added: 24 Aug 2008 11:26
Edited: 9 Sep 2008 15:52

# Problem RMQ (Range Minimum Query - at least in the interval). Solution in O (1) preprocessing with O (N)

Contents [hide]



Given an array A [1..N]. Receives requests form (L, R), for each query you want to find the minimum in the array A, starting from a position of L and ending at R. array A change in the process can not, ie here described solution of the static problem RMQ.

Described herein asimtpoticheski optimal solution. It stands apart from several other algorithms for solving the RMQ, because it is very different from them: it reduces the problem to the RMQ problem LCA, and then uses an algorithm Farah-Colton and Bender , which reduces the problem back to the LCA RMQ (but a particular form) and decides her.

## Algorithm

We construct the array A Cartesian tree where each node is a key position i, and priority - the sheer number of A [i] (it is assumed that in the Cartesian tree priorities are ordered from smaller to larger in the root). Such a tree can be constructed in O (N). Then inquiry RMQ (l, r) is equivalent request LCA (l ', r'), where l '- vertex corresponding to the element A [l], r' - corresponding to A [r]. Indeed, LCA will find the top, which is keyed between l 'and r', ie to position in the array A will be between l and r, and wherein the vertex closest to the root, i.e. with the lowest priority, ie the lowest value.

LCA problem we can solve in O (1) preprocessing with O (N) using the algorithm Farah-Colton and Bender , who, interestingly, reduces the problem back to the LCA problem RMQ, but a special form.