

**Assignment 2, Fall 2023**  
**CS4823/CS6643, Parallel Computing**  
**PRAM Algorithms**

**Due Date**

This assignment is due next Wed, 09/6/2023, at 11:59pm

**Materials to Review**

1. Read Chapter 2, sections 2.3 and 2.4.1 of textbook, and related slide sets posted for this chapter.

**Questions**

1. (10 points) Find one of the indices where maximum value occurs in an array  $A[1..n]$  of integers in  $O(1)$  time on a CRCW Common PRAM model.
  - (a) Give pseudocode (6 points).
  - (b) For  $p = n^2$ , calculate  $T_p$ ,  $S_p$ ,  $E_p$ , cost and work of your algorithm. Here,  $n$  is the size of the input,  $p$  is number of processors,  $T_p$  is the parallel time taken using  $p$  processors,  $S_p$  is the speedup,  $E_p$  is the efficiency, cost =  $pT_p$ , and work is the total operation count across all processors. (4 points).
2. (15 points) Design an algorithm for multiplying two square matrices of size  $n \times n$  which uses  $p \leq n^3$  processors and achieves the fastest parallel execution time of  $O(\log n)$ . You may assume EREW PRAM model.
  - (a) (10 points) Give major steps in high level description/pseudocode enough to answer part (b) – that is, detailed pseudocode is not needed.
  - (b) (5 points) For  $p \leq n^3$  processors, calculate expressions for  $T_p$ ,  $S_p$ ,  $E_p$ , cost and work of your algorithm as functions of  $n$  and  $p$  using  $O$  notation.