

**CS3383, Winter 2019 Assignment # 8**  
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**Due time:** Monday, April/8/2019, 13:30

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Student's full name: ..... Student ID:.....

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**Note:**

- No submission after the due time will be accepted.
  - The full credit will be given only for correct solutions that are described clearly.
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**Question 1 Matrices Multiplication:**

- (a) (5 marks) Given two square matrices  $A_{n \times n}$  and  $B_{n \times n}$ , design a multithreaded algorithm (in pseudocode) that computes  $A \times B$  with work  $\Theta(n^3)$  but span only  $\Theta(\log n)$ .
- (b) (6 marks) Using your algorithm in (a) as a base, design a multithreaded algorithm that compute  $A \times B$  where  $A_{p \times q}$  and  $B_{q \times r}$  are two given matrices.
- (c) (6 marks) Analyze both of your algorithms in (a) and (b).

**Note:** in part (b), your algorithm should be highly parallel even if any of  $p$ ,  $q$ , and  $r$  are 1.

**Question 2 (a)** (5 marks) Given a square matrix  $A_{n \times n}$ , design an efficient multithreaded algorithm that compute  $A^T$  ( $A$ -transpose) in place by using a divide-and-conquer approach (i.e. dividing the matrix recursively into four  $(n/2 \times n/2)$  submatrices  $C$ ,  $D$ ,  $E$ , and  $F$ .)

$$A = \begin{bmatrix} C & D \\ E & F \end{bmatrix}_{n \times n},$$

where the dimensions of all  $C$ ,  $D$ ,  $E$ , and  $F$  are  $(\frac{n}{2} \times \frac{n}{2})$

- (b) (3 marks) Analyze your algorithm in (a).