Assignment 1: Monte Carlo Pi Estimation

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1 Introduction

The Monte Carlo method is a probabilistic algorithm used for numerical integration and solving various computational problems. In this report, we use the Monte Carlo method to estimate the value of π by simulating random points within a unit square and determining whether they fall inside a quarter circle inscribed in the square. As the number of random points increases, the accuracy of the estimate improves.

2 Algorithm Summary

2.1 For Loop Approach

The first algorithm generates a fixed number of random points using a `for` loop. For each point, we check whether it lies inside the quarter circle by computing the distance from the origin. The ratio of points inside the circle to the total number of points gives an estimate of $\pi/4$.

2.2 While Loop Approach

In the second algorithm, a `while` loop is used to generate random points until the estimate of π reaches a user-specified precision level. The loop continues until the change in π becomes small enough to satisfy the desired precision.

3 Performance Discussion

The for loop version provides a quick estimation of π but is less flexible when it comes to precision. The while loop version dynamically adjusts the number of iterations to achieve better precision, but may require more computational time depending on the specified precision.

4 Final Results

Below is a screenshot of the final result for the `computePiWithPrecision` function.

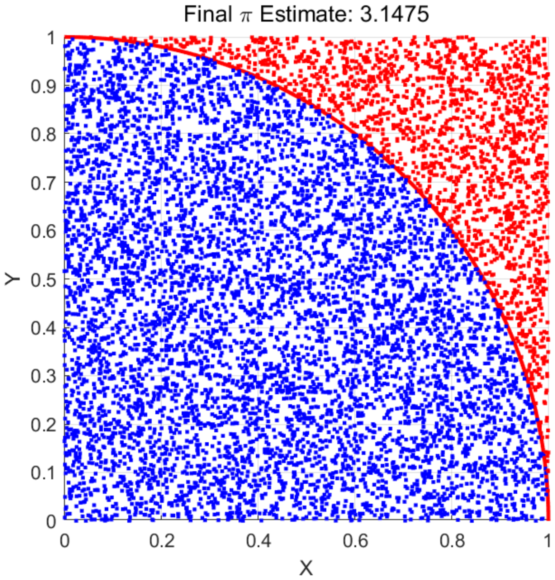

Figure 1: Computed Value of Pi and Precision