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Course: Life of a Particle Date: January 20, 2018

Question 1

We are to compute the value of π using Monte Carlo Integration. We generate a random uniform numbers between 0 and R for the pair of x and y at the quarter circle. We generate N random numbers from 0 to R, where we choose R to be equal to 1. We choose $M = 1000$ which is the number of times we are to perform the iteration. we choose a range of numbers and give condition for the Area of quarter circle. The circle formula is given as $x^2 + y^2 = R^2$. We got $y = \sqrt{R^2 - x^2}$ and we are to calculate the value of I. Using the graph below.

Computing the Area $I = \frac{\pi R^2}{4}$ from the $\int_0^R \sqrt{R^2 - x^2} dx$. From there, we computing the

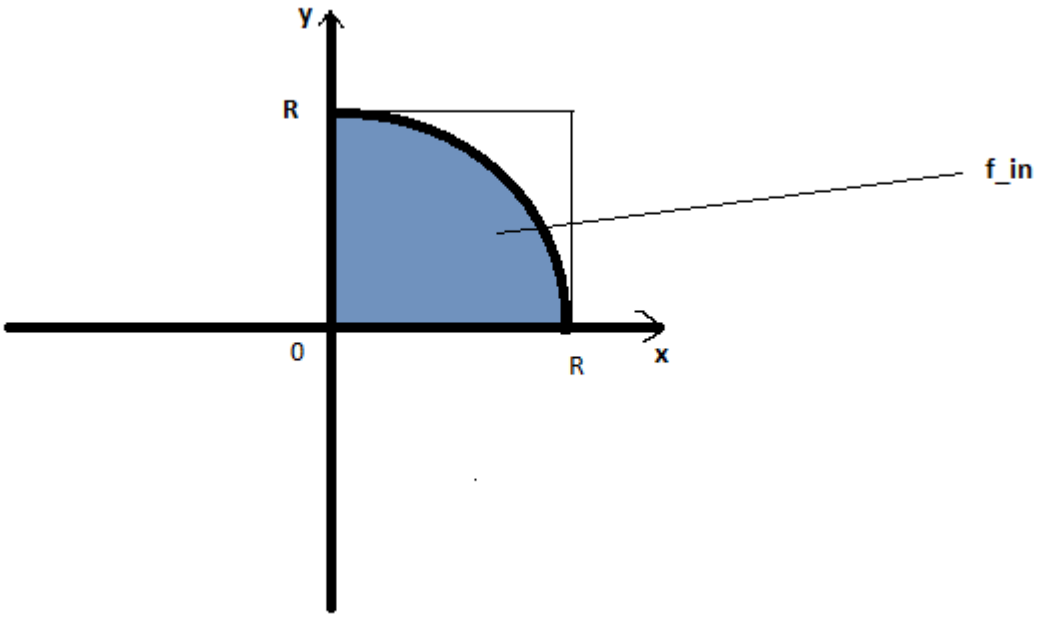

Figure 1:

Area of quarter circle in the box, which was denoted by $f_{in} = \frac{N_{in}}{N}$. We then get $\pi = 4f_{in}$. After

calculating for π , we get the average of π at each value of N compute for $M \times \pi$. We pick the best value from the mean of π and we then plot the histogram given (x, y) pair.

Question 2

Question 3

For this question we model the Particle In a Box using the Schrdinger equation.(To get More idea refer the question topic)

The idea is the position of the particle inside the box is given by the solution of the Schrdinger equation. From this equation, we have two possible values in this experience we are checking the solution that is better.

$$P_A(x) = c_1^2 \sin^2(\pi x) + c_2^2 \sin^2(2\pi x)$$
$$P_B(x) = c_1^2 \sin^2(\pi x) + c_2^2 \sin^2(2\pi x) + 2c_1 c_2 \sin(\pi x) \sin(2\pi x)$$

The first thing that we do is to plot the histogram of the dataset observed to visualize which distribution its follows.

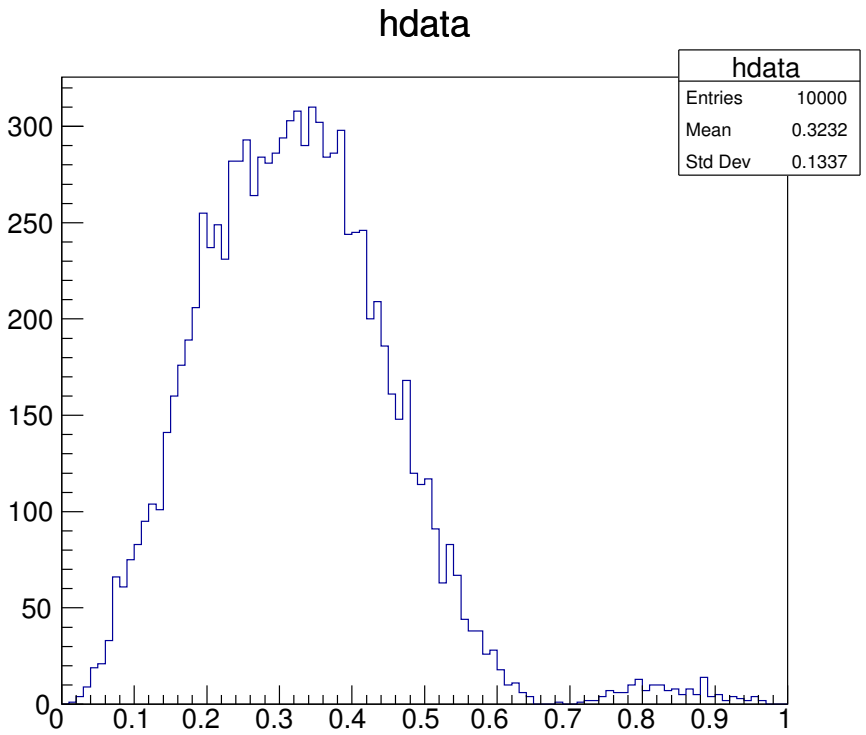

Figure 2: Histogram of observed hdata

Using the probability $P_A(X)$ we get the list of 1000 predicted values and by comparing the two histograms we have the following figure :

