

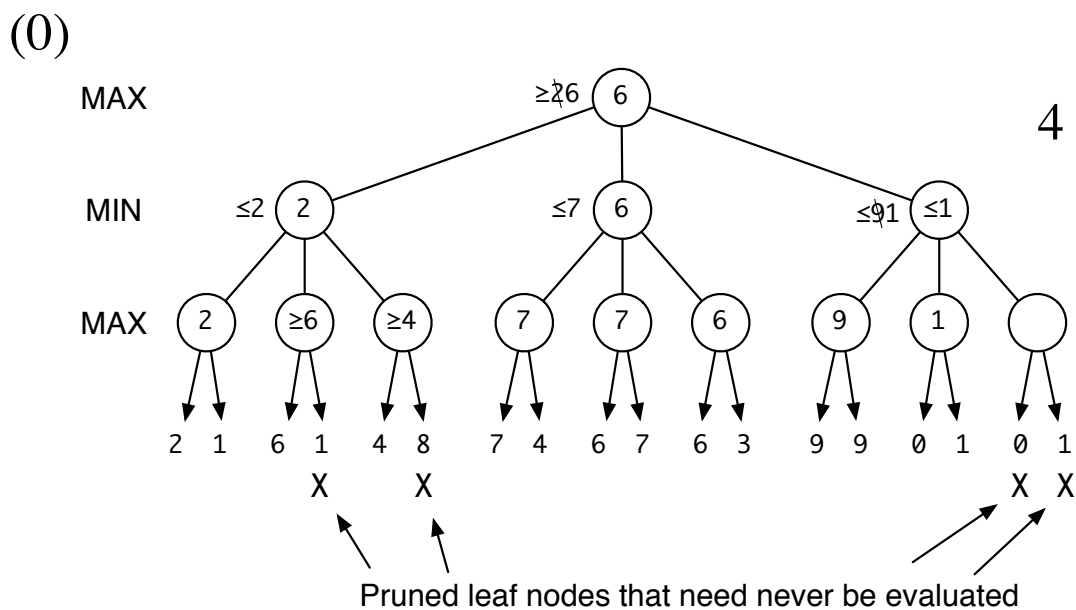
Alpha-beta Exercises

Following are 12 minimax trees. The numbers indicate the result of applying the static evaluation function to the leaf nodes (which are not themselves shown). However, with alpha-beta pruning there are some leaf nodes that need never be evaluated because their value can not affect the value of the top node. For each tree, mark the leaf nodes that need never be evaluated. We assume nodes are considered from left to right. To make the calculations easy, all the leaf values happen to be integers between 0 and 9, but do not assume that other (e.g., non-integer) values are not possible.

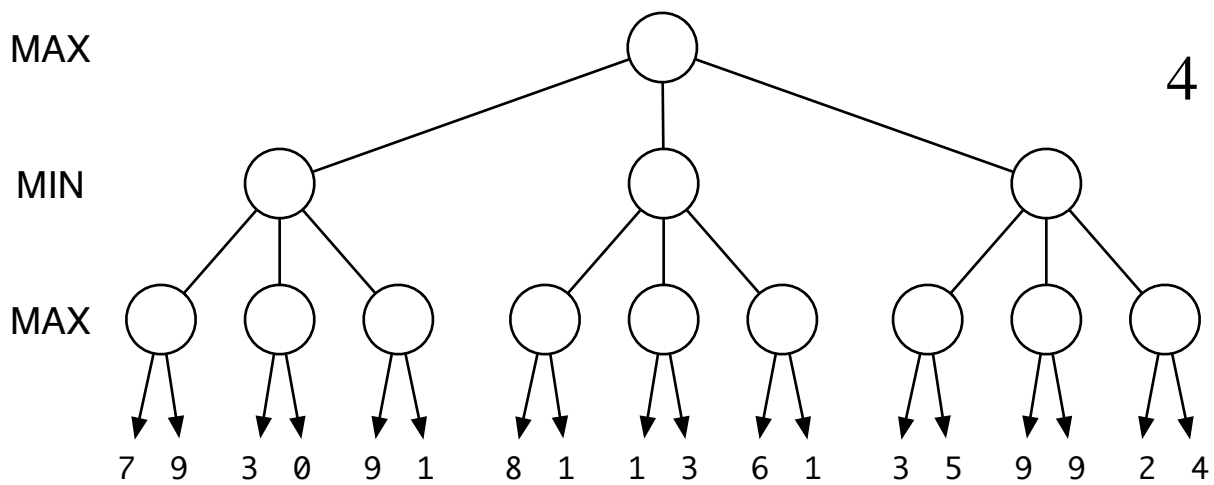
In these exercises, the total number of leaf nodes pruned is given to the right of each tree. You can use these as a crude check that you are getting the pruning right.

Here's some advice about how to go about solving these exercises. First, as you start depth first down the left-hand side, note that you have to go all the way down to the bottom and completely evaluate the first subtree (one circle and two leaf nodes) before you can consider pruning anything. In the leftmost circle, you can now write the value of that node. And this value provides a bound on the value of the node above it -- the upper node has to be that value or lower. Write this constraint next to the upper node. Then continue, left to right, at each step assessing (by consulting the bound) whether you need to evaluate the next node. After a while you will start to be able to provide bounds on the top node. Each time you are done working with a circle, fill it in with the value of the node or the final bound on the value of the node.

