CSE 5441 SP2021 (8386)

Lab 3 OMP

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1 The number of threads allocated by Open MP

There are two parallel regions in my program. One region is for producer and the other is for consumer. For each of the region, there are 28 threads allocated by Open MP.

2 Final runtimes

Run all data files using the serial program and parallel programs. Table 1 shows the "real" time from time(1). The pthread parallel program uses 5 producers and 15 consumers. The Open MP parallel program uses 28 threads for each parallel region which are allocated by Open MP.

Table 1: Final runtimes of serial, pthread parallel and OMP parallel programs

Data File	Serial	Pthread Parallel	OMP Parallel
PC_data_x1	0m03.506s	0m02.602s	0m0.559s
PC_data_t00100	0m22.443s	0m13.406s	0m1.507s
PC_data_t01000	3m26.711s	1m45.199s	0m12.984s
PC_data_t05000	17m35.247s	8m57.969s	1m5.447s
PC_data_t10000	34m51.188s	18m45.125s	2m8.622s
PC_data_t50000	246m38.747s	124m40.433s	14m8.171s

3 Scalability of OMP parallel program

Run the parallel program with data file "PC_data_t50000" with different number of threads. The results shows in Table 2 and Figure 1.

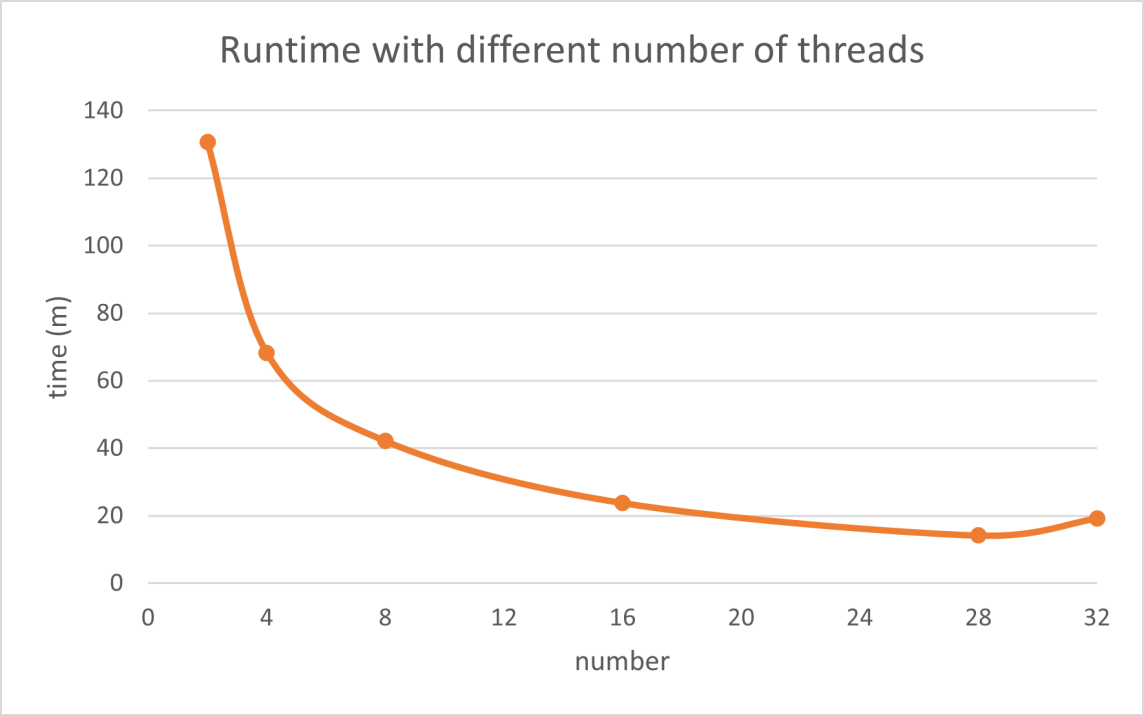

Figure 1: Runtimes of parallel program with different number of threads

Table 2: Runtimes of parallel program with different number of threads

# of threads	time
2	130m44.772s
4	68m17.433s
8	42m7.743s
16	23m46.187s
28	14m8.171s
32	19m10.462s

4 Workload distribution

The workload distribution by Open MP for 28 threads and 50 iterations is shown in Table 3

Table 3: workload distribution

thread	loop iterators	thread	loop iterators	thread	loop iterators
0	0 , 1	10	20 , 21	20	40 , 41
1	2 , 3	11	22 , 23	21	42 , 43
2	4 , 5	12	24 , 25	22	44
3	6 , 7	13	26 , 27	23	45
4	8 , 9	14	28 , 29	24	46
5	10 , 11	15	30 , 31	25	47
6	12 , 13	16	32 , 33	26	48
7	14 , 15	17	34 , 35	27	49
8	16 , 17	18	36 , 37		
9	18 , 19	19	38 , 39		

5 Results summary

5.1 Number of threads allocated by Open MP

The number of threads allocated by Open MP is 28, the same with the number of cores in the cluster node. That means the Open MP will maximum the number of threads based on the environment.

5.2 Comparing with serial and pthread parallel programs

From Table 1, comparing with serial and pthread parallel programs, OMP parallel program always has the better performance.

5.3 Scalability of parallel program

From Figure 1, as the the number of threads increases, the runtime goes down, and when the number of threads exceed the number of cores, the runtime goes up. That is the same with part of my intuition, in a reasonable range, more threads can reduce the runtime, but if the number of threads exceed the number of cores, there are no enough cores to allow so many threads to run parallel which can increase the time.

5.4 Workload distribution

As Table 3 shown, the workload distribution by Open MP is block distribution.