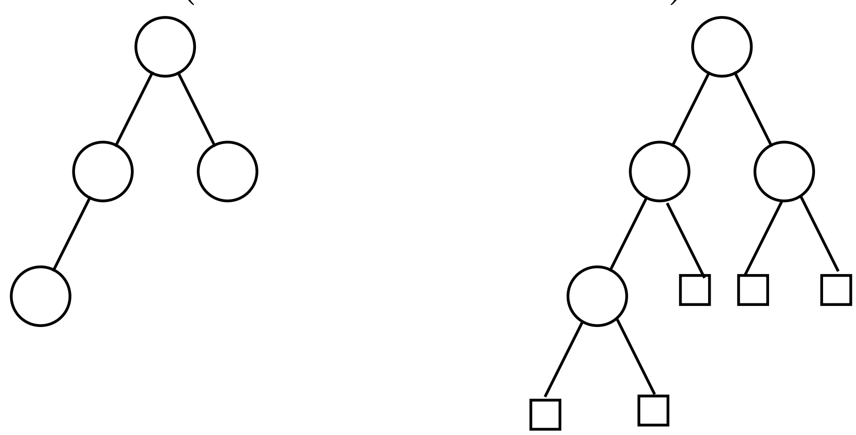
Leftist Trees

- Linked binary trees.
- Insert and DeleteMin (or Delete Max) takes $O(\log n)$ time.
- Can Meld (Merge) two leftist trees in $O(\log n)$ time.

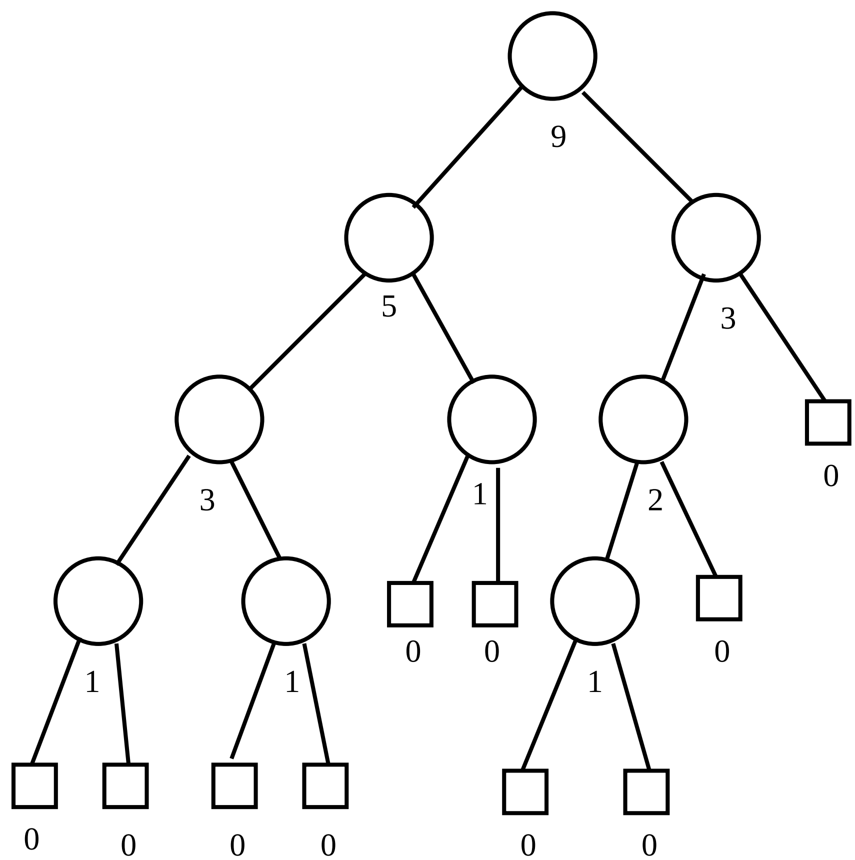
Extended Binary Trees

(Add external nodes)



W( ) Weight Function

$W(x)$: For any node x, $W(x)$ is the total number of (internal) nodes in the subtree rooted at x (including x).



