

## EECS 739: Homework 1

Due: Tuesday, March 2, 2021 (at 4pm)

### Questions:

1. (20 points) Do Problem 3.2 in Grama *et al.*
2. (20 points) Do Problems 3.7, 3.8, and 3.9 in Grama *et al.* For Problems 3.7 and 3.8, instead of proving that your mapping of tasks to processors is optimal in each case, provide some discussion on this.
3. (20 points) Consider the multiplication of two  $n \times n$  dense matrices  $A$  and  $B$  with  $A \times B = C$ . Show how to parallelize matrix-matrix multiplication when  $A$  is partitioned among  $p$  processors laid out in a logical square 2D mesh in the following formats:
  - (a) 1D rowwise block cyclic partitioning
  - (b) 2D block cyclic partitioning.

To answer this question, for each partition, draw a diagram illustrating the partitions of  $A$  and  $B$ . Then give a detailed pseudocode for the algorithm. Repeat for the second partition.

4. (20 points) Specify pseudocode for one parallel Gaussian Elimination algorithm. For this question, you should consider one permutation of the  $i, j$ , and  $k$  indices for the triple loop. (See p. 468 in Karniadakis and Kirby for the pseudocodes for each of the six different serial algorithms.)