NAME:_____Student Number:_____

CSE4/529 **MidTerm II** Fall, 2016

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) A *UPC code* is a 10-digit number that is used to uniquely identify a physical or digital music CD/EP/single. Given a set of *n* unique UPC codes, arbitrarily distributed, give an efficient algorithm to sort these values.

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

For each of the following, i) give an algorithm, ii) give the asymptotic running time of your algorithm, and iii) give the cost of your algorithm. Efficiency counts!

a) RAM
b) CREW 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-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: A point on the x-axis (*i.e.*, a single value) that is covered by the maximum number of line segments in the range of the left endpoint of the first line segment to the right endpoint of the last line segment.

For each of the following, i) give an algorithm, ii) give the asymptotic running time of your algorithm, and iii) give the cost of your algorithm. Efficiency counts!

a) Linear Array
b) Hypercube
c) CREW PRAM

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Q3 of 4 (8 pts)

Input: A mesh of size *n* where every processor is either marked (data value of "1") or unmarked (data value of "0").

Output: Every processor knows the Processor ID of a nearest marked processor in its row *and* of a nearest marked processor in its column.

Solution: Your solution must be primarily based on parallel prefex.

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

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Q4 of 4 (8 pts) Bitonic Sort Question.

a) Draw an 8-element bitonic sort unit (either method of presentation used in class is acceptable) and use it to
b) Show how the input sequence {5,3,6,2,4,8,7,1} will be sorted by Bitonic Sort.

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Bonus Question 1 (1 pt) Who is the President-Elect of the United States?

Bonus Question 2 (1 pt) What is the name of the company and the name of the CEO who Prof. Miller spent time with in the early 2000's?