CS431 / 531: Introduction to Performance Measurement, Modeling and Analysis
Winter 2019
Instructor: Professor Karavanic
HW #2
Due Sunday Jan 27

Part A: Running and timing the example pthreads "sum" code from the lecture (40 points)

1. Your first step is to implement several of the versions presented as full, working pthreads codes. One should be a sequential, single thread version for comparison. Two should be different multithreaded versions from the examples shown. You can write one main function that can call a different version based on an input parameter.
   (hint: the hello world example in lecture, and the Three Easy Pieces reading both show the extra things like #include you need to get this working).
2. Edit your source code to add measurements using calls to gettimeofday() and printout of total execution time. See man gettimeofday() for the needed arguments and return value information.
3. Run each of the 3 versions 30 times.
4. Record your results into a spreadsheet. Include each of the individual measured times, plus the mean, max, min and median, variance and standard variation for each of the 3 versions of the code.

Submit for Part A: *Your source code, your makefile to build it, your spreadsheet (google sheet or excel.)*

Part B: Amdahl's Law and Speedup (30 points)

1. Run gprof on the sequential version then use Amdahl's law to calculate the maximum possible speedup. (hint: What is the sequential part? What is the parallel / improved part?) Show the values you plug into Amdahl's law and your answer.
2. For each of the two threaded versions, calculate the speedup over the sequential version using the simple formula for speedup given in lecture.
3. For each of the two threaded versions, calculate:
   a. The difference of the means between this version and the sequential code
   b. The standard deviation of the difference of the means
   c. The 90% confidence interval for the difference of the means
4. Use ANOVA to determine if there is a statistically significant difference in execution time between the two threaded versions.

Submit for Part B: your calculation of Amdahl's Law and Speedup, your results for #3 and #4.

Part C: Calculating the Mean
(30 points)

Using a separate sheet from Part B, use a spreadsheet to:

1. Calculate the mean of the sustained performance of the top 10 systems reported on the most recent Top500 list. (top500.org)
2. Calculate the mean of the FLOPS/watt of the top 10 systems reported on the most recent Green500 list. (https://www.top500.org/green500/)

Submit for Part C: your spreadsheet containing your calculations for #1 and #2