Homework 1: Parallel Programming Basics

Due before class, Thursday, August 30

Turn in electronically on the CADE machines using the handin program: "handin cs4230 hw1 <probfile>"

- Problem 1: (from today's lecture) We can develop a model for the performance behavior from the versions of parallel sum in today's lecture based on sequential execution time S, number of threads T, parallelization overhead O (fixed for all versions), and the cost B for the barrier or M for each invocation of the mutex. Let N be the number of elements in the list. For version 5, there is some additional work for thread 0 that you should also model using the variables above. (a) Using these variables, what is the execution time of valid parallel versions 2, 3 and 5; (b) present a model of when parallelization is profitable for version 3; (c) discuss how varying T and N impact the relative profitability of versions 3 and 5.

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- Problem 2: (#1.3 in textbook): Try to write pseudo-code for the tree-structured global sum illustrated in Figure 1.1. Assume the number of cores is a power of two (1, 2, 4, 8, …).

  Hints: Use a variable `divisor` to determine whether a core should send its sum or receive and add. The `divisor` should start with the value 2 and be doubled after each iteration. Also use a variable `core_difference` to determine which core should be partnered with the current core. It should start with the value 1 and also be doubled after each iteration. For example, in the first iteration `0 % divisor = 0` and `1 % divisor = 1`, so 0 receives and adds, while 1 sends. Also in the first iteration `0 + core_difference = 1` and `1 - core_difference = 0`, so 0 and 1 are paired in the first iteration.

Homework 1, cont.

- Problem 3: What are your goals after this year and how do you anticipate this class is going to help you with that? Some possible answers, but please feel free to add to them. Also, please write at least one sentence of explanation.
  - A job in the computing industry
  - A job in some other industry that uses computing
  - As preparation for graduate studies
  - To satisfy intellectual curiosity about the future of the computing field
  - Other