Assignment 2: Estimation of PI

Monte Carlo Method

In this method we make a circle with origin as the center with unit radius, and a square in which the circle fits perfectly.

Radius of circle = r =1
Side of a square = 2 * r = 2;

Then we compute the areas of both circle and square:

Area of circle = PI * r^2 = PI * 1 * 1 = PI
Area of square = Side * Side = 2 * 2 = 4 sq. units

We randomly choose points from within the square and see how many of these points fall inside the circle and take the ratio to the total number of points. This ratio is directly related to the ratio of areas of circle and the square:

$$Circle\ /\ Square\ =\ Area\ of\ Circle\ /\ Area\ of\ Square$$

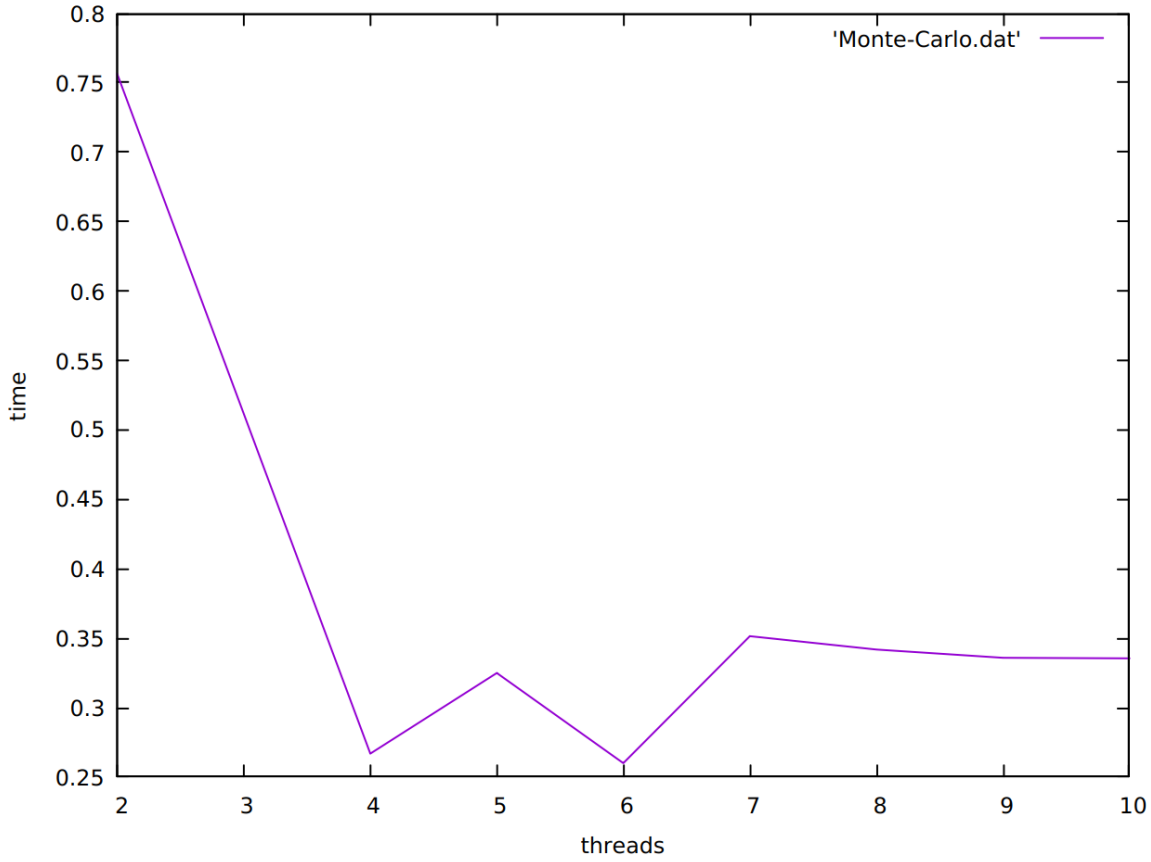
$$Circle\ /\ Square\ =\ PI\ /\ 4$$

$$PI\ =\ 4\ *\ Circle\ /\ Square$$

Using the above formula we calculate the value of PI.

