CS 1510 Midterm 4
Fall 2013

1. (20 points)

   (a) Explain how to find the maximum of n numbers in time $O(\log n)$ on a EREW PRAM with $p = n$ processors.

   (b) What is the efficiency of this algorithm? Start with a definition of efficiency.

   (c) State the folding principle in terms of the time $T(n, p)$ used by a parallel algorithm on an input of size n with p processors. What does this version of the folding principle say about the time for this algorithm with only $p = n/\log n$ processors?

   (d) State the folding principle in terms of the efficiency $E(n, p)$ of a parallel algorithm on an input of size n with p processors. What does this version of the folding principle say about the efficiency of this algorithm with only $p = n/\log n$ processors?

2. (20 points) We consider the problem of merging two sorted arrays A and B, each containing n integers, into one sorted array C of size $2n$.

   (a) Give an algorithm that runs in time $O(\log n)$ on an EREW PRAM with $p = n$ processors.

   (b) Give an algorithm that runs in time $O(1)$ on a CRCW-common PRAM with $p = n^2$ processors.

3. (20 points)

   (a) Give a parallel algorithm to add two n bit integers A and B (stored in bit arrays) that runs in time $O(\log n)$ on an CREW PRAM with n processors.

   (b) Give a parallel algorithm to add two n bit integers A and B (stored in bit arrays) that runs in time $O(\log^2 n)$ on an EREW PRAM with n processors.