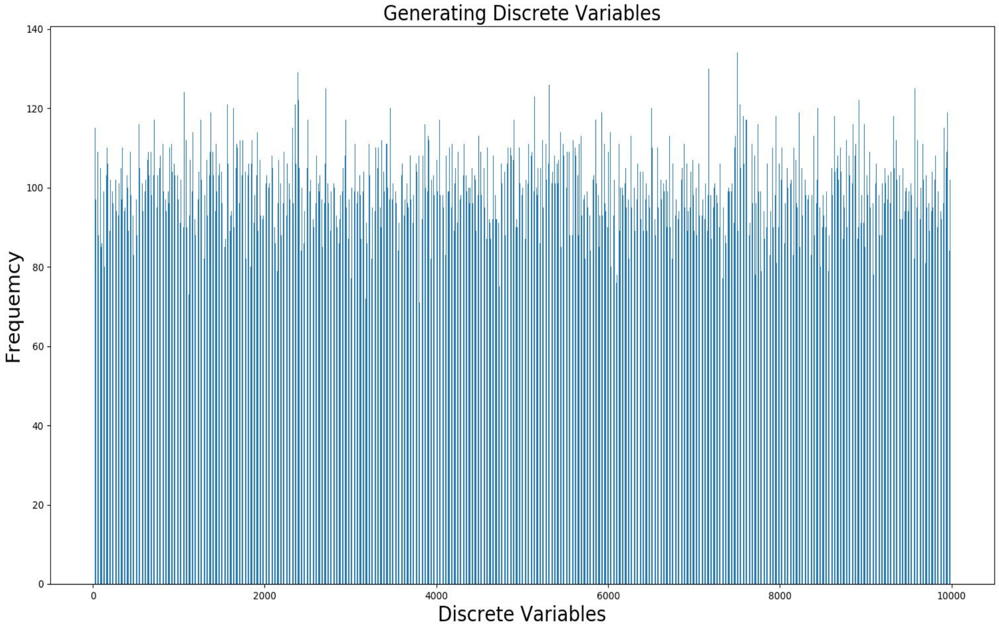
MA323(Lab-03)

Jatin Dhingra
Roll no. 180123060

Problem 1

Inbuilt function in python is used to generate 1,00,000 random numbers in U[0,1]. Then using algorithm, discrete random numbers are generated from {1, 3, --- , 9999} . Below is histogram which represent frequency of every number generated and it is clear that numbers are uniformally generated from given set {1, 3, -- , 9999}.



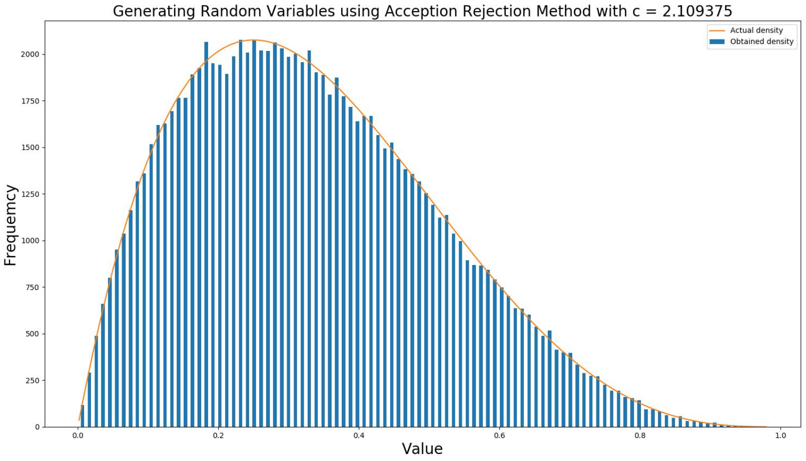
Problem 2

Part a: Given inequality is f(x)<=(c*g(x))

Smallest constant c which satisfy given inequality is **2.109375** (Solved using differentiation).

Part b: First of all random numbers are generated using probability density function g(x) (i.e U[0,1]). Then using acceptance-rejection method(using c as calculated above), random numbers are generated which correspond to probability density function f(x).

