CMPSC 140 Summer 2022: Homework 5: OpenMP

Instructor: Richard Boone

Due: Friday August 12th, 2022 9 PM

Purpose: This assignment is meant to familiarize you with programming using OpenMP, as well as a number of methods by which you can deal with the conventional issues caused by multi-threaded programs.

Written Questions:

1. (5 points) Book Problem 5.4

2. (5 points) Traditional bubble sort looks something like the following:

```
int a[100];
for (int j = 0; j < 99; j = j + 1){
    for (int i = 0; i < 99; i = i + 1){
        if (a[i] < a[i+1]){
            int temp = a[i];
            a[i] = a[i+1];
            a[i+1] = temp;
        }
    }
}
```

   If we try to immediately parallelize with a #pragma for, what immediate problems will we see? How would you go about resolving these problems?

Programming:

1. (10 points) Attached to this handout is a program omp_trap1.c, which demonstrates trapezoidal estimation of integration as discussed in class. Note that in the trap function we declare the summation calculations critical. Remove this critical pramga and gradually increase the number of threads and number of trapezoids until you get an incorrect value (you will need to compare to a legitimate summation to evaluate this). Report the number of threads and samples when you find an error

2. (20 points) Attached to this homework is the same histogram file from last week, histogram.c. Using OpenMP, parallelize the for loop as in part 1 of your last homework. You will need to use some sort of access control to keep bin_counts consistently accurate. Run similar experiments to that of your last homework, and compare your timing results using both static and dynamic scheduling. Does scheduling make a difference? Why might your OpenMP implementation have different timing than your Pthreads impelementation? If slower, could things be improved? Answer these questions and give your results in graphs in your report.

Submission Instructions: Submit your report with all code in a zip file to gauchospace. Include a README that explicitly shows how to compile and run your code using OpenMP.

Turn in Instructions: Please turn in the homework via gradescope by 9 PM on Friday August 12th, 2022. For this programming assignment you will be allowed to submit in pairs. If you are submitting with a partner, please link your partner on your Gradescope submission.