Q3. Numerical Integration: (Dr. Shanbhag)

Amirhessam Tahmassebi

May 19, 2016

1 Method

For this problem, I used MCMC method. I have used Dr. Sachin's notes for MCMC class. Here is the link: MCMC NOTES
We have also the notes online at Github.com/FSUSciComp.
For this problem, we have a probability distribution function $\pi(X, Y)$. Using MCMC we will throw some sample points (like 10000) to find some points which work for our distribution function. To find expectation value of X we can find the mean value of X coordinates of our points we found:

$$\mathrm{E}[X] = \frac{X_1 + X_2 + \cdots + X_n}{n} = \frac{1}{n}\sum_i^n X_i$$

2 Accuracy

for this part I defined the error the standard deviation of the coordinate divided by the square root of number of sample points.

$$Error_X = \frac{\sigma_X}{\sqrt{N}}$$

I ran the code, for different number of Sample points and plot the error versus the number of sample points in the loglog scale. As you can see in the figure 2, we can get the accuracy of 10^{-3} by throwing 10^6 sample points.

3 Results

Acceptance Ratio = 0.0201
Number of Successes = 2010
Expectation Value X = 1.87170374819
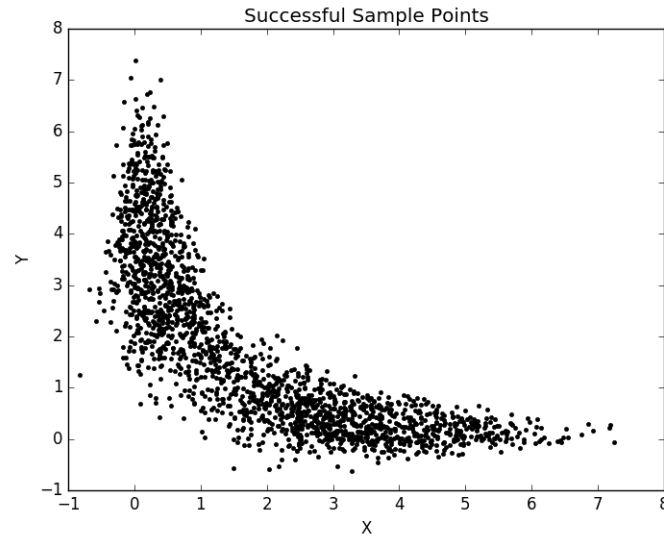Expectation Value Y = 1.83804480452

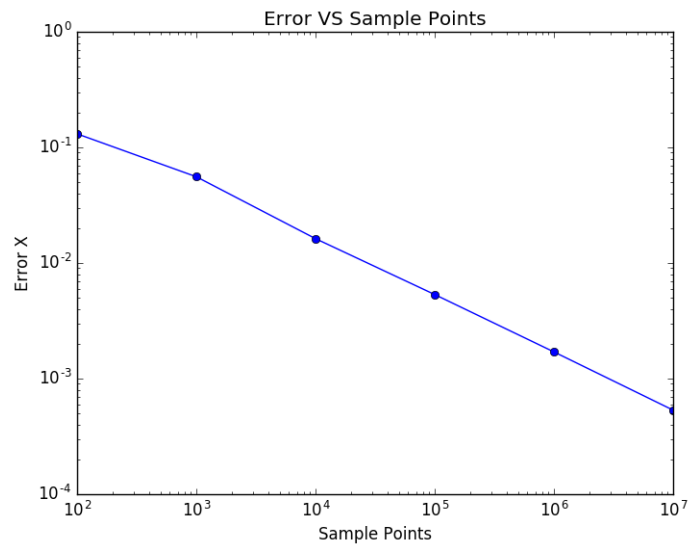Figure 1: Probability Distribution Function $\pi(X, Y)$ with 2010 Successful Sample Points, and 10000 as Starting Number of points

Figure 2: Accuracy of the MCMC Integral

2