I implemented the program in C language in two ways. First involved serial calculation and the other involved Multi-threading.

The following graph depicts the number of threads v/s the time taken to find the value of pi:



This graph was plotted with the value of n = 1000000.

Mclauren Series Method

I have estimated the value of pi using the Mclauren method using the geometric series and estimating the arctan function to evaluate the value of PI/4 and then multiply both the sides of the equation by 4.

Estimate pi using the Maclaurin series for arctan(x):

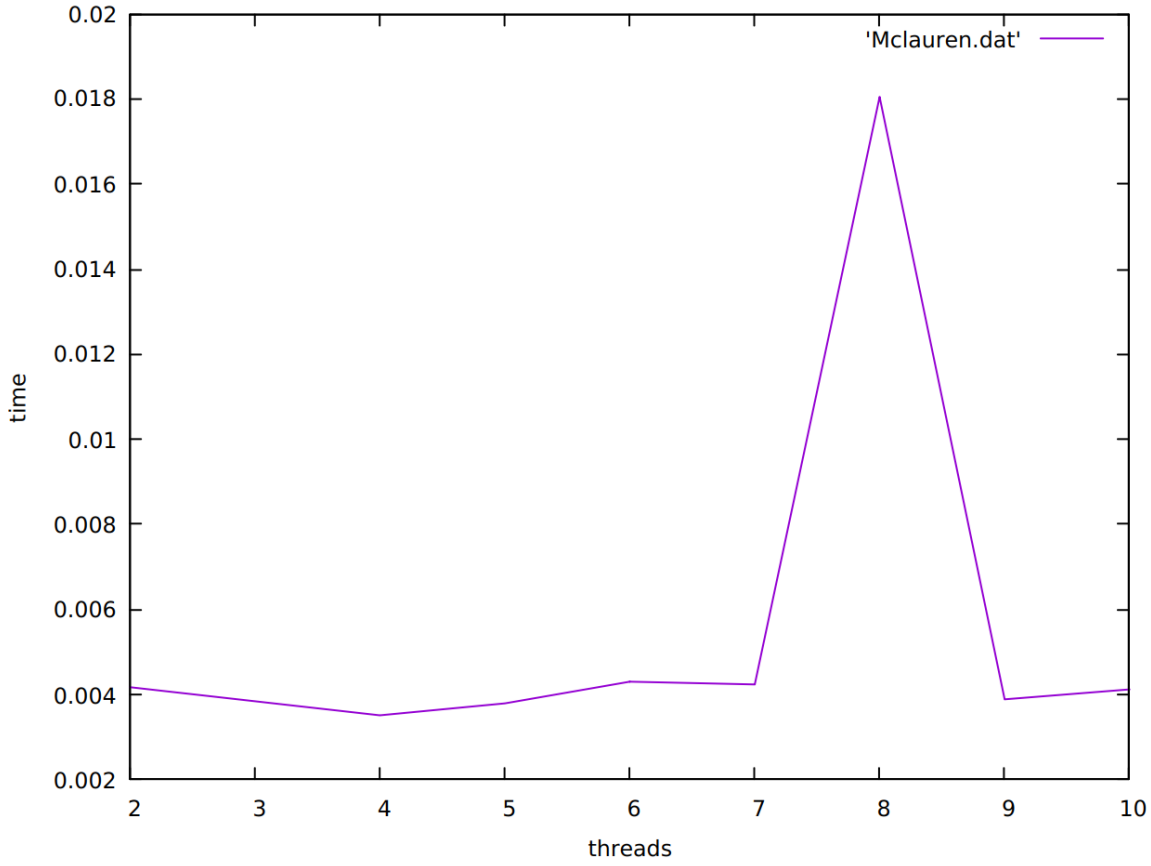
arctan(x) = Sum_n=0 ^infty (-1)^n x^(2n+1)/(2n+1), |x| <= 1

Since arctan(1) = pi/4, we can compute

pi = 4*[1 - 1/3 + 1/5 - 1/7 + 1/9 - . . .]

I implemented the program in two ways one involved serial implementation of the algorithm and the other involved multi-threading.

The following graph depicts the number of threads v/s the time taken to find the value of pi:



This graph was plotted with the value of n = 1000000.