Name: _____

CSE 3500 Algorithms and Complexity

Exam III; December 8, 2016

Note: You are supposed to give proofs to the time and processor bounds of your algorithms. Read the questions carefully before attempting to solve them.

1. (20 points) Input is a weighted undirected graph $G(V, E)$ in which each edge has the same weight w. Present an $O(|V| + |E|)$ time algorithm to solve the single source shortest path problem from the source node $s \in V$.

2. (20 points) Input is a sequence $X = k_1, k_2, \ldots, k_n$ of arbitrary real numbers. The problem is to check if X is in sorted order. Present an $O(1)$ time algorithm to solve this problem. You can use up to n common CRCW PRAM processors.

3. (20 points) Input is a sequence $X = k_1, k_2, \ldots, k_n$ of integers in the range $[1, 10]$. Present an $O(\log n)$ time algorithm to sort X. You can use up to $\frac{n}{\log n}$ CREW PRAM processors.

4. (20 points) Input is a sequence $X = k_1, k_2, \ldots, k_n$ of arbitrary real numbers. The problem is to find the maximum element in X. Present an $O(\log \log n)$ time algorithm to solve this problem. You can use up to n common CRCW PRAM processors.

5. (20 points) Assume that SATALG is a deterministic polynomial time algorithm for solving the decision version of the SAT problem. Now consider the following variant of the SAT problem: Let F be any Boolean formula in CNF. The problem is to find a satisfying assignment to F (if F has one). Show how to solve this variant in deterministic polynomial time (using SATALG).