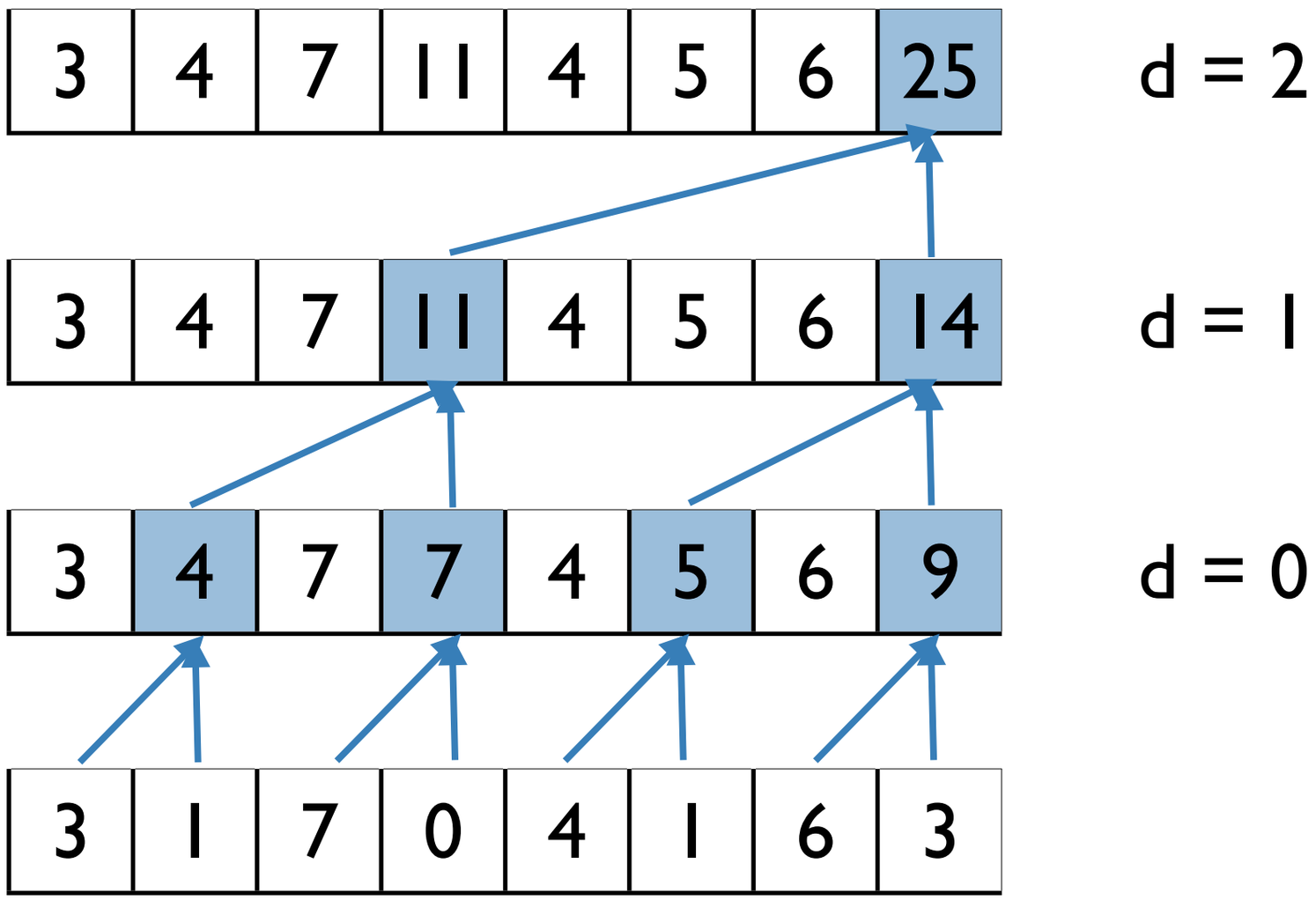
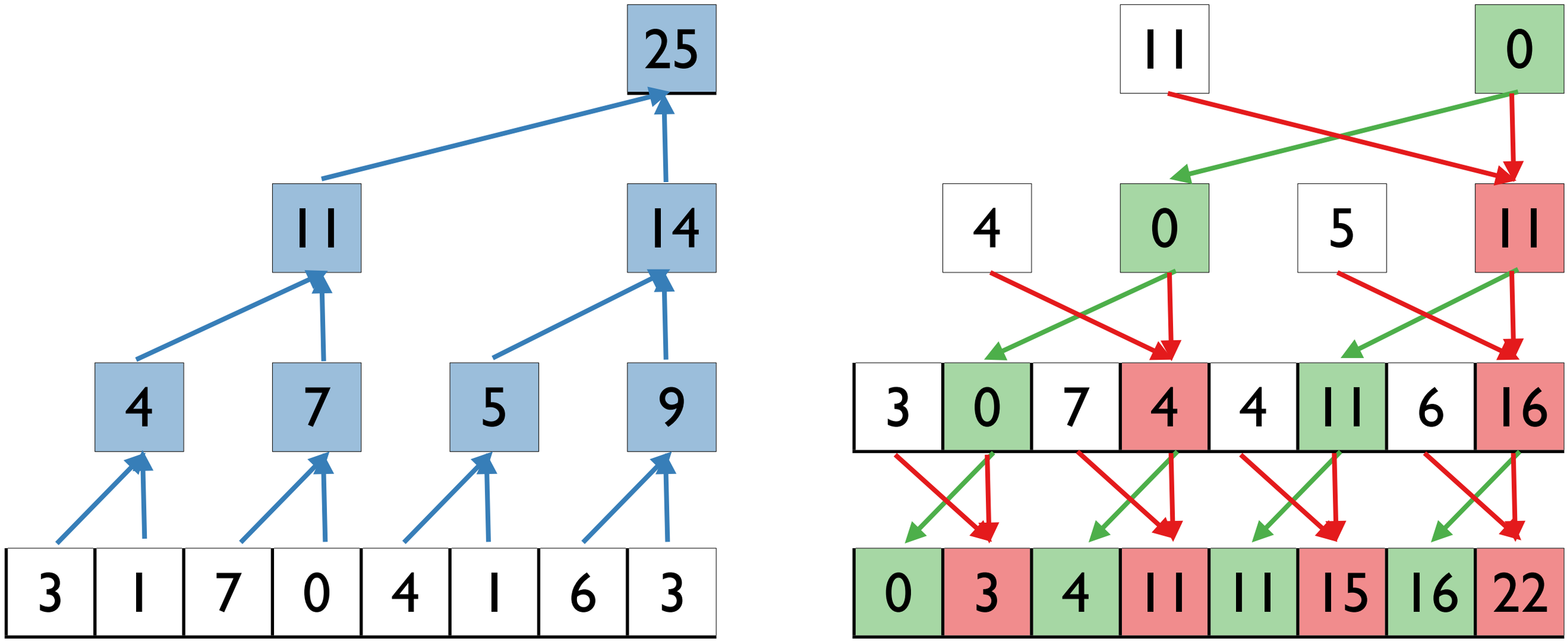
Upsweep



