SSL Assignment-2
Entry No -2021MCS2147
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Introduction : In this assignment we have to implement two methods to calculate the value of pie and achieve parallel computing using pthreads.

I have implemented Euler Series ,Wallies Method to calculate the value of pie .

My folder includes following files.
1. main.c
2. Modules.c
3. func.h
4. Make file
5. Euler.dat
6. Wallies.dat

Make File command :
1. make /make build   -to compile the main.c,module.c including func.h
2. make run - to run the program by giving argument t=no of thread,n=noof iteration
3. make plot   -to plot the graph of both the methods.
4. make clean   -to remove the executable file from obj folder

Euler Method-   In this method we use arc tanx series given below,

$$\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \cdots + (-1)^n \frac{x^{2n+1}}{2n+1} + \cdots$$

$$= \sum_{n=0)}^{\infty} (-1)^n \frac{x^{2n+1}}{2n+1}, -1 < x < 1$$

To form (5), when $x = \frac{1}{2}$, $x = \frac{1}{3}$ can get

$$\frac{\pi}{4} = (\arctan\frac{1}{2} + \arctan\frac{1}{3})$$

Euler Method converges faster than the Leibniz and It is very simple to understand the algorithm
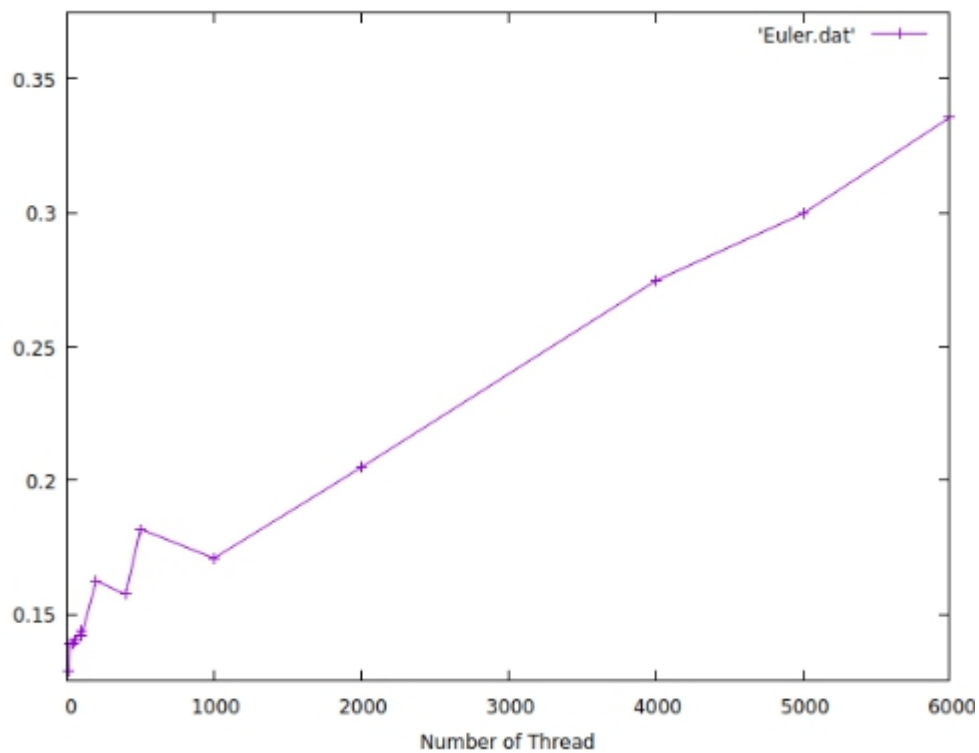
Graph for Euler Parallel Implementation

Table Data for Euler

Thread	Time(in sec)
10	0.128574
20	0.139157
40	0.138954
50	0.140226
100	0.143942
100	0.142266
200	0.162506
400	0.157451
500	0.181871
1000	0.170942
2000	0.204822
4000	0.274501
5000	0.299547
6000	0.335501

