Homework #5:
Monte Carlo Techniques

Importance of Randomness

1. To examine the effects of a poor random number generator, modify the program that answered Exercise 1 (in MonteCarlo_integration.ipynb) to use (1) the linear congruential random number generator using the perameters $a = 5$, $c = 0$ and the seed $x_1 = 1$ and then use (2) IBM's bad LCM from the 1960s. Repeat Exercise 1 and compare your results.

Using Monte Carlo Techniques

2. Calculate the integral $\int_0^1 x^2 dx = 1/3$ using simple MC integration and importance sampling with $P(x) = x$

3. Calculate the integral $\int_0^1 \sqrt{x} dx = 2/3$ using simple MC integration and $P(x) = 1 - e^{-ax}$. Find the values of a that minimizes the variance.