Name:___________________________ Student Number________________________

CSE4/529 **MidTerm II** Fall, 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 these exam pages. 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 (7 pts) Given N pieces of data per processor on a hypercube of size n, where $N \geq n$, highlight critical differences between Bitonic Sort and Hyperquicksort.

Name:___________________________ Student Number________________________

Q2 of 5 (7 pts) Given a set of n labeled line segments situated on the X-axis, where each line segment is represented by 2 records, one corresponding to its left endpoint and one corresponding to its right endpoint. Assume that these $2n$ records are initially ordered by endpoint. Give an efficient algorithm to identify those sets of maximally-overlapping line segments that cover a distance greater than some value K. That is, identify those maximally-overlapping sets of line segments for which the distance from the start of the set to the end of the set is greater than K.

Discuss the quality of your solution, in terms of cost and running time, on each of the following architectures.

a. RAM
b. PRAM
c. Hypercube

Name:____________________________ Student Number_________________________

Q3 of 5 (7 pts) Suppose there is an algorithm that runs in $\Theta(R)$ time on a CREW PRAM with *n* processors to solve some problem B. Based on this information, provide an upper bound on the running time to solve problem B on the following architectures.

a. Mesh of size *n*
b. Hypercube of size *n*
c. Pyramid of size *n*

Justify your answer. Quality of solution counts.

Name:____________________________ Student Number_________________________

Q4 of 5 (7 points) Given $n \times n$ matrices A, B, and C, where $C = A \times B$, give an efficient algorithm to compute C from A and B on each of the following models of computation. Discuss the cost and running time of your algorithm. Efficiency counts.

a. CREW PRAM of size n
b. CREW PRAM of size n^2
c. CREW PRAM of size $n^3 / \log_2 n$

Name:____________________________ Student Number_________________________

Q5 of 5 (7 points) Given a mesh-of-trees of base size n^2, where every processor contains an integer value in the range of [1,…,*C*], for some constant *C*, give an algorithm to sort the n^2 integers. Efficiency counts.

Name:____________________________ Student Number_________________________

Extra Credit (1 point each)

1. Select a course that Prof. Miller is teaching next semester.
    a. Natural Language Processing
    b. Genetic Algorithms
    c. Introduction to Microsoft Office
    d. Web Programming
    e. Theory of Computation

2. Select a sport that Prof. Miller played in his youth.
    a. Lacrosse
    b. Baseball
    c. Hockey
    d. Football
    e. Ultimate Frisbee

3. Circle *all* of the areas that Prof. Miller works in.
    a. Parallel Algorithms
    b. Machine Learning
    c. Molecular Structure Determination
    d. Cyberinfrastructure
    e. Cybersecurity

4. When did Prof. Miller join UB?
    a. 1985
    b. 1990
    c. 1995
    d. 2000
    e. 2005

5. Prof. Miller runs a youth sports league in which sport?
    a. Golf
    b. Baseball
    c. Football
    d. Gymnastics
    e. Basketball