

Fall 2024
Exam I (scaled to 30 pts)
Thursday, November 7

**DO NOT OPEN THIS EXAM UNTIL YOU ARE
INSTRUCTED TO DO SO**

Name: _____ . Student ID No. _____

1. **NO TALKING UNTIL YOU LEAVE THE EXAM ROOM, PERIOD.** Talking before you leave the exam room will earn you an F on the exam, at a minimum.
 2. You may **NOT ASK ANY QUESTIONS DURING THE EXAM.** Do your best and note any concerns on your paper.
 3. **Write the exam with a dark colored pen or pencil.** Light colored pens or pencils do not scan well.
 - A. Answer all questions on these pages. No code or pseudo-code is necessary – just a precise and concise explanation and justification.
 - B. *Unsupported work will receive no credit.*
- **Plagiarism** will earn you an F in the course and a recommendation of expulsion from the university.
 - a. You may not refer to any material outside of this exam.
 - b. That is, you may **not** refer to notes, books, papers, calculators, phones, classmates, classmates' exams, and so forth.
 - c. **Do not talk to fellow students at any time while in the exam room.**

Q1 (7 pts) Given a pyramid with n data evenly distributed amongst the base processors, give an asymptotically cost-optimal algorithm to compute the summation of the n values. At the conclusion of the algorithm, all base processors should know the result. The algorithm should be one of the most efficient of the cost-optimal algorithms. Efficiency counts! Justify your answer.

Q2 (7 pts) Given a hypercube of size n , with one piece of data per processor, give an asymptotically optimal algorithm to compute the sum of the n values. At the end of the algorithm, every processor should know the final value. Efficiency counts! Justify your answer.

Q3 (8 pts) Given a mesh with n data evenly distributed amongst the processors, give an asymptotically cost-optimal algorithm to determine the parallel prefix of the n items. The algorithm should be one of the most efficient of the cost-optimal algorithms. Efficiency counts! Justify your answer.

Q4 (8 pts) (a) Draw an 8-element Bitonic Merge Unit. (b) Give the asymptotic time for input data fed into an n -element Bitonic Merge Unit to move through the unit from entry (left) to exit (right). Justify your answer.

Extra Credit

(1 Pt) What professional baseball team does Dr. Miller root for?

- a. New York Yankees
- b. New York Mets
- c. Toronto Blue Jays
- d. Cleveland Guardians

(1 Pt) Which algorithm is Dr. Miller known for?

- a. Lets-play-Two
- b. One-and-Done
- c. Shake-and-Bake
- d. Crystals-R-Us

