

Spring 2024
Exam II Evening
Thursday, April 18

**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. Not now. Not when you are done. Not when you are collecting your things. Not when you are getting ready for the exam. NO TALKING!** Doing so will earn you an F on the exam, at a minimum.
 2. You May **NOT ASK ANY QUESTIONS DURING THE EXAM** due to Requirements of Social Distancing. Do your best and note any concerns on your page.
 3. **Write the exam with a dark colored pen or pencil.** Light colored pens or pencils do not scan well.
- **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.**
 - Answer all questions on these pages. No code or pseudo-code is necessary – just a precise and concise explanation and justification.
 - *Unsupported work will receive no credit.*

Q1 (4 pts) Given a mesh with n pieces of data distributed evenly amongst the processors, give an asymptotically cost-optimal algorithm to compute the summation of the n values. At the conclusion of the algorithm, all processors should know the result. The algorithm should be one of the most efficient of all such cost-optimal algorithms. Efficiency counts! Justify your answer.

Q2 (5 pts) Given a tree machine with n leaf processor and one piece of data distributed per leaf processor, give an asymptotically optimal algorithm to compute the parallel prefix of the n values. Efficiency counts! Justify your answer.

Q3 (5 pts) Given a hypercube of size n with 1 piece of data distributed per processor, give an asymptotically optimal algorithm to determine the minimum of the n values so that all processors know the result. Efficiency counts! Justify your answer.

Q4 (4 pts) Draw an 8-element bitonic merge unit.

Q5 (2 pts). What is the conclusion of Amdahl's Law? Describe, generally, how one arrives at this conclusion.

