Ay190 – Worksheet 07
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1 Exercise 1

For small sample size N, error decreases with sample size following the $N^{-1/2}$ convergence for MC methods. However, we see for larger sample size N, the error becomes oscillatory. Roundoff error probably dominates here.

See Figure 1.

SystemRandom uses system processes to generate random numbers instead of the seed algorithm using in the previous part.

See Figure 2

2 Exercise 2

We see that in a group 23 people, the probability for a birthday among exactly two people to be shared is greater than 0.5. We run this for a varying amount of runs. Increasing the runs(the sample sizes) returns expected convergence.

To compute this analytically: let $p_{dif}(n)$ be the probability for everyone in a group of n people to have a different birthday.

Then,

$$p_{dif}(n) = 1 \times (1 - \frac{1}{365}) \times (1 - \frac{2}{365})... \tag{1}$$

The probability for at least 2 people to share a birthday is then $p(n) = 1 - p_{dif}(n)$.

If we simplify our expression for p_{dif}, we get

$$p(n) = 1 - \frac{365!}{365^n (365 - n)!} \tag{2}$$

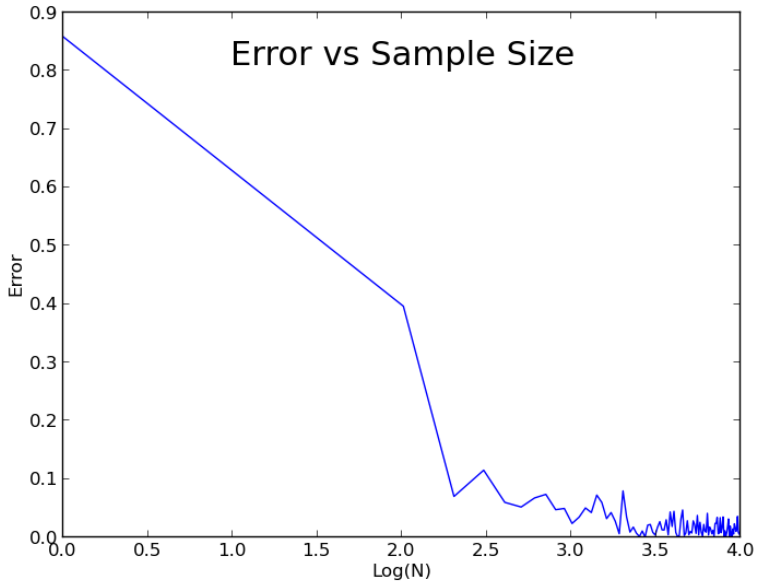

Figure 1: Random.Seed Error.

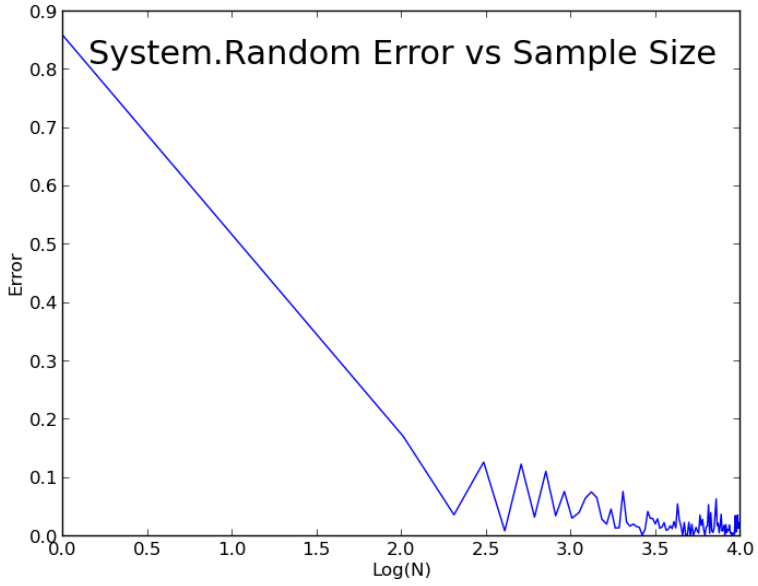

Figure 2: System.Random Error.