Wallies Method :

In this Method following Integration concept is used,

Utilize Integration $\int_0^{\frac{\pi}{2}} \sin^n x dx = \frac{(n-1)!!}{n!!} \cdot \frac{\pi}{2}$, n is odd number, then deduce the formula

$$\frac{\pi}{2} = \frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdots \cdot \frac{2n}{2n-1} \cdot \frac{2n}{2n+1} \cdots \quad (19)$$

It is also easy to understand and simple to implement.
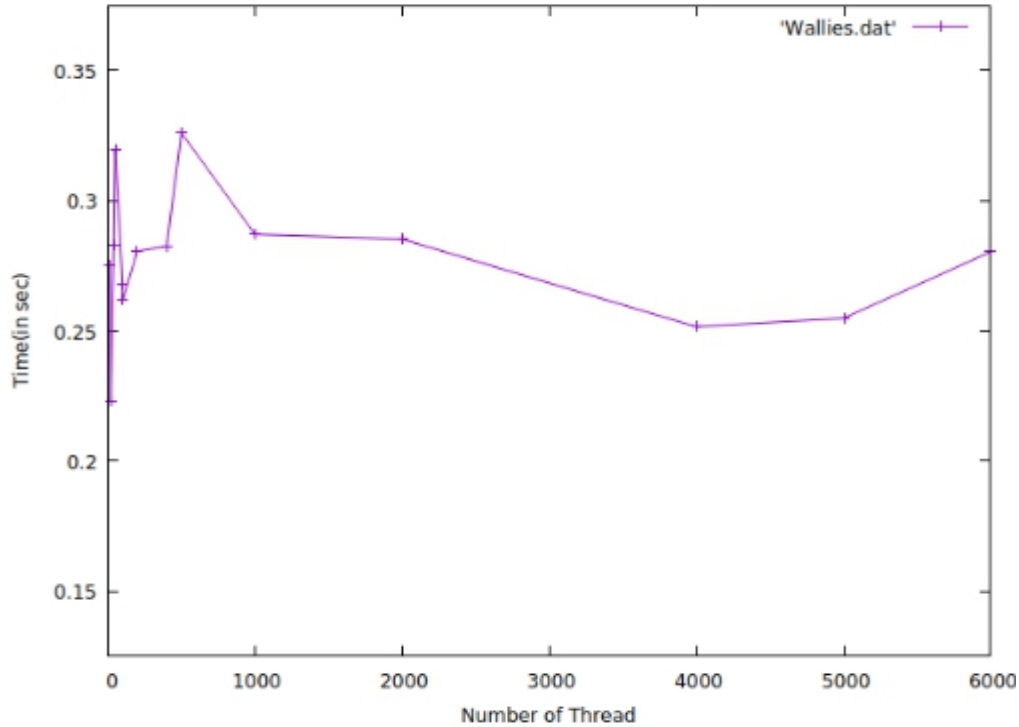It provides better speedup than the Euler

Table Data for Wallies

Number of Thread	Time(in sec)
10	0.275159
20	0.2231567
40	0.283097
50	0.319394
100	0.268071
100	0.261800
200	0.280487
400	0.282479
500	0.325925
1000	0.287059
2000	0.285168
4000	0.251554
5000	0.254838
6000	0.280297

Result /Findings:

1.For smaller values of n serial methods of both method performs better than the parallel implementation because of overhead of thread creation and thread overhead

2.For large value of n parallel implementation perform better than the serial because overhead is smaller compare to parallel computation gain

3. When we increase the the number of thread time decreases but not in constant manner. and for large number of thread parallelimplementation start performing worse than the Serial due to creation and join overhead of threads.

 4Increasing no of iteration increase the speedup of parallel implementation

 5. For serial implementation increasing n increases the time of execution.

 6. Wallies method provides better speedup than the Euler for same no of iterations.

 7. Euler provides better precision.