DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
ODENSE UNIVERSITY

COMPUTER SCIENCE COLLOQUIUM

Optimal Pointer Algorithms for Finding Nearest Common Ancestors in Dynamic Trees

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Abstract: We consider the problem of finding the nearest common ancestor of two given nodes x and y (denoted by $nca(x, y)$) in a dynamic forest of rooted trees. Interspersed with nca-queries are on-line commands $link(x, y)$, where x but not necessarily y is a tree root. The effect of a command $link(x, y)$ is to combine the trees containing x and y by making y the parent of x. This problem was originally proposed by Aho, Hopcroft and Ullman (SIAM J. Comput. 5(1), 115-132, 1976). We present a pointer machine algorithm, which performs n $link$ and m nca in time $O(n + m \log\log n)$, matching a lower-bound by Harel and Tarjan (SIAM J. Comput. 13(2), 338-355, 1984). The previous best bound on a pointer machine was $O((n + m)\log n)$, due to Sleator and Tarjan (J. Comput. Syst. Sc. 26(3), 362-391, 1983).

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