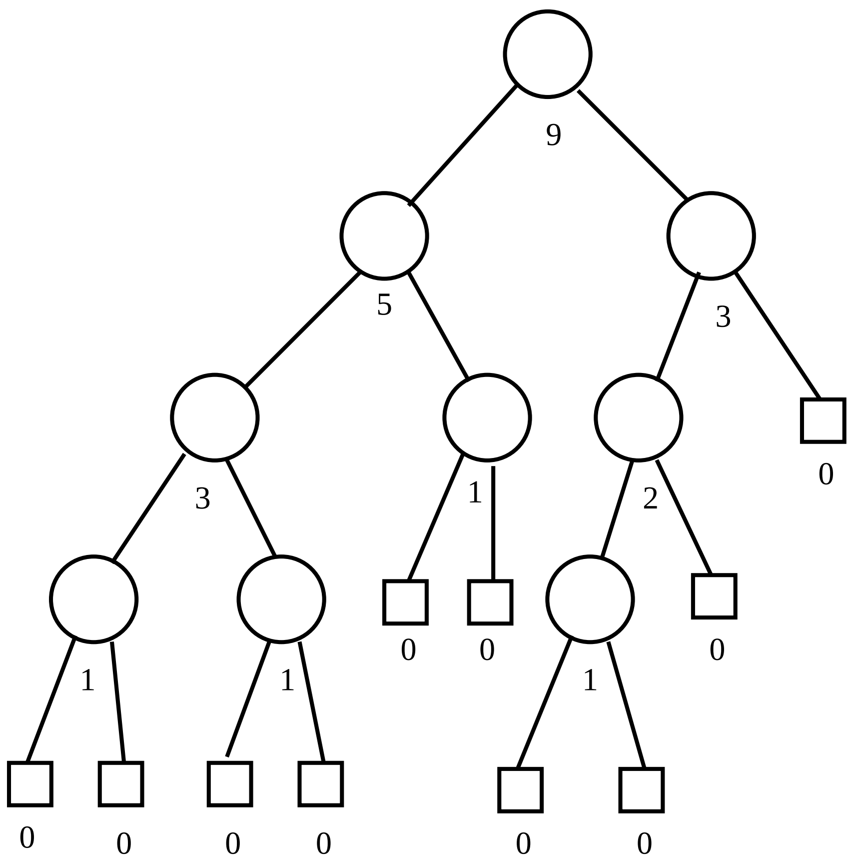
Computing $W(x)$

$$S(x) = \begin{cases} 0 & \text{if } x \text{ is an external node} \\ W(lc(x)) + W(rc(x)) + 1 & o.w. \end{cases}$$

where lc (rc) represents leftchild (rightchild).

Weight-Biased Leftist Trees (WBLT)

- A Binary tree is a WBLT
- iff
- for every internal node x,
  $W(lc(x)) \geq W(rc(x))$

