

EE511-F17 (Silvester)
Projects 2 and 3 Monte Carlo Methods

Due in class on **Wednesday October 4 (Weds section)**
or **Thursday October 5 (Thurs section)**

Some fairly straightforward Monte Carlo evaluation projects.

1. Estimate π by the area method and also find including confidence intervals on your estimate. Draw a graph of the successive values of the estimator as the number of samples increases.

How many points do you need to use for your estimate to be within $\pm 1\%$ of the true value of π (with probability 0.95)?

2. Evaluate the following integral by a Monte Carlo approach.

$$I(n) = \int_{(n-1)\pi}^{n\pi} \frac{\sin(x)}{x} dx$$

For $n = 1, 2, 3, 4, 5$ (You can reuse the random samples x (shifted by π for each consecutive interval) and values for $\sin(x)$ (which only change in sign from $n \rightarrow n+1$) that you found for the case of $n = 1$, for the latter integrals, due to the nature of the sin function.)

Based on this approach, evaluate the following integral

$$D(n) = \int_0^{n\pi} \frac{\sin(x)}{x} dx$$

For $n = 10, 100, 1000$. What do you observe? Can you speculate on the value of

$$\int_0^{\infty} \frac{\sin(x)}{x} dx \quad (\text{this is called the Dirichlet Integral})$$

3. Find (by a Monte Carlo approach) the probabilities of the different possible poker hands (see lecture notes).