Assignment 4

Due on Monday, April 28, 2025

1. Draw the compare-and-exchange circuit configuration for the odd-even merge sort algorithm described in Section 10.2.7 to sort 16 numbers. Sort the following sequence by hand using the odd-even merge sort algorithm.

**12 11 2 9 4 1 10 5 15 7 14 8 3 13 16 6**

2. Repeat Problem 2 using bitonic mergesort.

3. Use the quicksort to sort the following numbers by hand, and then discuss how to parallelize it.

 **38 22 81 48 13 69 93 45 14 58 79 72**

4. Use rank sort to repeat problem 3. How to fix the original algorithm to ensure it is stable? How to parallelize the rank sort.

5. Use counting sort algorithm to sort the following numbers by hand, and then discuss how to parallelize it.

**2 8 4 5 3 6 3 5**

6. Draw the exchanges of numbers for a four-dimensional hypercube, using the parallel hypercube described in Section 10.2.6 that leave the results in embedding ring order. determine a general algorithm to handle a hypercube of any size.

7. Assume there are two 3\*3 matrices *A* and *B* as follows. Using Cannon's algorithm to calculate the multiplication of *A* and *B* using 9 processors.

*A*= $\left[\begin{array}{c}2 1 2\\1 1 2\\1 1 1\end{array}\right]$ *B*= $\left[\begin{array}{c}1 0 2\\2 1 1\\1 2 1\end{array}\right]$

8. Use the Systolic Array to solve Problem 7, and then analyze the communication time and computation time respectively.