Homework 2

CSc 8530 Parallel Algorithms
Spring 2020

Due: 11:59pm, March 8, 2020

1. **(15 pts) Write pseudocode** for a non-recursive prefix-sums algorithm that is similar to the one studied in class but that does not use the auxiliary variables B and C. The input array A should hold the prefix sums when the algorithm terminates.

2. **(15 pts)** We are given an array of colors $A = [a_1, a_2, \ldots, a_n]$ drawn from k colors $\{c_1, c_2, \ldots, c_k\}$, where k is a constant. We wish to compute k indices $i_1, i_2, \ldots, i_k$, for each element a_i, such that i_j is the index of the closest element to the *right* of a_i whose color is c_j. If no such element exists, then set $i_j = 0$. **Write pseudocode** for solving this problem in $O(\log{(n)})$ using a total of $O(n)$ operations.

3. **(15 pts)** Suppose that we have an algorithm A to solve a given problem P of size n in $O(\log{(n)})$ time on the PRAM model using $O(n \log{(n)})$ operations. On the other hand, an algorithm B exists that reduces the size of P by a constant fraction in $O\left(\frac{\log{(n)}}{\log\log{(n)}}\right)$ time using $O(n)$ operations without altering the solution. Derive an $O(\log{(n)})$ time algorithm to solve P using $O(n)$ operations.