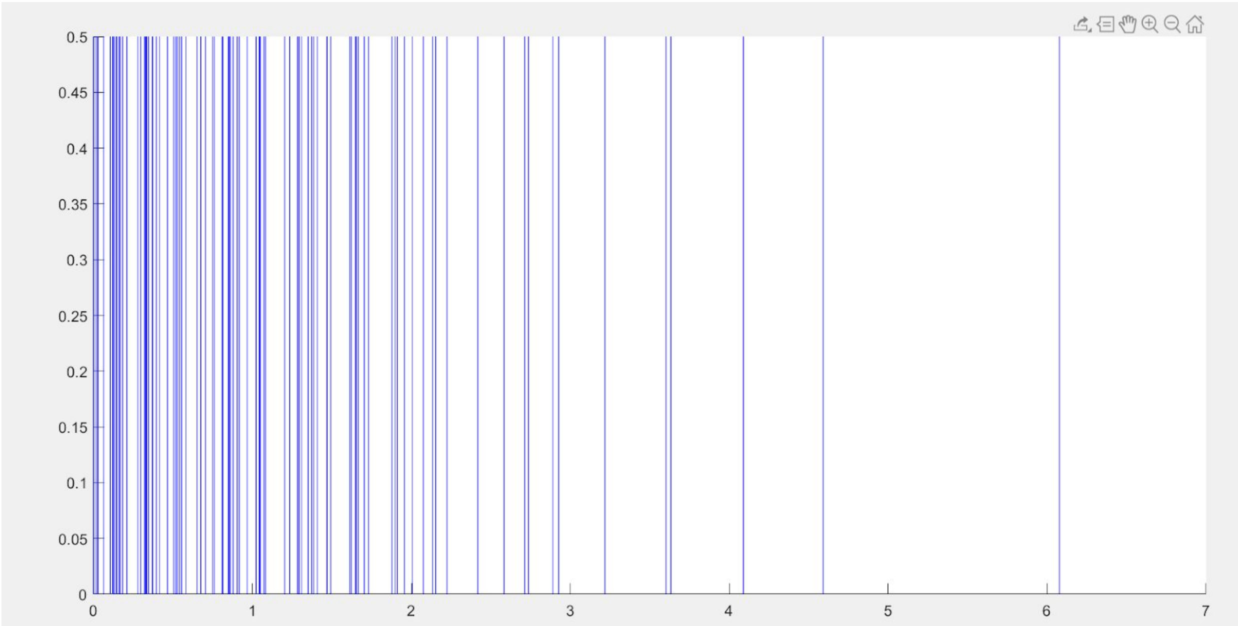
Density distribution of 100 samples of pd = N(1, 0.5)



y = x^2, what is the histogram of Y?



Density distribution for n= 100 samples



0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5
6
7