In the histogram shown, the orange curve is the actual density function scaled to match the frequencies denoted by the blue bars in the histogram. As can be seen in the graph, the density of the generated sequence converges to actual density.

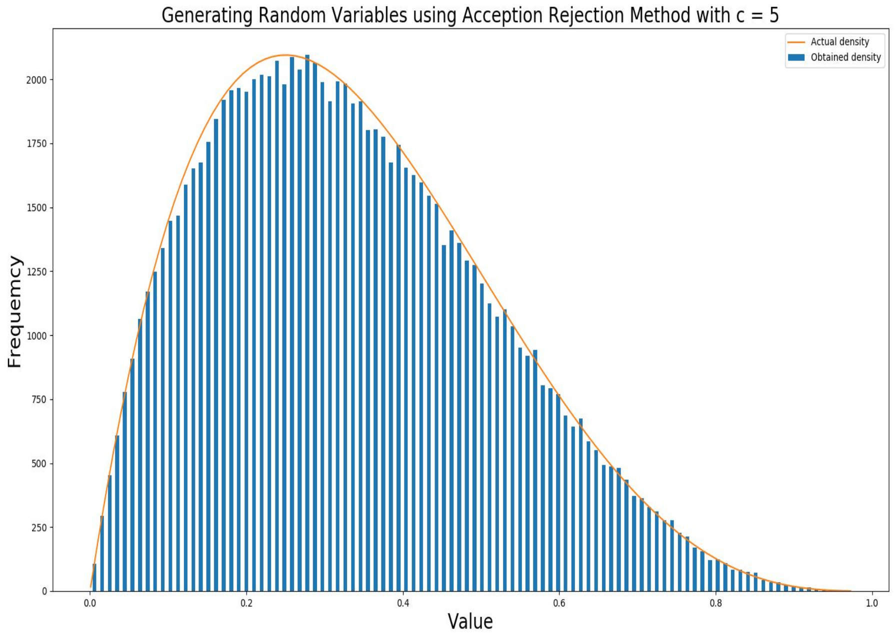


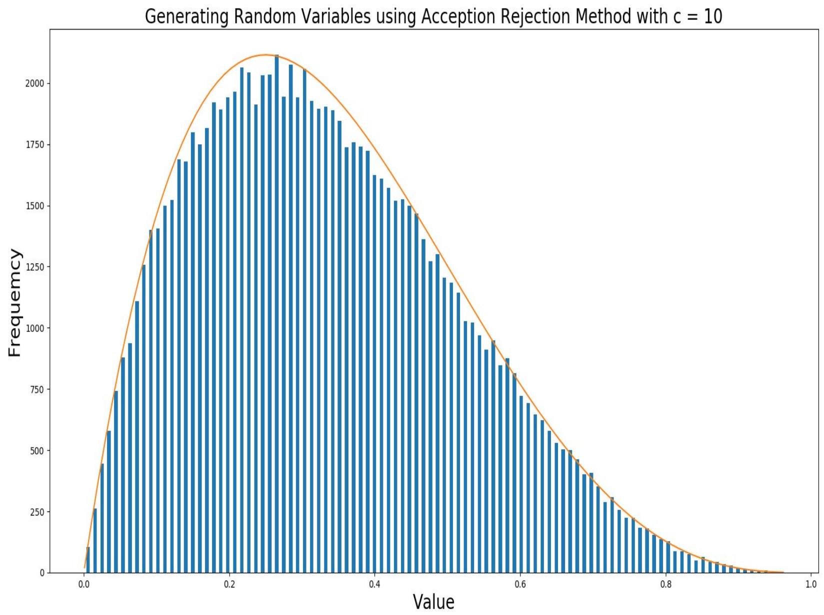
Part c: Mean of numbers of iterations required for acceptance of random number is 2.114820 which is very close to value of c(2.109375).

Part d: Repeating above experiment for two more values of c(5 and 10 in my case), I observe that value of c in every case is approximately equal to mean of number of iterations required for acceptance of random variable. Below is table representing same.

