

NAME: _____ Student Number: _____

CSE4/529

MidTerm II

Fall, 2015

This exam is *closed book/notes/neighbors/etc.* Answer all questions on these exam pages. No code or pseudo-code is necessary – just a precise and concise explanation and justification. Give the best answer possible. *Unsupported work will receive no credit.*

Q1 of 4 (8 pts) Given a set of n GPA values, arbitrarily distributed, give an efficient algorithm to sort these n values. Note that each of the n GPA values is taken from one of the 41 possible 2-digit numbers between 0.0 and 4.0.

Your algorithm *must* be based almost exclusively on use of the parallel prefix operation.

Discuss the i) asymptotic running time and ii) cost of your solution on each of the following architectures.

- a) RAM
- b) PRAM
- c) Mesh of size n
- d) Hypercube of size n

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Q2 of 4 (6 pts)

Input: A set of n labeled line segments situated along the x -axis. Each line segment is initially represented by two records, one describing its left endpoint, as $(x\text{-value, label, } \mathbf{L})$, and one describing its right endpoint, as $(x\text{-value, label, } \mathbf{R})$. Assume that the $2n$ points are initially given ordered by x -value and that no two points have the same x -value.

Output: The number of breaks (*i.e.*, a single integer) between overlapping sequences of line segments in the range of the left endpoint of the first line segment to the right endpoint of the last line segment.

Discuss the i) asymptotic running time and ii) cost of your algorithm on the following architectures.

- a) RAM
- b) CREW PRAM

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Q3 of 4 (8 pts)

Input: A linear array of size n where every processor is either marked (data value of “1”) or unmarked (data value of “0”).

Output: Every processor knows the ID of its nearest marked processor to its left and the ID of the nearest marked processor to its right.

Discuss the asymptotic running time of your algorithm. Efficiency counts.

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Q4 of 4 (8 pts)

- a) Define a *bitonic sequence*.
- b) Draw an 8-element bitonic **merge** unit.

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Bonus Question 1 (2 pts) What is the name of the supercomputing center that Prof. Miller founded in the late 1990s?

Bonus Question 2 (2 pts) In the early 2000's, Prof. Miller and a high-profile U.S. elected official hosted a group of Billionaires from India. Name that U.S. official.