Name:__________________________ Student Number________________________

CSE4/529 **MidTerm II** Fall, 2018

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 (4 pts) Input: Draw an 8-element Bitonic Merge Unit. Either a "line and boxes" drawing or a "parallel lines with connections" diagram is fine. Do not worry about whether elements are put into non-decreasing or non-increasing order.

Q2 of 5 (5 pts) Compare and contrast Mergesort and Quicksort with respect to the sequential model of computation.

Name:___________________________ Student Number________________________

Q3 of 4 (8 pts)

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

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

Define the *interval-weight* of a maximally contiguous set of overlapping line segments to be the sum of the weights of all line segments in the maximally contiguous set of overlapping line segments.

Output: The maximum interval-weight of any maximally contiguous set of overlapping line segments.

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) Tree
b) Hypercube
c) Mesh

Name:____________________________ Student Number_________________________

Q4 of 5 (10 points) Discuss options for cost-effective algorithms to multiply two $n \times n$ matrices on a CREW PRAM.

Give and discuss efficient algorithms for the following number of processors:

i. n^3
ii. n^2
iii. n
iv. $n/\log n$

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,…,10], give an algorithm to sort the n^2pieces of data. Your sort routine must be constructed primarily from parallel prefix operations. In particular, you cannot utilize, nor should you construct, a general-purpose sorting routine (*e.g.*, bitonic sort). Efficiency counts.