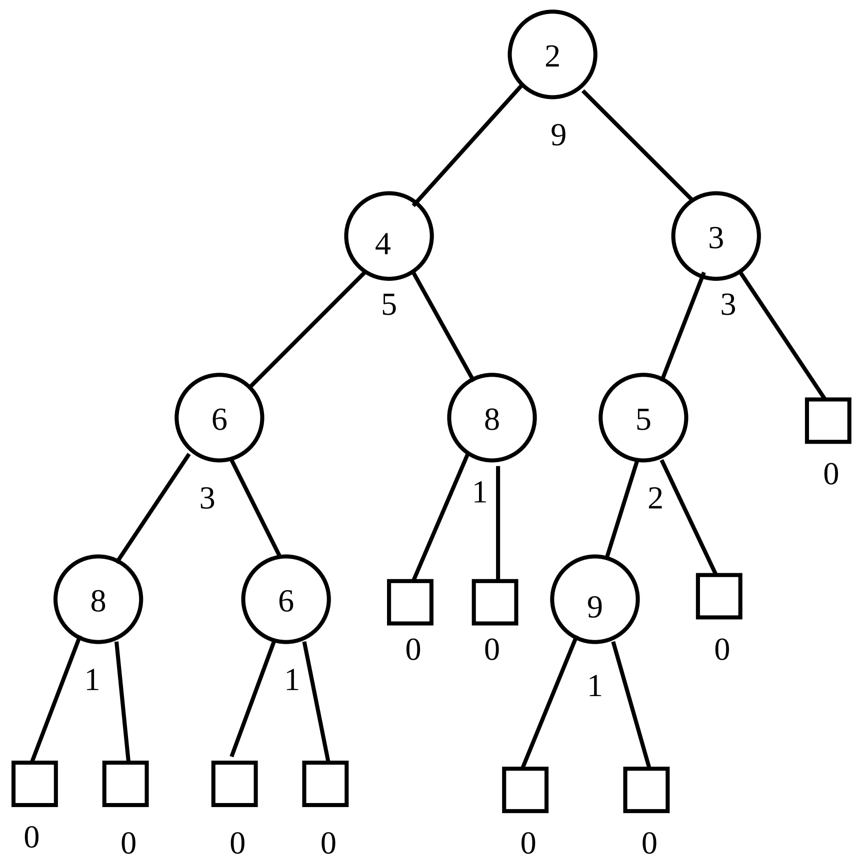


Property of WBLTs

- A shortest root to external node path has lengt $O(\log W(Root))$.
- The rightmost path has this length.

Min WBLTs

A Min WBLT that satisfies the "Min Heap ordering" is a Min WBLT.

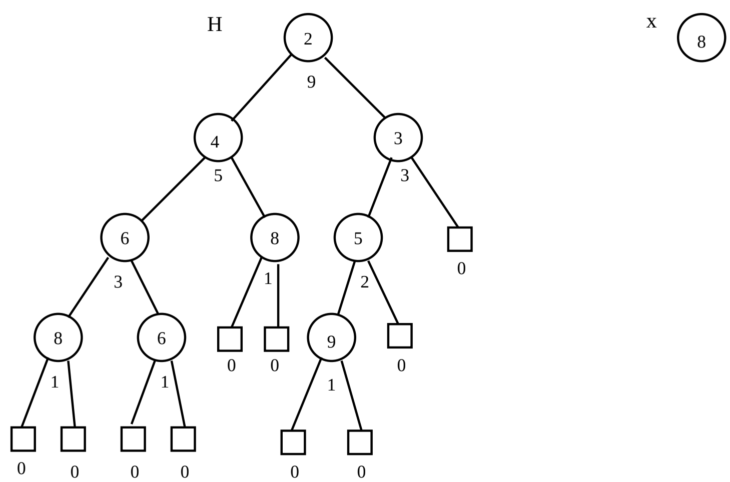


The Insert, DeleteMin and Meld operations can be performed in $O(\log n)$ time.

Insert Operation

Insert x in WBLT H is just MELD(x, H)

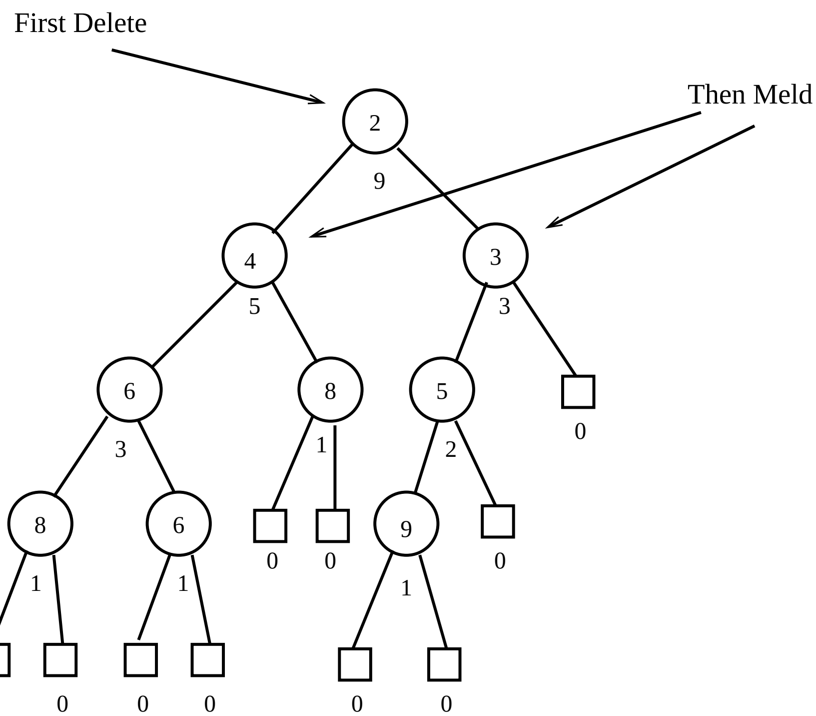
Insert x with value 8 => Meld H and the single node WBLT x with value 8



