

CS6868 Concurrent Programming

Programming Assignment 1: Due 15th February 2013

Problem 1

For all the following exercises on matrix multiplication, consider two square matrices A and B that are multiplied. Vary the size of the matrices from 64x64 to 8192x8192 in increasing powers of 2. Run each program five times and report the average runtime across the five runs. For the first two problems, compile with `-O3` option turned on but parallelization turned off. For implementations that use cilk, use cilk related options. Assume that the matrices are given in row major order. If you perform any transformation, this has to be accounted in the runtime as well.

Fill in A and B matrices with random entries ranging from 0 to 1. Assume that C is not initialized and any initialization to elements in C should also be counted in runtime calculations.

Use `gettimeofday()` for calculating runtimes. Cilkplus also gives you options for other counters but `gettimeofday()` suffices for this exercise.

1. Write a serial program for multiplying two matrices A and B.
2. Write a program that performs block multiplication.
3. Write cilk versions of matrix multiplication where you decide the appropriate “for loops” for which you want to apply cilk. You should have at least three implementations.

Exercise 1: Compare the runtimes of implementations in 1 and 2 with implementations in 3. For each matrix size, compare the growth of runtime on one processor.

Exercise 2: Compare the runtimes of implementations in 3 with 1, 2 and 4 processors.

Exercise 3: Your cilk programs must be checked with `cilkscreen` and ensure that there are no races. Summarize the report that you get from `cilkscreen`.

Exercise 4: For each implementation in (3), run `cilkview` and obtain parallelism values reported. Compare the parallelism that is reported with parallelism that you obtained. Explain why your results are different from the theoretical calculations if the trends are different.