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CSE5441
February 16, 2016

Lab 1 Serial. AMR Convergence

Basic Information:

Parameters: To run the lab program please follow the following format.

```
./a.out <data_file_name> <epsilon> <affect rate>
```

The following outputs were produced when running the program with the provided test files on the Oakley super computer cluster.

testgrid_1

```
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Dissipation converged in 52 iterations.
Max DSV     : 131.441040
Min DSV     : 118.525566
Affect rate : 0.100000
Epsilon     : 0.100000
Elapsed time (clock) in seconds  : 0.000000
Elapsed time (time) in seconds   : 0.000155
Elapsed time (chrono) in seconds : 0.000148
real	0m0.003s
user	0m0.001s
sys	0m0.001s
```

testgrid_2

```
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Dissipation converged in 1508 iterations.
Max DSV     : 25.804934
Min DSV     : 23.227625
Affect rate : 0.100000
Epsilon     : 0.100000
Elapsed time (clock) in seconds  : 0.130000
Elapsed time (time) in seconds   : 0.131706
Elapsed time (chrono) in seconds : 0.1317
real    0m0.135s
user    0m0.134s
sys     0m0.001s
```

testgrid_50_78

```
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Dissipation converged in 14461 iterations.
Max DSV     : 0.898287
Min DSV     : 0.808463
Affect rate : 0.100000
Epsilon     : 0.100000
Elapsed time (clock) in seconds  : 15.240000
Elapsed time (time) in seconds   : 15.245000
Elapsed time (chrono) in seconds : 15.245
real    0m15.250s
user    0m15.244s
sys     0m0.000s
```

testgrid_200_1116

```
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Dissipation converged in 22285 iterations.
Max DSV     : 1.305197
Min DSV     : 1.174685
Affect rate : 0.100000
Epsilon     : 0.100000
Elapsed time (clock) in seconds  : 35.279999
Elapsed time (time) in seconds   : 35.289619
Elapsed time (chrono) in seconds : 35.2896
real	0m35.300s
user	0m35.284s
sys	0m0.001s
```

testgrid_400_12206

```
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Dissipation converged in 75269 iterations.
Max DSV     : 0.095762
Min DSV     : 0.086186
Affect rate : 0.100000
Epsilon     : 0.100000
Elapsed time (clock) in seconds  : 1089.869995
Elapsed time (time) in seconds   : 1090.266467
Elapsed time (chrono) in seconds : 1090.27
real	18m10.328s
user	18m9.926s
sys	0m0.006s
```

When first thinking about what timing method was best for determining the runtime of a serial program my first instinct was to go with the library **chrono.** I discovered that the timeval struct in C,C++ gave a more precise runtime however timeval is using the function **gettimeofday( )** which might not be the most accurate measurement if running on a machine where there is timesharing of the CPU. Clock uses CPU time which might be preferable in serial cases.

In the case of parallel programs, I think it might make more sense to use system time instead of CPU time. If one CPU processing threads finish earlier than others, it might throw off the timing results. For parallel programs, I think it would be better to use the timeval structs to get a more reasonable estimate of the overall runtime of the program.