DeleteMin Operation

DeleteMin from WBLT H is just
MELD$(lc(H), rc(H))$

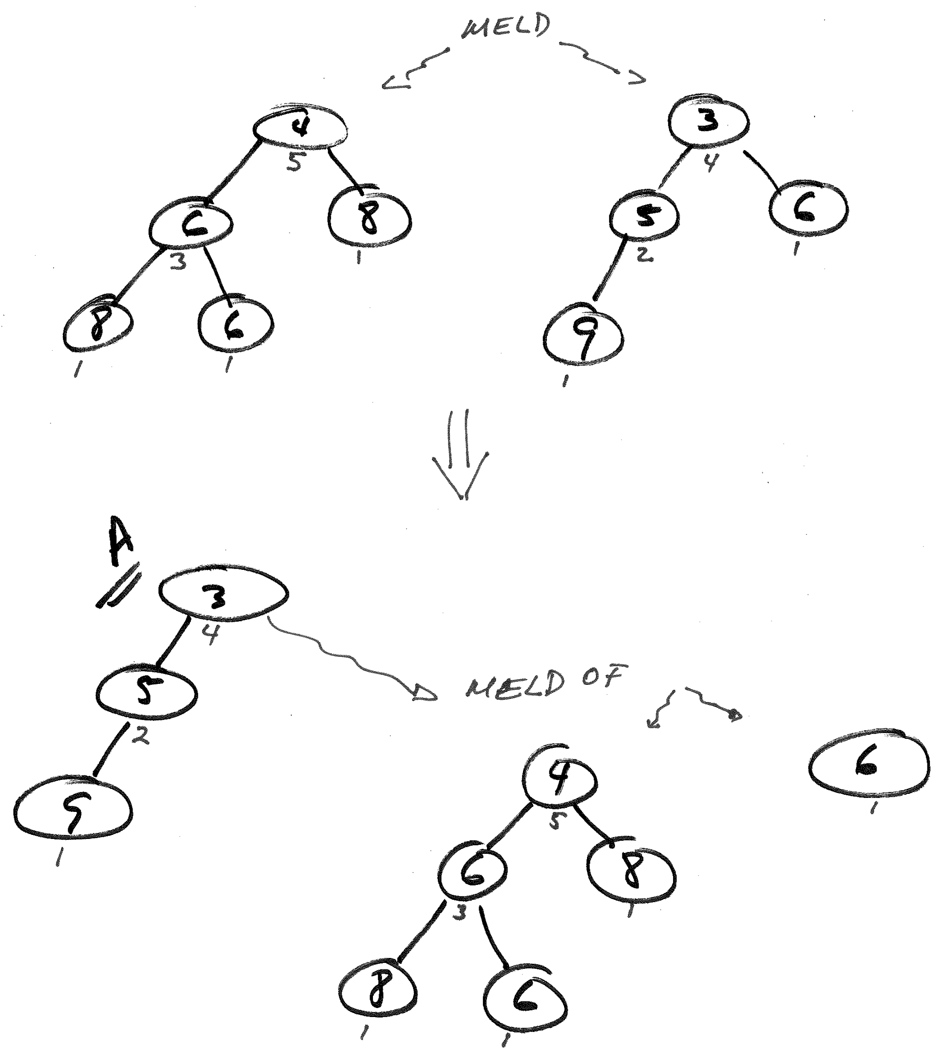
Delete Min => Merge(lc(Root),rc(root))

