

Ay190 – Worksheet 07: Monte Carlo
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1 Estimation of Pi

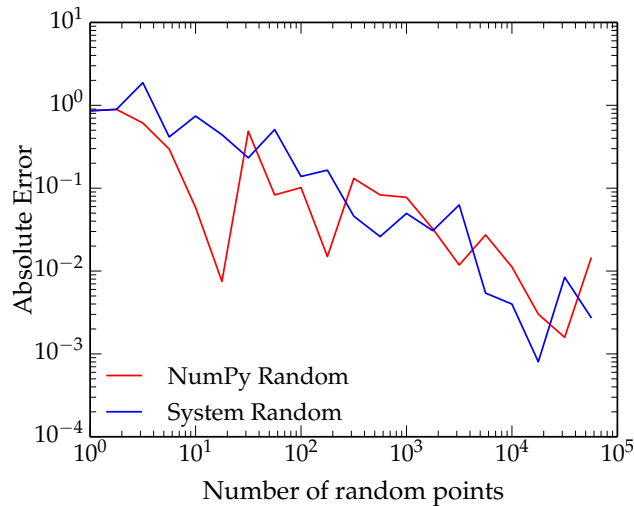


Figure 1: Absolute error of estimation of pi, using monte carlo method, with two types of random generator, Numpy and System random.

Using Monte Carlo to calculate the value of pi, based on the steps in the lecture note. We can see that the lines are not smooth, because we are dealing with random numbers. However, we can see that the errors have the trend of decreasing, as number of points increases. In this circumstances, there is not much difference between using Numpy or System random generator, may be because the number of points is not big enough that the Numpy random completes the cycle.

2 Birthday Paradox

In figure 2, we can see that when number of people reaches 23, the probability of having at least 2 people with the same birthday increases over 50%. That number matches with the answer given from the internet search, which derived from the law of probability, instead of Monte Carlo. It's amazing to see that, even at low number of people as 50, it's almost guarantee that at least 2 people will have the same birthday.

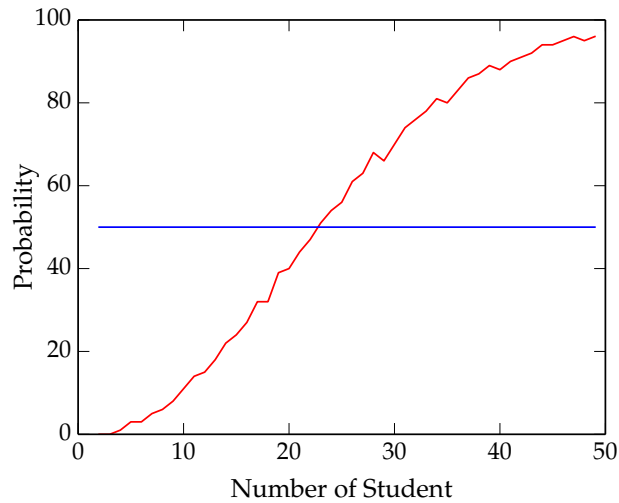


Figure 2: Probability of having at least 2 people with the same birthday vs. the group size. The probability goes over 50% at 23 people.

3 More MC Integration

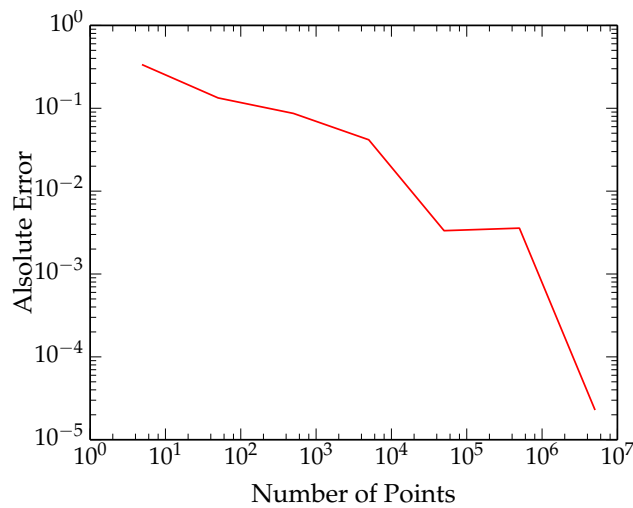


Figure 3: Error of the integral using the hit-or-miss Monte Carlo.

The exact answer of the integral in question is $22/3$. We can see that the error is close to $\propto N^{-0.5}$, as expected.