T.Y.B.Tech (CSE)

High Performance Computing

Lab Assignment No – 2

Name: Aniruddha Shende

Roll number: PE04

Batch: E1

Panel: E

Assignment no: 2

Title: Serial to Parallel

Aim: To write a parallel program for an existing serial program

Objective:

1. To analyze the existing algorithm
2. To use appropriate OpenMP directive to parallelize the code.

Theory:

1) Serial program and Parallelization of the program.

Serial program is executed in a sequential manner whereas using parallel programming, your code spreads data processing tasks across multiple CPUs for radically better performance.

The main difference between serial and parallel processing in computer architecture is that serial processing performs a single task at a time while parallel processing performs is multiple tasks at a time. Therefore, the performance of parallel processing is higher than in serial processing.

FAQ:

1. What are OpenMP directives?

Ans 1: OpenMP directives exploit shared memory parallelism by defining various types of parallel regions. OpenMP provides compiler directives and clauses that used together control the parallelism of regions of code. The directive keyword specifies the parallel action you want to take place.

The format for OpenMP compiler directives and clauses is as follows:

#pragma omp directive [clause[[.] clause]...] newline

We can use the various OpenMP directives like parallel, for, sections, single, parallel for, parallel, sections, barrier, flush, master, critical, atomic, ordered, etc.

2. Give an example from your daily activities where you can incorporate parallelism.

Ans 2: Some of the daily activites in which we incorporate parallelism Eating dinner while watching TV and cooking food while cleaning house.

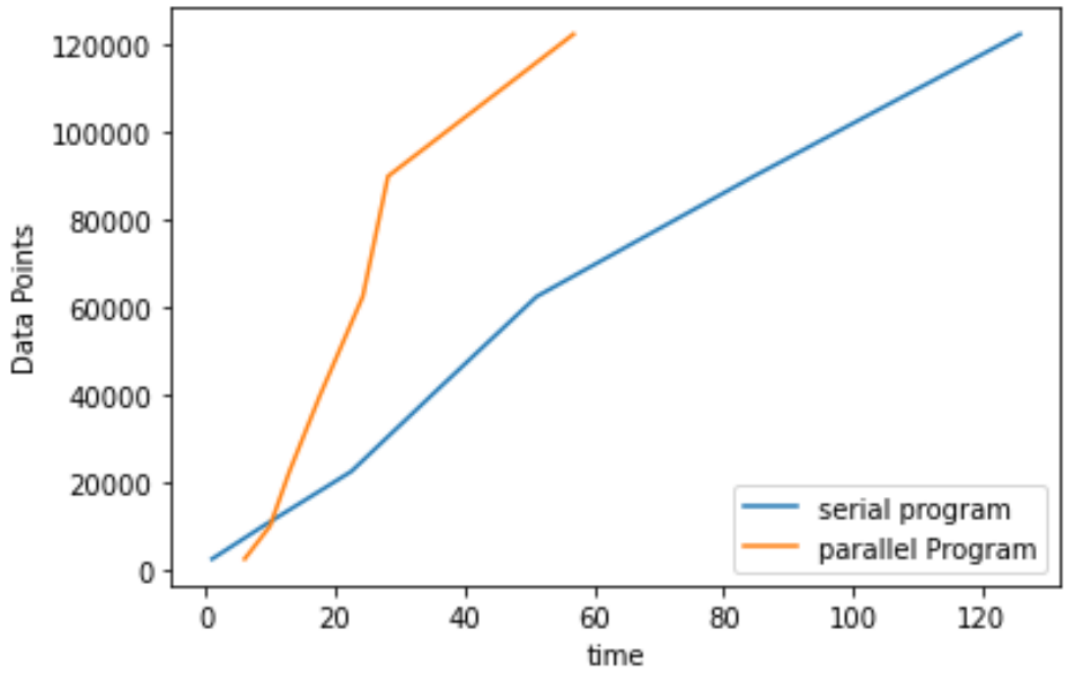
Conclusion:

Successfully converted a serial program to parallel program. After performing the given experiment we can see that after making the program, a parallel program using the header "omp.h" we see that the execution time of the program becomes less as compared to the execution time of the same serial program.

Table :

Data points	Serial execution time	Parallel execution time
2500	0.983734	6.009051
10000	8.849930	9.926322
22500	22.475784	12.926322
40000	34.950494	17.677064
62500	51.117142	24.261547
90000	84.669420	28.155339
122500	125.778970	56.816012

Plot :



Program Code :

```
// Name : Aniruddha Shende
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// Batch : E1
// Panel : E
#include <stdio.h>
#include <pthread.h>
#include <stdlib.h>
#include <sys/time.h>
#include <omp.h>
int main()
{
    int r1, c1, r2, c2, i, j, k;
    printf("Enter 1st matrix rows : ");
    scanf("%d", &r1);
    printf("Enter 1st matrix columns : ");
    scanf("%d", &c1);
    int a[r1][c1];
    //printf("Enter the elements of First matrix\n");

    for (i = 0; i < r1; i++)
    {
        for (j = 0; j < c1; j++)
        {
            //assigning a random value
            a[i][j] = 3000;
            // scanf("%d", &a[i][j]);
        }
    }
    printf("\n");

    printf("Enter 2nd matrix rows : ");
```

```
    scanf("%d", &r2);
    printf("Enter 2nd matrix columns : ");
    scanf("%d", &c2);
    int b[r2][c2];
    int final_multiplication[r1][c2];
    printf("Enter the elements of Second matrix\n");
    for (i = 0; i < r2; i++)
    {
        for (j = 0; j < c2; j++)
        {
      a       /z/assigning a random value
            b[i][j] = 3000;
            // scanf("%d", &a[i][j]);
        }
    }
    printf("\n");
    if (c1 != r2 || r1 < 0 || c1 < 0 || r2 < 0 || c2 <
0)
    {
        printf("\nMatrix multiplication not
possible\n");
    }

    // for serial
    double start = omp_get_wtime();
    #pragma omp parallel for
    for (i = 0; i < r1; i++)
    {
        for (j = 0; j < c2; j++)
        {
            final_multiplication[i][j] = 0;
            for (k = 0; k < r2; k++)
            {
```

```
                final_multiplication[i][j] += a[i][k]
* b[k][j];
            }
           // printf("%d ",
final_multiplication[i][j]);
        }
       // printf("\n");
    }
    double end = omp_get_wtime();
    printf("\nTime taken for Serial: %lf\n", (end-
start)*1000);


    //for parallel
    start = omp_get_wtime();
    #pragma omp parallel for
    for (i = 0; i < r1; i++)
    {
        for (j = 0; j < c2; j++)
        {
            final_multiplication[i][j] = 0;
            for (k = 0; k < r2; k++)
            {
                final_multiplication[i][j] += a[i][k]
* b[k][j];
            }
           // printf("%d ",
final_multiplication[i][j]);
        }
       // printf("\n");
    }
    end = omp_get_wtime();
    printf("\nTime taken for Parallel: %lf\n", (end-
start)*1000);
```

```
    // for (i = 0; i < r1; i++)
    // {
    //     for (j = 0; j < c2; j++)
    //     {
    //         printf("%d\t",
final_multiplication[i][j]);
    //     }
    //     printf("\n");
    // }
    // return 0;
}
```

Execution Screenshot :