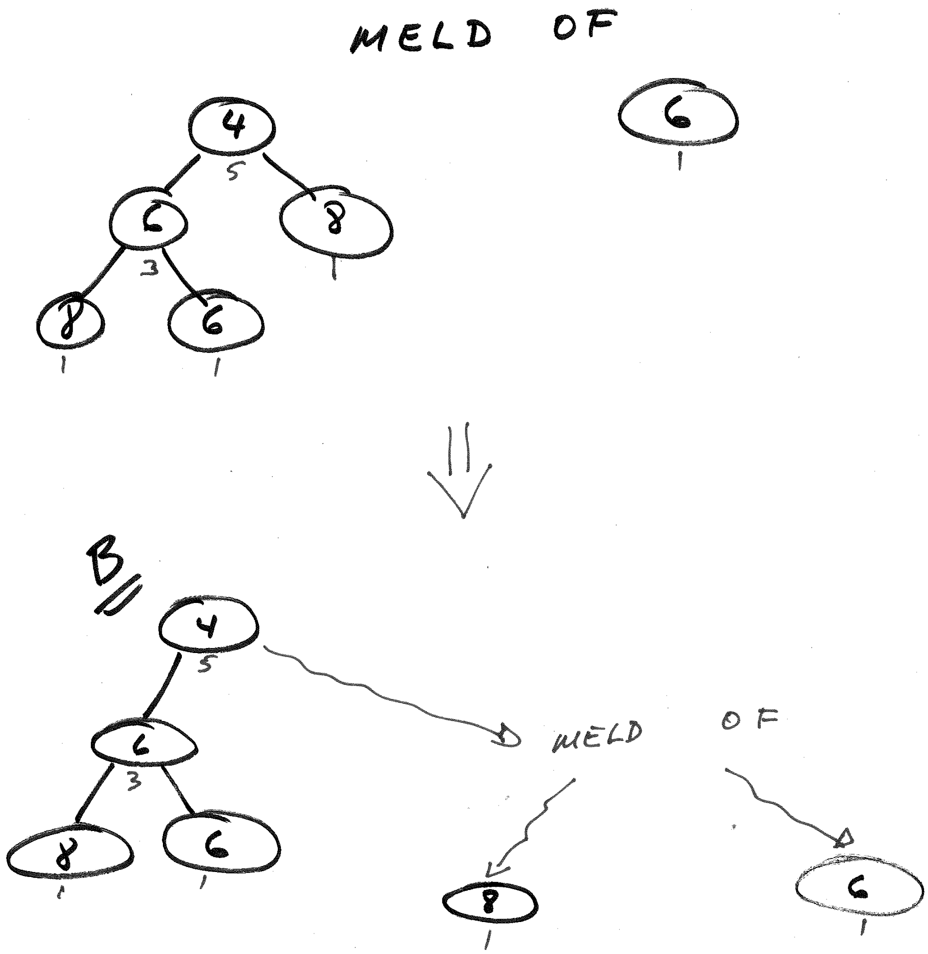


Meld Two WBLTs

Traverse rightmost paths. See example beginning next page.

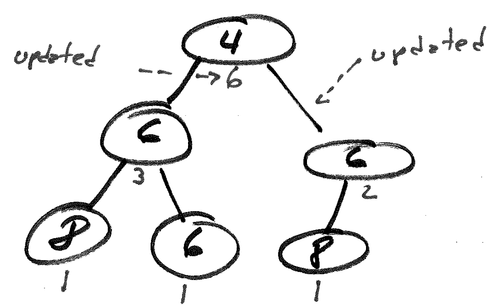
MELD TWO WBLT



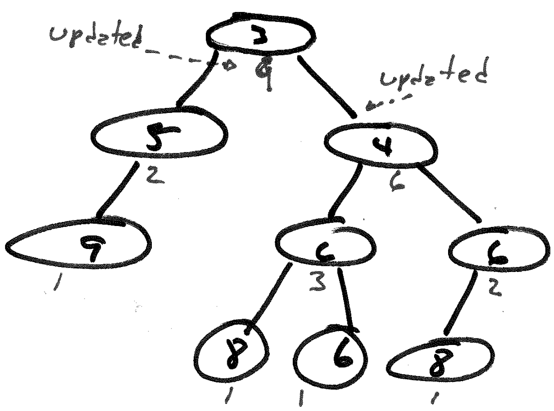

MELD OF
4
5
6
8
1
3
8
6
1
1
6
1
B
4
5
6
3
8
6
1
1
MELD OF
8
1
6
1

PASTE BACK IN B

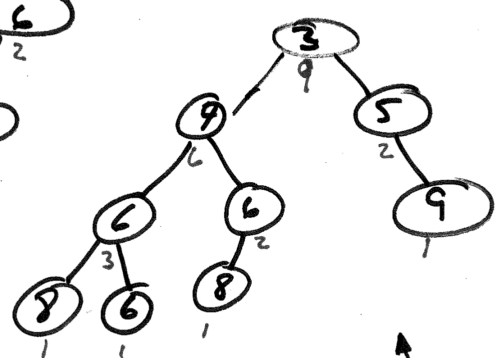
B



PASTE BACK IN A



Swap lc & rc



RESUTING WBLT