Spring 2025
Exam II (scaled to 30 points)
Thursday, April 17

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 (6 pts) Given a mesh of size n with one piece of data stored per processor, give an asymptotically cost-optimal algorithm of minimal asymptotic running time to compute the summation of the n values. At the end of the algorithm, all processors should know the final result. Efficiency counts! Justify your answer.

Q2 (5 pts) Given a tree with n pieces of data stored one per leaf processor, give an algorithm with asymptotically optimal running time to determine the parallel prefix of the n values. Efficiency counts! Justify your answer.

Q3 (9 pts) Hypercube Problem with 2 parts.

(i) Draw and label a hypercube of size 8. Justify your answer.
(ii) Given a hypercube of size *n* with one piece of data per processor, determine the parallel prefix (sum) of the data. Efficiency counts! Justify your answer.

Q4 (5 pts) Draw an 8-element bitonic merge unit.

Q5 (5 pts)

(i) Paraphrase the conclusion of Amdahl's Law. (You may, but do not need to, write the equation representing Amdahl's Law.)

(ii) What is the major difference between Gustafson's Law and Amdahl's Law?