Homework 3

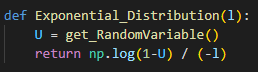
Computational Methods for Data Science

r11946013 簡立誠

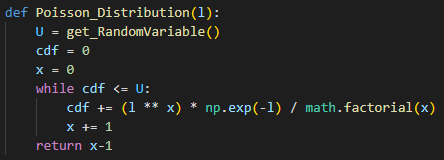
Q1.

1. Normal

(b) Exponential



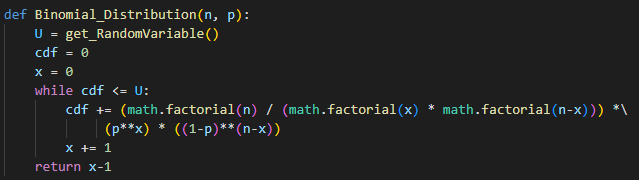
(c) Poisson



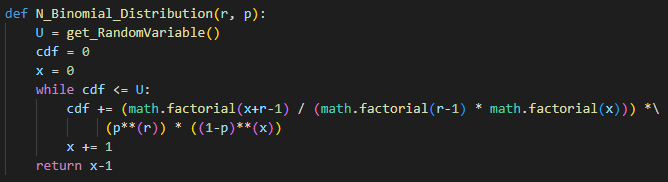
(d) Chi-Square

(e) Fk,m

(f) Binomial



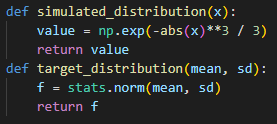
(g) Negative Binomial



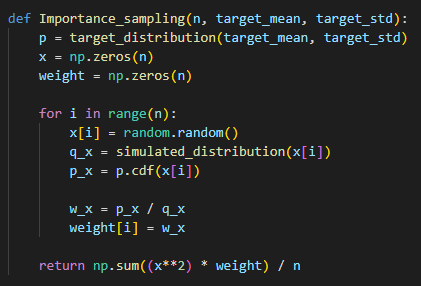
(h) Dirichlet

Q2.

p(x) is the target distribution and q(x) is the simulated distribution. I assume that the distribution is as following respectively.



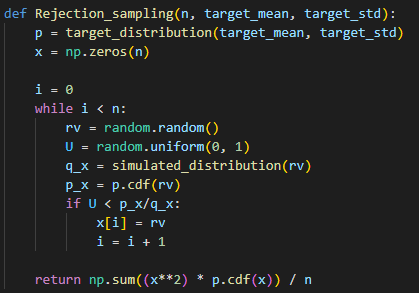
(a)



As the problem set, target mean is 0 and target std is 1. I do sampling for 10000 times. The estimated E(X2) is 0.3058

For the distribution of estimation,

(b)



As the problem set, target mean is 0 and target std is 1. I do sampling for 10000 times. The estimated E(X2) is 0.3135

Q3.

(a)

“h” will affect the accuracy of the estimation. Thus, if h increases, will be close to 3.14. In fact, it has a lower bound.

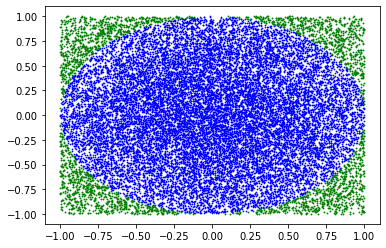
|  |  |  |
| --- | --- | --- |
| Simulation for 100 times | | |
| h | Mean | Std |
| 1 | 3.448 | 0.009 |
| 2 | 3.319 | 0.011 |
| 3 | 3.318 | 0.009 |

“n” will affect the convergence of the distribution. The larger the “n” is, the smaller the standard deviation is.

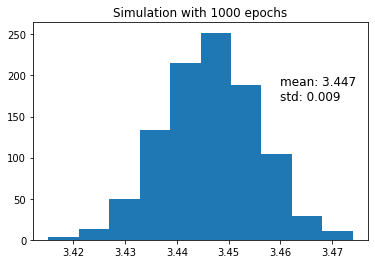
|  |  |  |
| --- | --- | --- |
| Simulation for 100 times | | |
| n | Mean | Std |
| 200 | 3.466 | 0.093 |
| 1000 | 3.449 | 0.038 |
| 2000 | 3.447 | 0.026 |
| 20000 | 3.448 | 0.01 |

(b)

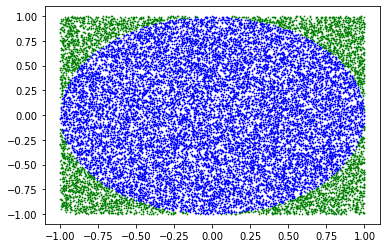
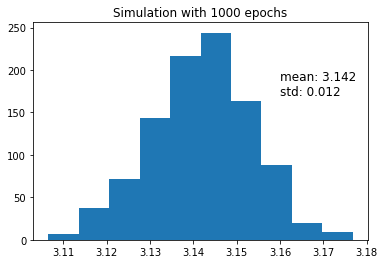
The method finds a new point based on the previous simulated point, which may cause bias of the estimation.

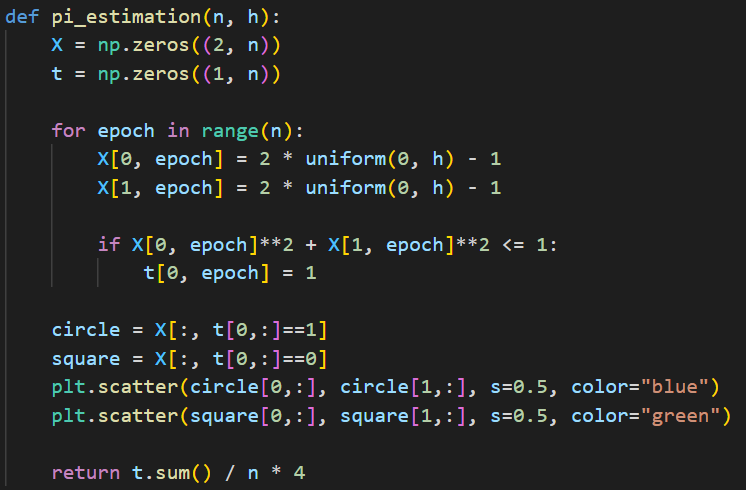
For example, the following figure is the simulation of the given method, and is 3.4619 with generated 23109 points.

When we simulate for 1000 times to find its distribution, it shows that mean has bias to 3.44.



(c)

the following figure is the simulation of my method, which is 3.136. And there is the histogram of estimation for 1000 epochs simulation. It shows that my method can accurately estimate which is close to 3.14.

code:

Q4.

Q5.

Q6.