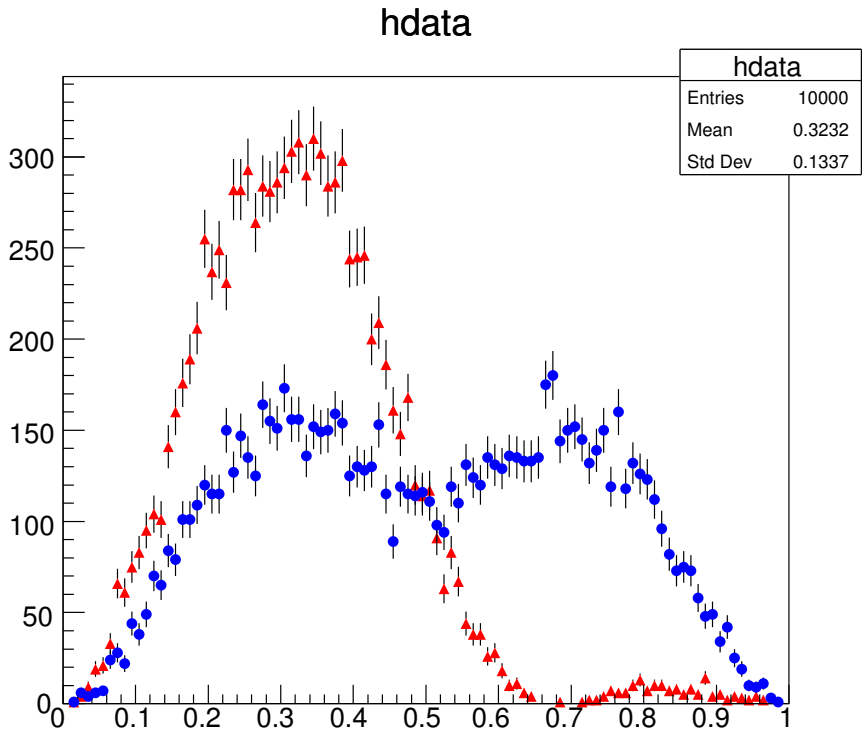

Figure 3: Prediction Vs Observable using $P_A(X)$

Using the probability $P_B(X)$ we get the list of 1000 predicted values and by comparing the two histograms we have the following figure :

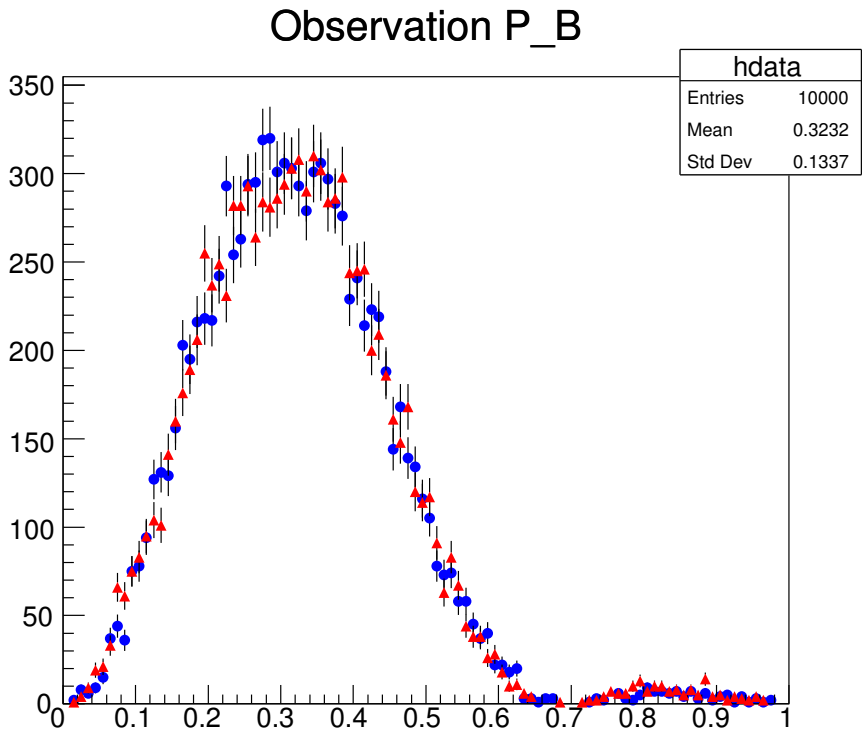

Figure 4: Prediction Vs Observable using $P_B(X)$

Note that it is after many iterations with a different value of c_1 and c_2 that we found the values of $c_1 = 0.75$ and $c_2 = 0.64$.

We perform the chi square Statistical test of each of those 1000 set of predicted values for P_A observation and P_B observation

We get :

$$chiSquare(P_A) = 4834.03103175$$

$$chiSquare(P_B) = 114.627111111$$

We this we can conclude that the given set of data observed can approximate to the probability density distributed function $P_B(X)$