算法 2 数据结构的高效实现

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procedure INITIALIZE-TREE
    INITIALIZE-TREE-SIMPLE
    build heavy-light decomposition
    calculate $g_u \quad (\forall u)$
    for each chain $c$ do
        let $c.segment\text{-}tree$ be a new segment tree of $g_u$
        initialize $c.segment\text{-}tree$
    end for
end procedure

procedure MODIFY-CHILD-VALUE($u$, $v$, $b$)
    assume $v_1, \ldots, v_k$ are children of $u$
    assume $v = v_i$, and $v_j$ is the heavy-child of $u$ $(i \neq j)$
    $u.processor$.MODIFY($i$, $b$)
    $u.processor$.MODIFY($j$, 0)
    $g_u(0) \leftarrow u.processor$.QUERY
    $u.processor$.MODIFY($j$, 1)
    $g_u(1) \leftarrow u.processor$.QUERY
end procedure

procedure RECALCULATE($u$)
    assume $u$ is the $i^{\text{th}}$ node of chain $c$
    $r \leftarrow c.top$
    $c.segment\text{-}tree$.MODIFY($i$, $g_u$)
    $g^* \leftarrow c.segment\text{-}tree$.QUERY
    $W(r) \leftarrow g^*(0)$                              ▷ 此时 $g^*(0) = g^*(1)$
    if $r \neq$ root then
        $p \leftarrow r.parent$
        MODIFY-CHILD-VALUE($p$, $r$, $W(r)$)
        RECALCULATE($p$)
    end if
end procedure

procedure MODIFY-TREE($u$, $b$)
    $g_u(0) \leftarrow b,\ g_u(1) \leftarrow b$
    RECALCULATE($u$)
end procedure

function QUERY-TREE
    return $W$(root)
end function
```