

Fork-join pattern

By using the fork-join pattern, give a parallel solution for the *sorting problem*. The sorting problem is a fundamental problem in computer science and it is defined as follows: Given a set of elements and a total order between the elements, the sorting problem refers to rearranging the elements of the set such that the elements are in a given order (an increasing or a decreasing order),

Design and analyze parallel versions for the algorithms *merge sort*, *quick sort* and *counting sort*. For the algorithms merge and quick sort, apply the fork-join pattern. For the counting sort algorithm, assuming that the keys of the elements are in the range $[0-N-1]$, proposed an iterative algorithm based on prefix sum.

Note 1: There are public implementations for some sorting algorithms at <http://parallelbook.com/sites/parallelbook.com/files/code20131121.zip>. Those implementations are available in Cilk Plus for C++.

Note 2: For a visual explanation of the merge sort and quick sort algorithms, visit <https://www.cs.usfca.edu/~galles/visualization/ComparisonSort.html>. For the counting sort algorithm, visit <https://www.cs.usfca.edu/~galles/visualization/CountingSort.html>.