

# ESE536/CSE626 Switching and Routing in Parallel and Distributed Systems

## Assignment 1

Handed out: January 30, 2022

Due: February 13, 2022

1. Given  $n/\log n$  processors, design an algorithm to find the maximum of  $n$  numbers in  $O(\log n)$  time on an EREW-PRAM model. Assume that initially each shared memory location holds one input value. Give necessary explanation and analysis.
2. Given  $n$  processors and assume that initially each shared memory location  $M(i)$  ( $1 \leq i \leq n$ ) holds an input value  $a_i$ . Design an  $O(\log n)$  time algorithm on a CREW-PRAM model such that at the end of the algorithm,  $M(i) = \sum_{k=1}^i a_k$ . Give necessary explanation and analysis.
3. Design an algorithm on a CRCW-PRAM model for fast multiplication of two  $n \times n$  matrices for the following cases:
  - (a) The number of processors  $P(n) = n$  and the time complexity of the algorithm  $T(n) = O(n^2)$ .
  - (b) The number of processors  $P(n) = n^2$  and the time complexity of the algorithm  $T(n) = O(n)$ .

Give necessary explanation and analysis.

4. Prove that the best parallel algorithm written for an  $n$ -processor EREW-PRAM model can be no more than  $O(\log n)$  times slower than any algorithm for a CRCW model of PRAM having the same number of processors.