Value of c	Mean number of iterations
2.109375	2.114820
5.000000	5.002170
10.000000	9.980840

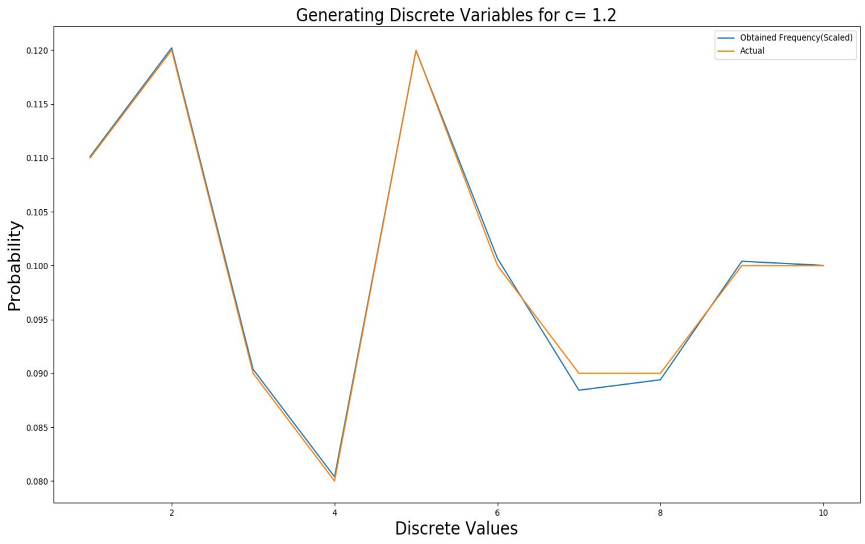
Below are histogram for c= 5 and c= 10

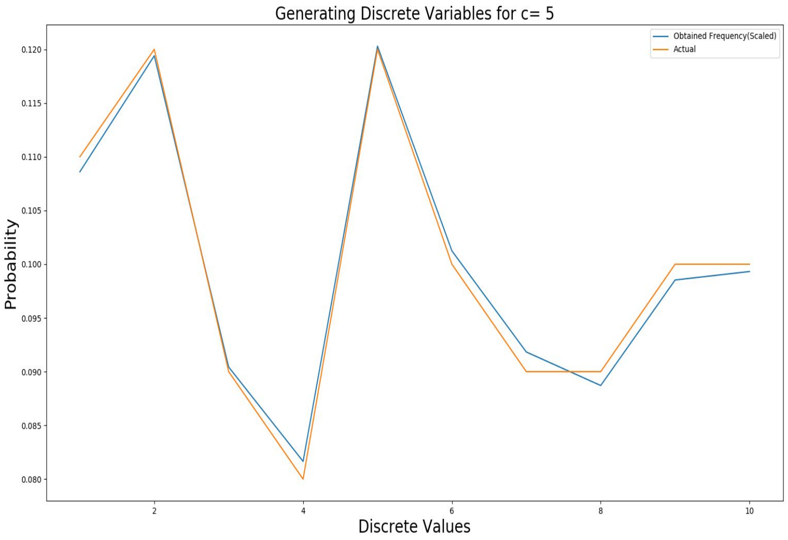




Problem 3

In this case base distribution is discrete uniform distribution on S= {1, 2, -- , 10}.
Probability Mass function for base distribution is g(x)= 0.1 for all x in S.
Since f(x) takes maximum value of **0.12** .Therefore, minimum possible value of c is 1.2 (Solving f(x)<=c*g(x)).
Thus 2 values of c chosen are 1.2 and 5.
I generated a sequence of variables with 1,00,000 elements for both values of c using Acceptance-rejection method.
In the below graphs, the orange curve is the actual density function and blue curve is the obtained density functions. It is clear from below graphs that the density of the generated sequence converges to actual density.





I also observed that value of c in both case is approximately equal to mean of number of iterations required for acceptance of random variable.
Below is table representing same.

Value of c	Mean number of iterations
1.200000	1.198660
5.000000	4.988390