Finding All Maximal Contiguous Subsequences of a Sequence of Numbers in O(1) Communication Rounds

Carlos Eduardo Rodrigues Alves, Edson Norberto Cáceres, and Siang Wun Song

Abstract—Given a sequence A of real numbers, we wish to find a list of all nonoverlapping contiguous subsequences of A that are *maximal*. A *maximal* subsequence M of A has the property that no proper subsequence of M has a greater sum of values. Furthermore, M may not be contained properly within any subsequence of A with this property. This problem has several applications in Computational Biology and can be solved sequentially in linear time. We present a BSP/CGM algorithm that solves this problem using p processors in $O(|A|/p)$ time and $O(|A|/p)$ space per processor. The algorithm uses a constant number of communication rounds of size at most $O(|A|/p)$. Thus, the algorithm achieves linear speedup and is highly scalable. To our knowledge, there are no previous known parallel BSP/CGM algorithms to solve this problem.

Index Terms—All maximal subsequences problem, maximum subsequence problem, parallel algorithm, coarse-grained multicomputer, communication rounds

✦