Fall 2022
Midterm II
Thursday, March 31

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

Name:_____. Student ID No._____

Student UB E-Mail Address_____

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**. Do your best and note any concerns on your page.
3. **Write only on the front of each page**. Anything written on the back of a page will not be graded.

- **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.*

No exam questions on this page – Feel free to scribble/doodle on this page

Q1 (20 pts) Given a set of n values evenly distributed amongst the processor of a linear array, give a cost-optimal solution to the problem of parallel prefix sum. Your algorithm should also be time optimal. Describe your algorithm and justify its cost and running time. Efficiency counts!

Q2 (30 pts) Suppose that n data items are distributed one per processor on a mesh of size n, where each data item is either a 1 or a 0. For every processor, determine *i*) the nearest processor that has a 1 in its row, *ii*) the nearest processor that has a 1 in its column, and *iii*) the nearest processor anywhere in the mesh that has a 1, using the standard Euclidean distance metric, *i.e.*, where distance between two processors/vertices is the length of a line between the processors/vertices. You do not need to know the formula for Euclidean distance to solve part *iii* of the problem. Describe your algorithms and justify their running times. Efficiency counts!

Q3 (30 pts) Given *n* pieces of data evenly distributed amongst the leaf processors of a Tree, determine the parallel prefix sum of the values. Provide a cost-effective algorithm with an efficient running time. Describe your algorithm and justify its cost and running time. Efficiency counts!

Q4 (10 pts) Given a set of n values stored one per base processor on a Pyramid of base size n, give an efficient algorithm that will determine for *every processor* in the pyramid, the sum of the values in its descendant base processors. Describe your algorithm and justify its running time. Efficiency counts!

Q5 (10 pts) Given n pieces of data stored one per base processor on a Mesh-of-Trees of base size n, determine the sum of the data. When the algorithm terminates, all processors should store the sum of the n pieces of data. Describe your algorithm and justify its running time. Efficiency counts!

Extra Credit Questions (1 point each added to your final course grade):

1) Which of the following are true? Circle all that apply. (No partial credit – all or nothing.)
   a) Miller is a Fellow of the IEEE (Institute of Electrical and Electronics Engineers).
   b) Miller is a Fellow of AAIA (Asia-Pacific Artificial Intelligence Association).
   c) Miller is a Fellow of the ACM (Association for Computing Machinery).
   d) Miller is a member of the European Academy of Sciences.

2) Prof Miller has performed cutting-edge research in parallel algorithms on which of the following architectures? Circle all that apply. (No partial credit – all or nothing.)
   a) Pyramid
   b) PRAM
   c) Mesh
   d) Hypercube

Extra Page that will be viewed.

Extra Page that will be viewed.