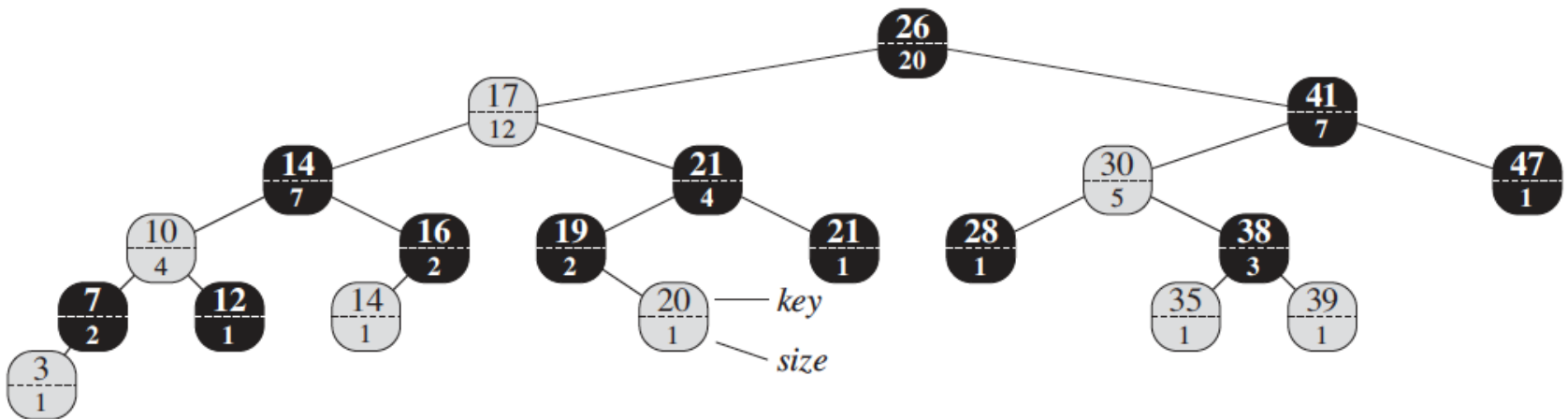# HW2. Order-Statistic Tree

Order-Statistic Tree

- Darkened node : black node
- Shaded node : red node

Retrieving an element with a given rank

OS-SELECT(x, i)

1 $r = x.left.size + 1$
2 **if** $i == r$
3   **return** x
4 **elseif** $i < r$
5   **return** OS-SELECT$(x.left, i)$
6 **else return** OS-SELECT$(x.right, i - r)$

- Returns a pointer to the node containing the ith smallest key in the subtree rooted at x.

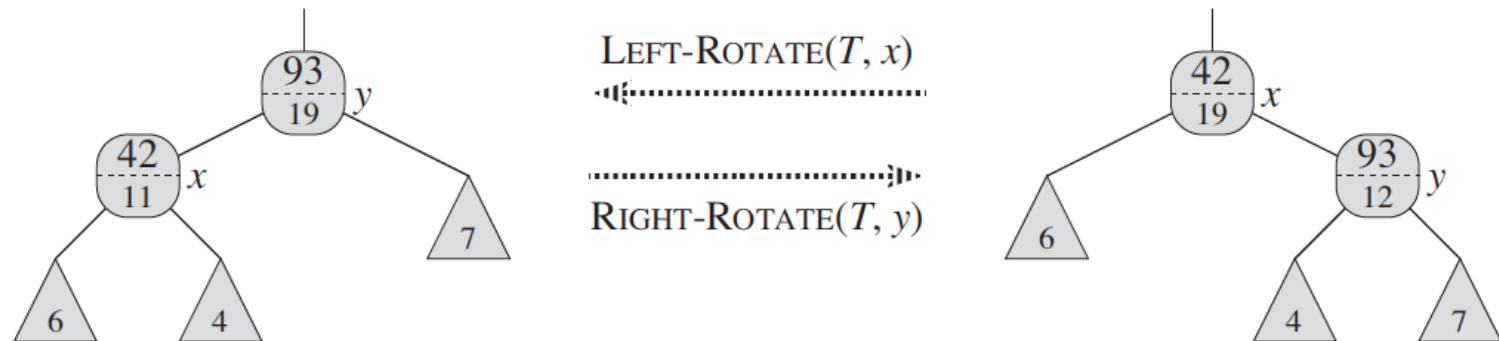# Determining the rank of an element

OS-RANK(T, x)

1   $r = x.left.size + 1$
2   $y = x$
3   **while** $y \neq T.root$
4   **if** $y == y.p.right$
5           $r = r + y.p.left.size + 1$
6       $y = y.p$
7   **return** r

- Returns the position of x in the linear order determined by an in-order tree walk of T.

Maintaining subtree sizes

- Updating subtree sizes during rotations (Left-Rotate)
  - y.size = x.size
  - x.size = x.left.size + x.right.size + 1

Thank you