

## CS 3006 Parallel and Distribute Computing

### Assignment #1

Fall 2022

**Due Date: Sunday 02 Oct, 23:59**

**Q1:** Given a 1-D array of size N, write a parallel approach (step-by-step) to calculate the overall average of the matrix.

**Q2:** What does it mean by Instruction Pipelining and Superscalar Execution? What are WASTES in superscalar execution? Also elaborate the reasons of WASTE in superscalar execution

**Q3:** What is mapping in Caches? Explain all possible mapping techniques in caches.

**Q4:** Given the following matrices A and B, what could the best possible decomposition among tasks for the operation  $A \times B$  (Matrix Multiplication) with 8 available cores.

**MATRIX A**

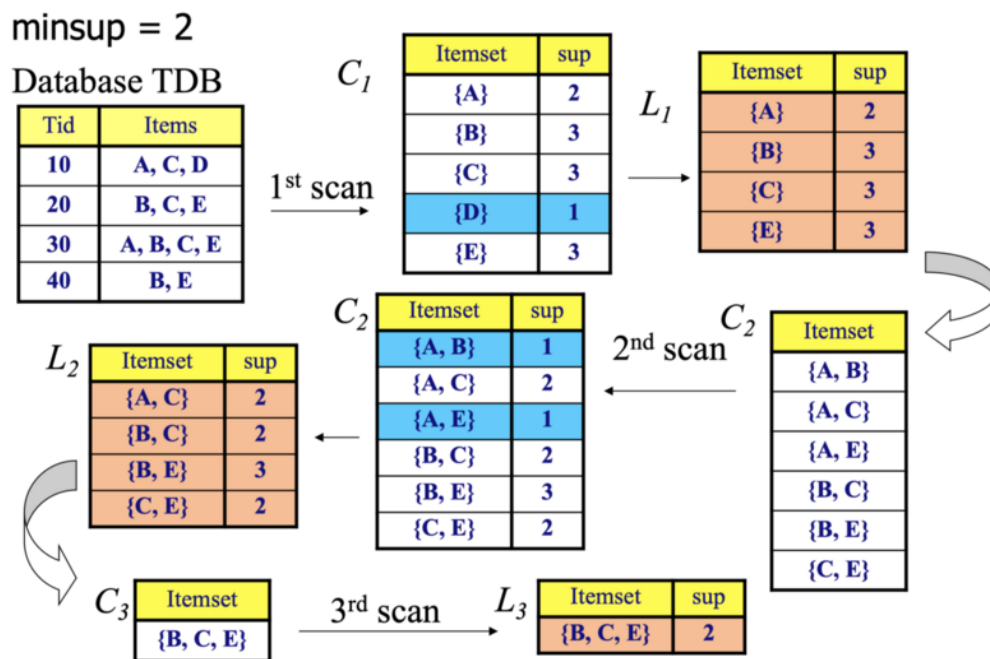
1	7	5	5	0	8	8	3	1	4	11	17	13	19	15	1
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7
1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5
6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7
1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5
6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
1	7	5	5	0	8	8	3	1	4	11	17	13	19	1	7
1	7	5	5	0	8	8	3	1	4	11	17	13	19	1	7

**MATRIX B**

1	7	5	5	0	8	8	3	1	4	11	17	13	19	15	1
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7
1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5
6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3
1	2	3	4	9	6	8	2	10	9	3	4	5	8	6	7

1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5
6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9
4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1
1	7	5	5	0	8	8	3	1	4	11	17	13	19	1	7
1	7	5	5	0	8	8	3	1	4	11	17	13	19	1	7

Q5: Given the following Apriori Algorithm (which finds out frequent K-Itemsets), construct a dataset with 20 transactions where each transaction would have 3 to 6 items. For any itemset to be frequent it must appear atleast 2 times in the dataset. How do you see it as parallel computing problem? Write and explain the whole algorithm.



Q6: Taking the same problem from Q3, explain how each of the following decomposition is possible to find out frequent K-itemsets, assuming you have maximum of 8 processors.

- Input Data decomposition
- Output Data Decomposition
- Intermediate Data Decomposition