A note on the traceback involved in the maximum weighted independent set problem on a tree.

The book is not very explicit on how to do the traceback for the problem of finding a maximum weighted independent set in a tree. Here is a more explicit version.

When the algorithm does the computation for a node $u$, it determines $M_{in}(u)$ and $M_{out}(u)$. At that point it can record which of those values is larger. That means it can leave a “bread-crumb” $B(u)$ at node $u$, which either says “in” or “out”. After the $M$ values have been computed for all nodes, including for the root node $r$, we can do a traceback to find the actual maximum weighted independent set $S$. We start by looking at $B(r)$; if $B(r)$ is ‘in’, then node $r$ should be placed into set $S$, and we continue with the traceback by looking at all of the grandchildren of $r$. Otherwise, if $B(r)$ is ‘out’, $r$ is not put into $S$ and we recurse by looking at all of the children of $r$. In general, when we look at a node $u$, we look at $B(u)$; If $B(u)$ is ‘in’, then node $u$ will be put into $S$, and we continue with the traceback by looking at all of the grandchildren of $u$. Otherwise, if $B(u)$ is ‘out’, $u$ is not put into $S$, and we recurse by looking at all of the children of $u$.

Clearly, the time for the traceback is proportional to the size of the tree.