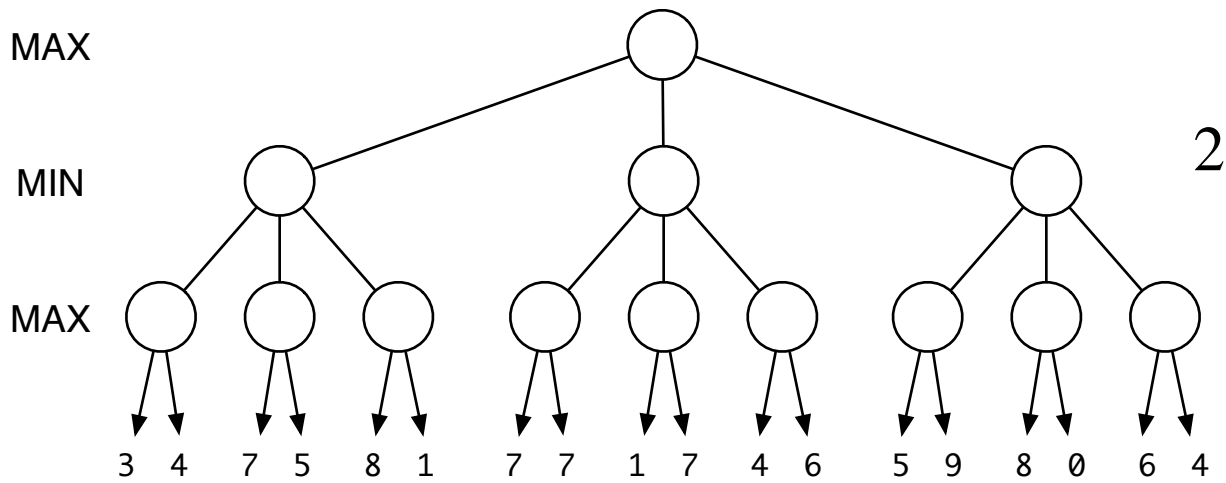
Below is the final result of one worked example like this.



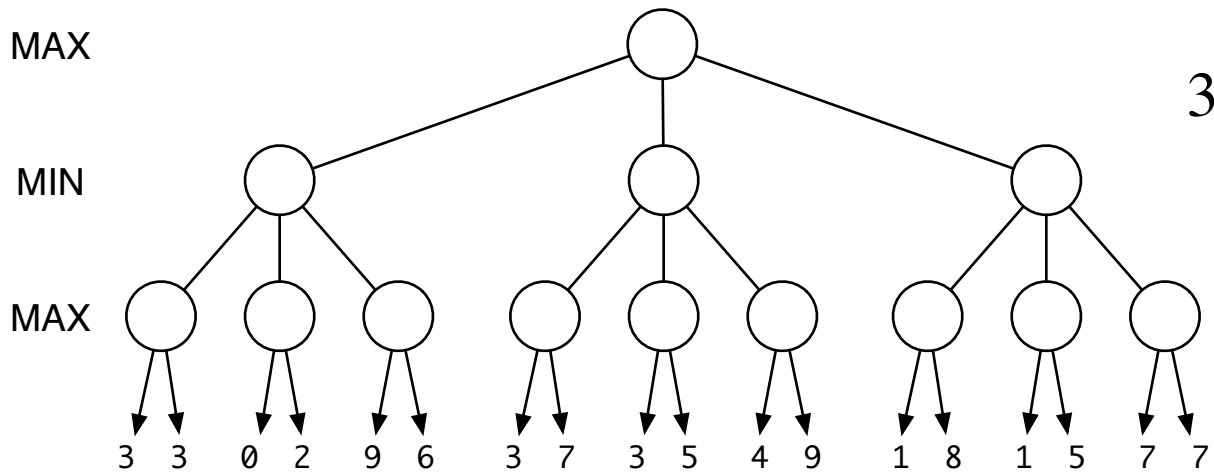
(1)



