CS 596: Introduction to Parallel Computing
Homework4:
Pthreads

Mary Thomas

Department of Computer Science
Computational Science Research Center (CSRC)
San Diego State University (SDSU)

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1. HW4, P1: Numerical Integration/Calculate Pi (25 points)
2. HW4, P2: Matrix-Matrix Multiplication (25 points)
3. Misc. Instructions
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Write a Pthreads program that uses numerical integration to calculate PI.

You may use your code from HW2, or Pacheco code (e.g. `mpi_trap4.c`).

Use a shared variable for the sum of all the threads’ computations.

Use (i) busy-waiting; (ii) mutexes; (iii) and semaphores to enforce mutual exclusion in the critical section.
Homework #1, Problem #1: Using Numerical Integration to Estimate $\pi$

- Run the jobs on one node using the batch queue
- Vary the number of areas used such that $N$ is evenly divisible by the number or threads.
- Vary the number of threads. What is the max number you can use?
- Time the job runs.
- Report timings for each of these methods and compare to your MPI version
- What advantages and disadvantages do you see with each approach?
HW4, P2: Matrix-Matrix Multiplication (25 points)

Write a Pthreads program that multiplies a matrix times a matrix.
Assume the arrays are square [NxN], and that N is evenly divisible by the number or threads.
You may base your code on the MPI code provided in the /cs596/hw4 directory
Use any method you choose to enforce mutual exclusion in the critical sections.
Report timings for each of these methods and compare to your MPI version
HW4, P2: Matrix-Matrix Multiplication - Test Cases

- Run the jobs on one node using the batch queue
- For the ProbSize Scaling, you will use input files provided in /cs596/hw4/inputs
  - make a local copy of the input files.
  - Test arrays will be $A[N \times N]$
  - Vary the number of threads. What is the max number you can use?
  - Choose 4 ProbSizes, including the [4x4] and [1024x1024] cases
  - Save results for the [4x4] and [1024x1024] cases to output files.
- Submit copies of code, batch scripts and results for two small cases
- Report timings for different problem sizes, and compare to the MPI version
HW4: Experimental Approach

For all experiments, do the following:

- Modify all inputs to come from either the command line, or from a file
- Vary inputs as specified for each problem.
- Add/use error checking in the code where needed; use proper/clean exits
- Add timing diagnostics where needed.
- Include tables and plots of relevant results.
Due: 10/23/14, at start of class.

Turn in a written report, describing your solution and results; include:

- a discussion of what you did, why, and what you measured, etc.
- relevant code snippets and copies of batch scripts.
- printout of output data for small, readable test cases (see below).
- tables of results with notation about the data and what it means (see below).
- plots of results with notation about the data and what it means (see below).
printout of output data for small, readable test cases

[mthomas@tuckoo]$ ./serial-mat-mult
Creating Matrix A,B
Print Matrix A[4x4]
   1.0   2.0   3.0   4.0
   11.0  12.0  13.0  14.0
   21.0  22.0  23.0  24.0
   31.0  32.0  33.0  34.0

Print Matrix B[4x4]
   1.0   2.0   3.0   4.0
   21.0  22.0  23.0  24.0
   41.0  42.0  43.0  44.0
   61.0  62.0  63.0  64.0

Print Matrix C[4x4]
  410.0  420.0  430.0  440.0
 1650.0 1700.0 1750.0 1800.0
 2890.0 2980.0 3070.0 3160.0
 4130.0 4260.0 4390.0 4520.0