Name:___________________________ Student Number________________________

CSE4/529 **MidTerm II** Spring, 2019

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. That is, you may not refer to notes, books, papers, calculators, phones, classmates, classmates' exams, and so forth. You may use a writing utensil to write on these pages. Nothing more.

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.*

Q1 of 5 (5 pts) Draw and label the nodes of a Hypercube of size 8. Place numbers on the edges that show the order in which comparisons are made to perform a Bitonic Merge on the Hypercube. Do not worry about whether elements are put into non-decreasing or non-increasing order.

Q2 of 5 (5 pts) What is the running time of Bitonic Sort on each of the following architectures? Discuss the efficiency of Bitonic Sort on each architecture in terms of cost and running time.

a. RAM
b. Combinational Circuit
c. PRAM
d. Hypercube
e. Mesh

Q3 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 (x-value, label, **L**), and one describing its right endpoint, given as (x-value, label, **R**).

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

Output: Between the first left endpoint and the last right endpoint, determine the total number of breaks in overlapping line segments. That is, if the line segments represent cell tower coverage on a thruway, determine the total number of breaks in coverage from beginning to end.

Solution: (*i*) Give a generic, machine independent, algorithm to solve the problem.
(*ii*) 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. Justify your answer. Efficiency counts.

a) PRAM
b) Linear Array
c) Hypercube
d) Mesh

Name:____________________________ Student Number_________________________

Q4 of 5 (4 points) Given a Pyramid of base size *n* with a 0 or 1 in every base processor, give an efficient algorithm that will result in every non-base processor knowing the number of 1's in the base processors of its descendants.

Name:____________________________ Student Number_________________________

Q5 of 5 (8 points) Given a mesh of size n^2, where every processor contains an integer value in the range of [1,…,n], give an algorithm to sort the n^2pieces of data. Your sort routine must be constructed primarily fundamental operations (rotations, parallel prefix, etc). However, you cannot use a general-purpose sorting routine (*e.g.*, bitonic sort) in your solution. Efficiency counts.

Name:____________________________ Student Number_________________________

Extra Credit (1 point each)

1. What is the name of the band that Prof Miller plays in?
    a. Shake-and-Bake
    b. Turn-n-Burn
    c. Algo Rhythms
    d. Turings Tirade
    e. Escher's Enigma

2. Where did Prof Miller spend his youth?
    a. New Jersey
    b. New York City
    c. Long Island
    d. Staten Island
    e. Brooklyn

3. Where did Prof Miller do his undergraduate work?
    a. SUNY-Stony Brook
    b. SUNY-Albany
    c. SUNY-Buffalo
    d. SUNY-Binghamton
    e. SUNY-Geneseo

4. How many unique books (not different editions of the same book) has Prof Miller authored or co-authored?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5