

NAME: _____ Student Number: _____

CSE4/529

MidTerm II

Fall, 2013

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 3 (10 pts) Given a set of n **integers** with values in the range of $[1,100]$, arbitrarily distributed, give an efficient algorithm to “sort” these values.

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

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

- a) RAM
- b) CREW PRAM with n processors
- c) Tree of base size n

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Q2 of 3 (10 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 -value, label, **L**), and one describing its right endpoint, as (x -value, label, **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 asymptotic running time and cost of your algorithm on the following architectures.

- a) RAM
- b) Mesh of size n

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Q3 of 3 (10 pts) Input: A pyramid of base size n with a 1 or a 0 initially stored in every base processor.

Procedure: Give a top-down divide-and-conquer solution that runs in asymptotically optimal time on a pyramid of base size n to determine, for every processor in the pyramid, the percentage of 1's in the base of its sub-pyramid.