$$sum[i] := sum[L_i] + sum[R_i]$$

So at this point, the nodes contain partial sums of the result we'd like. It turns out there is an analogous phase (the downsweep) that will build all the prefix sums. We'll do the downsweep first and then I'll justify it to you.

Downsweep (again)



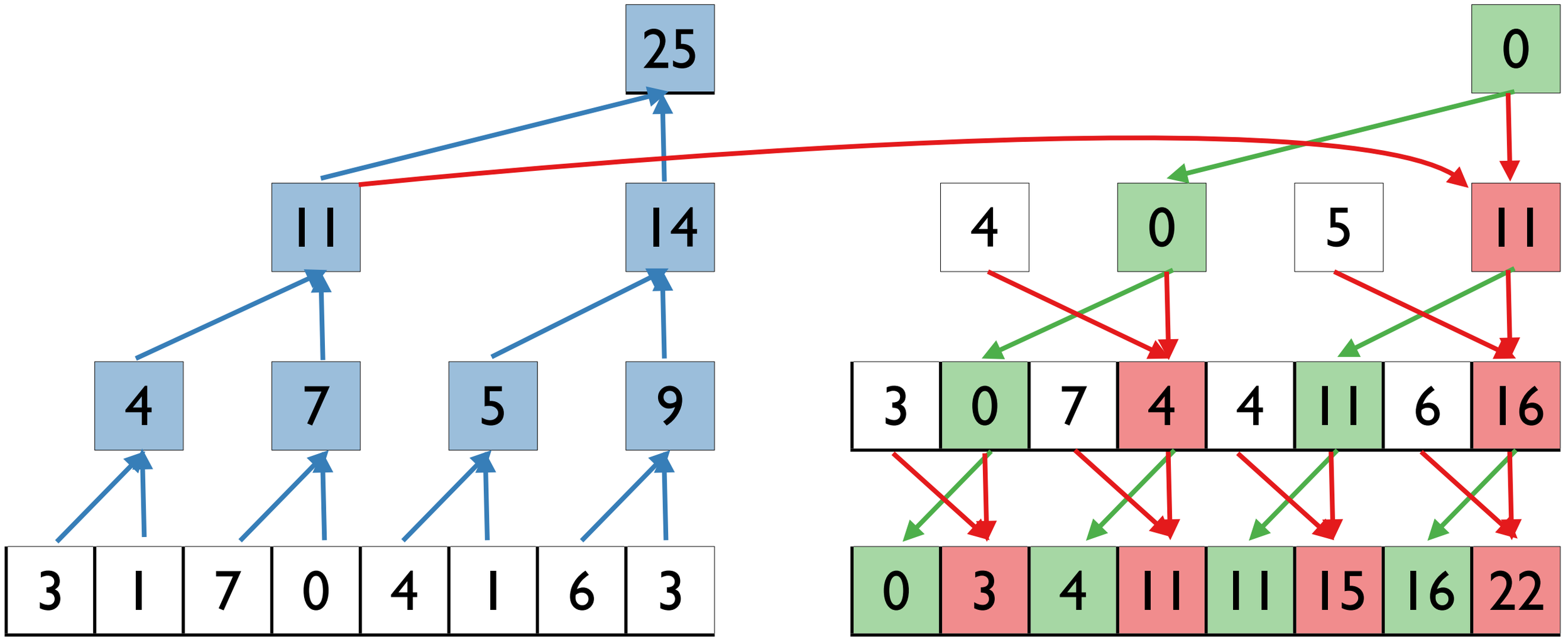
$$out[L_i] := out[i]$$

$$out[R_i] := sum[L_i] + out[i]$$

Working in-place obscures the fact that we are really working with two trees `sum` and `out`, generated by the upsweep and downsweep, respectively. The red arrows (which update the right child in `out`) are taking partial sums from the upsweep `sum` tree.

We'll note here that each node in `sum` is the sum of the leaf nodes below it.

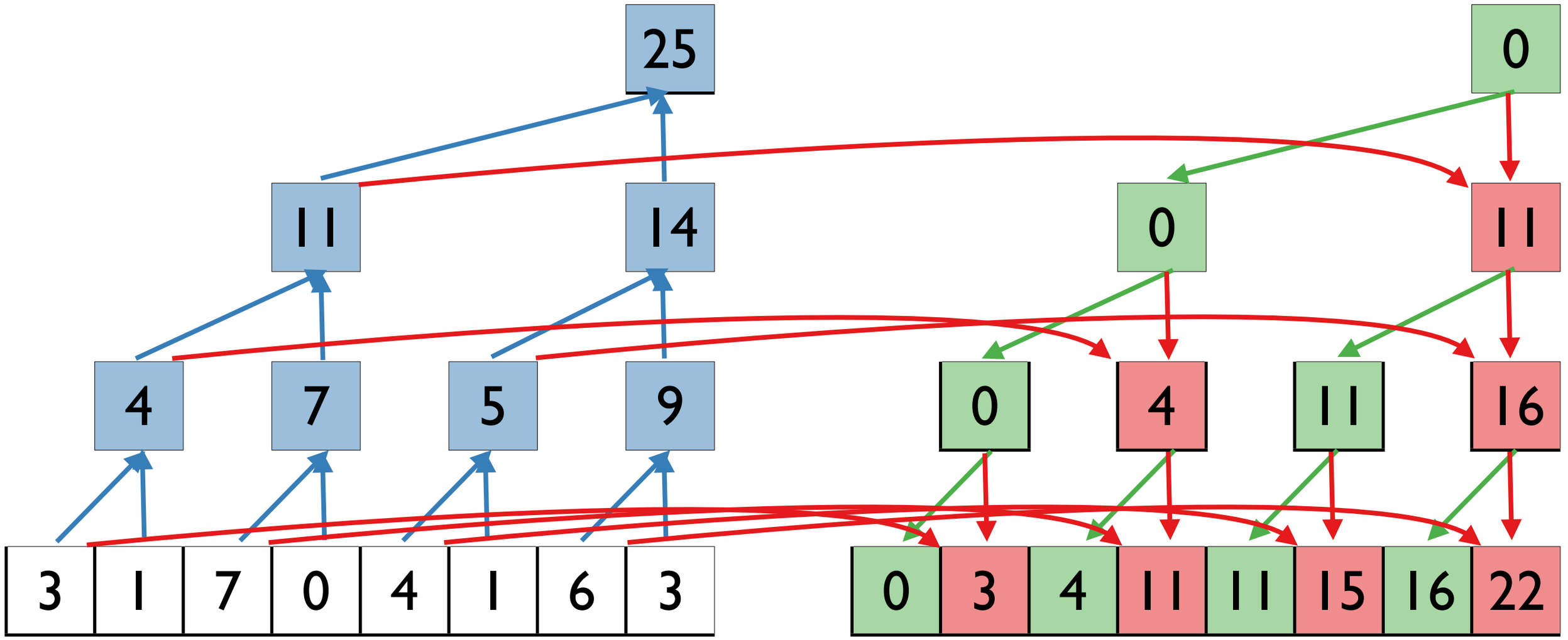
Downsweep (again)



$out[L_i] := out[i]$

$out[R_i] := sum[L_i] + out[i]$

Downsweep (again)



$\text{out}[L_i] := \text{out}[i]$

$\text{out}[R_i] := \text{sum}[L_i] + \text{out}[i]$