NAME:_____Student Number:_____

CSE4/529 **MidTerm II** Fall, 2017

Plagiarism will earn you an F in the course and a recommendation of expulsion from the university. You may not refer to any material outside of this exam.

Answer all questions on these exam pages. No code or pseudo-code is necessary – just a precise and concise explanation and justification. Unsupported work will receive no credit.

Q1 of 4 (8 pts) Input: A set of *n* letters, taken from {A, B, C, …, Z}, arbitrarily ordered, and evenly distributed amongst the processors.

Output: The *n* letters in order, distributed evenly amongst the processors.

Solution: (*i*) Give a generic parallel-prefix-based algorithm to solve this problem.
(*ii*) Then, for each of the architectures listed below, give a configuration of the architecture that will result in a cost-optimal algorithm with minimal running time to solve the problem on that architecture.

a) CREW PRAM
c) Mesh
d) Mesh-of-Trees

NAME:_____

Q2 of 4 (8 pts)

Input: A set of n labeled line segments situated along the x-axis. Each line segment is represented by two records, one describing its left endpoint, given as (**L**, label, x-value), and one describing its right endpoint, given as (**R**, label, x-value).

Assume that the $2n$ records are initially given ordered by x-value and that no two points have the same x-value.

Output: The maximum number of line segments in any maximally overlapping subset of line segments.

Solution: (*i*) Give a generic algorithm to solve the problem.
(*ii*) Then, for each of the architectures listed below, give a configuration of the architecture that will result in a cost-optimal algorithm with minimal running time to solve the problem on that architecture.

a) Tree
b) Hypercube
c) Mesh

NAME:_____

Q3 of 4 (6 pts)

Input: A set of *n* numeric values arbitrarily distributed amongst the processors.

Output: Every processor with initial value below the median of the input values is set to 0 and every processor with initial value at or above the median on the input values is set to 1.

Solution: (*i*) Give a generic algorithm to solve the problem.
(*ii*) Then, for each of the architectures listed below, discuss the running time of your algorithm on that architecture.

a) Mesh of size *n*
b) Hypercube of size *n*
c) Pyramid of base size *n*

Efficiency counts!

NAME:_____

Q4 of 4 (8 pts) Bitonic Sort Question.

a) Draw a 2-element Bitonic Merge Unit.
b) Draw a 4-element Bitonic Merge Unit.
c) Draw an 8-element Bitonic Merge Unit.
d) Use the Bitonic Merge units from a), b), and c) to construct an 8-element Bitonic Sort Unit. {Feel free to ignore whether a comparator orders data into increasing or decreasing order.}