Lab 2 Report – Threading

Shivani Sabhlok

500237896

From Lab 1 – The running time for serial program -

Test File	Affect Rate	Epsilon	Iterations	Max DSV	Min DSV	Clock	Time	Chrono
testgrid_400_12206	.1	.1	75270	0.0866713	0.0780044	37470000	39	39590777

Threading Type	**Number of Threads**	**Time**
Persistent	2	33
Disposable	2	36
Persistent	**4**	**29**
Disposable	4	35
Persistent	8	33
Disposable	**8**	**31**
Persistent	16	41
Disposable	16	63
Persistent	32	56
Disposable	32	135

Did this program perform better sequentially or in parallel?
For 2, 4 and 8 threads, persistent as well as disposable program performed better than the sequential program. When number of threads were very large (16/32) the performance degraded. The reason for this might be the that with larger number of threads, there was a substantial overhead of creation of threads.

Which number of threads was most effective?
With persistent threads, the minimum time recorded was in case of 4 threads.
With disposable threads, the minimum time recorded was in case of 8 threads.

Which parallel version was most effective?
In general, out of the two kinds of threading strategies, persistent thread program performed better than the disposable one. This can be reasoned by the fact that in persistent threads, threads were created once and were used during the entire program where as in disposable threads, there was an overhead of thread creation and disposal at each iteration. There was a significant time difference between the performance of the two threading strategies when the number of threads were 32. The persistent threaded program took 56 seconds whereas the disposable threaded program took 135 seconds.

How did your results match or conflict with your expectations?
Some of the results were surprising. With 2 and 4 threads, none of the program reduced the time to half of that of serial execution. This might because of the thread creation and disposal overhead.
Another surprise was substantially high time for disposable threaded program when we used 32 threads. This essentially highlight the time penalty in context switching of large number of threads.

Were there any unexpected anomalies in the timing information collected?

• I expected the parallel code with 2/4 threads to take approximately half the time it took for serial execution. But that was not achieved. Most likely because of thread creation and disposal overhead.
• Also the execution time increased to almost double of that of serial code when there were 32 threads in parallel. This was a little surprising.
• As expected, the persistent threaded program performed better but with 32 threads, the disposable threaded program performed extremely poorly in contrast to the persistent one.

Which timing methods seem best for parallel programs? How does this compare with your expectations?

The time from the time.h and time returned from the unix was fairly close. This is as per the expectation that both return the wall time for the program. The clock time however was larger than wall time and consistently increased with increased number of threads. The fact that clock time is the total CPU time used by the program, this explains the consistent increase in the clock time because with the increasing number of threads, more processor time is taken.

Comparison of threaded(with 1 thread) and sequential program -

Sequential	39 sec
Disposable	52 sec
Persistent	42 sec

Box allocation strategy to threads –

I used cyclic distribution of boxes.

Persistent :

```
**************************************************************************
dissipation converged in 75270 iterations,
        with max DSV = 0.0866713 and min DSV = 0.0780044
        affect rate = 0.1 , epsilon = 0.1 and number of threads =2

elapsed convergence loop time (clock) : 346320000
elapsed convergence loop time  (time) : 34
elapsed convergence loop time  (chrono) : 33523436.000000
**************************************************************************

real    0m33.524s
user    0m57.393s
sys     0m2.023s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =4

elapsed convergence loop time (clock) : 389610000
elapsed convergence loop time  (time) : 29
elapsed convergence loop time  (chrono) : 29013134.000000
**********************************************************************

real    0m29.013s
user    0m37.213s
sys     0m1.133s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =8

elapsed convergence loop time (clock) : 563150000
elapsed convergence loop time  (time) : 33
elapsed convergence loop time  (chrono) : 32653236.000000
**********************************************************************

real    0m32.653s
user    0m59.723s
sys     0m1.323s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =16

elapsed convergence loop time (clock) : 589560000
elapsed convergence loop time  (time) : 41
elapsed convergence loop time  (chrono) : 40723436.000000
**********************************************************************

real    0m40.741s
user    1m15.201s
sys     2m1.413s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =32

elapsed convergence loop time (clock) : 6140320000
elapsed convergence loop time  (time) : 56
elapsed convergence loop time  (chrono) : 55923436.000000
**********************************************************************

real    0m56.012s
user    0m59.693s
sys     0m12.023s
```

Disposable :

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =2

elapsed convergence loop time (clock) : 532450000
elapsed convergence loop time  (time) : 36
elapsed convergence loop time  (chrono) : 36145426.000000
**********************************************************************

real    0m36.142s
user    0m58.413s
sys     0m53.131s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =4

elapsed convergence loop time (clock) : 5880810000
elapsed convergence loop time  (time) : 35
elapsed convergence loop time  (chrono) : 35013165.000000
**********************************************************************

real    0m35.059s
user    0m52.518s
sys     0m27.617s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =8

elapsed convergence loop time (clock) : 691230000
elapsed convergence loop time  (time) : 31
elapsed convergence loop time  (chrono) : 30915616.000000
**********************************************************************

real    0m31.019s
user    0m56.261s
sys     0m13.319s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =16

elapsed convergence loop time (clock) : 730320000
elapsed convergence loop time  (time) : 63
elapsed convergence loop time  (chrono) : 63013916.000000
**********************************************************************

real    1m30.418s
user    1m52.393s
sys     0m55.123s
```

```
**********************************************************************
dissipation converged in 75270 iterations,
          with max DSV = 0.0866713 and min DSV = 0.0780044
          affect rate = 0.1 , epsilon = 0.1 and number of threads =32

elapsed convergence loop time (clock) : 815360000
elapsed convergence loop time  (time) : 135
elapsed convergence loop time  (chrono) : 134742362.000000
**********************************************************************

real    2m15.019s
user    1m28.196s
sys     1m28.823
```