

# Homework 1: Parallel Programming Basics

Turn in electronically on the CADE machines using the handin program: "handin cs4961 hw1 <profile>"

- Problem 1: (#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  $0 \% \text{divisor} = 0$  and  $1 \% \text{divisor} = 1$ , so 0 receives and adds, while 1 sends. Also in the first iteration  $0 + \text{core\_difference} = 1$  and  $1 - \text{core\_difference} = 0$ , so 0 and 1 are paired in the first iteration.

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- Problem 2: I recently had to tabulate results from a written survey that had four categories of respondents: (I) students; (II) academic professionals; (III) industry professionals; and, (IV) other. *The number of respondents in each category was very different; for example, there were far more students than other categories.* The respondents selected to which category they belonged and then answered 32 questions with five possible responses: (i) strongly agree; (ii) agree; (iii) neutral; (iv) disagree; and, (v) strongly disagree. My family members and I tabulated the results "in parallel" (assume there were four of us).
  - (a) Identify how *data parallelism* can be used to tabulate the results of the survey. Keep in mind that each individual survey is on a separate sheet of paper that only one "processor" can examine at a time. Identify scenarios that might lead to load imbalance with a purely data parallel scheme.
  - (b) Identify how *task parallelism* and combined task and data parallelism can be used to tabulate the results of the survey to improve upon the load imbalance you have identified.

## Homework 1, cont.

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- 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