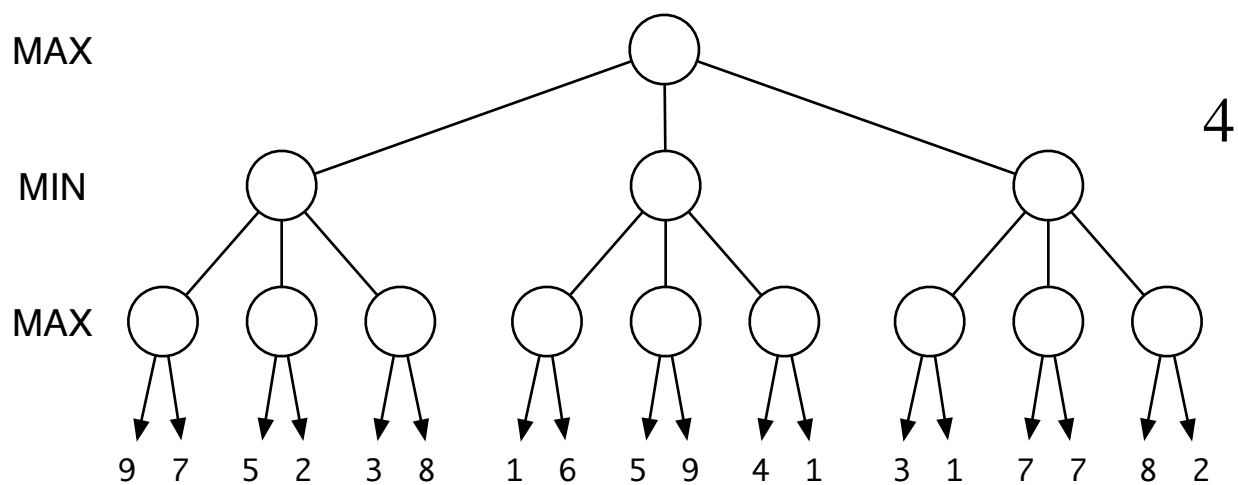
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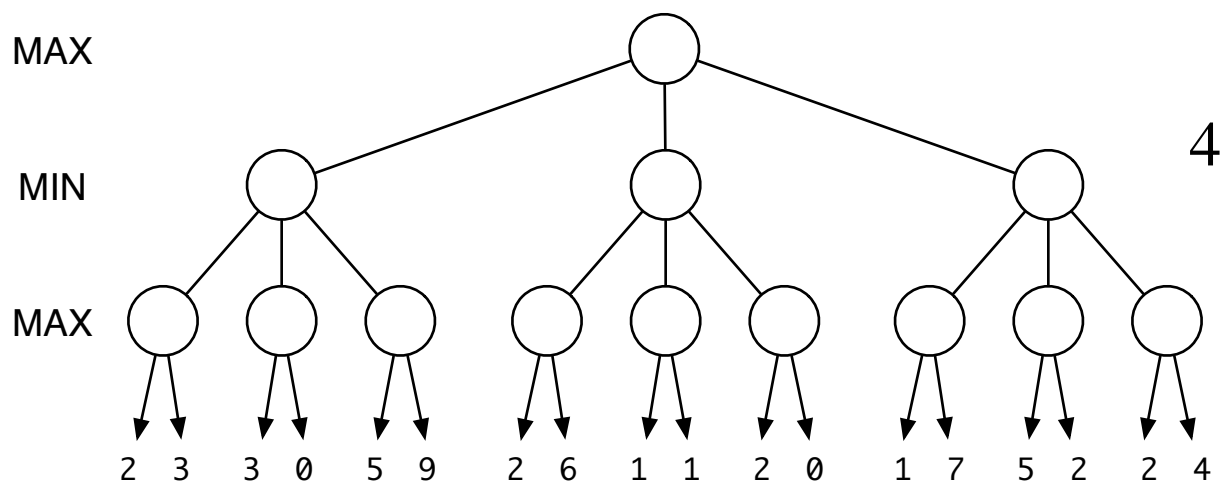
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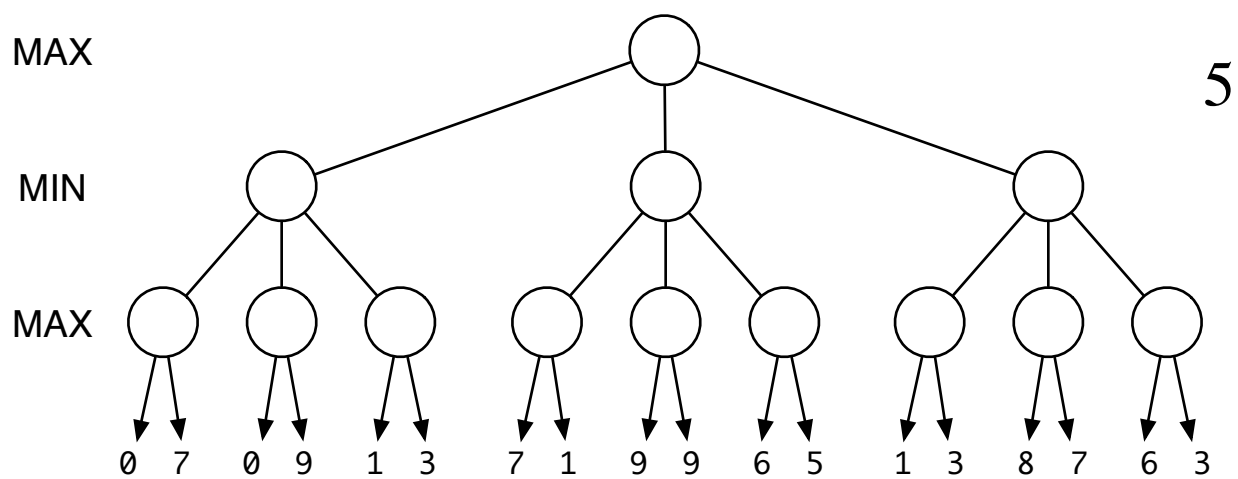
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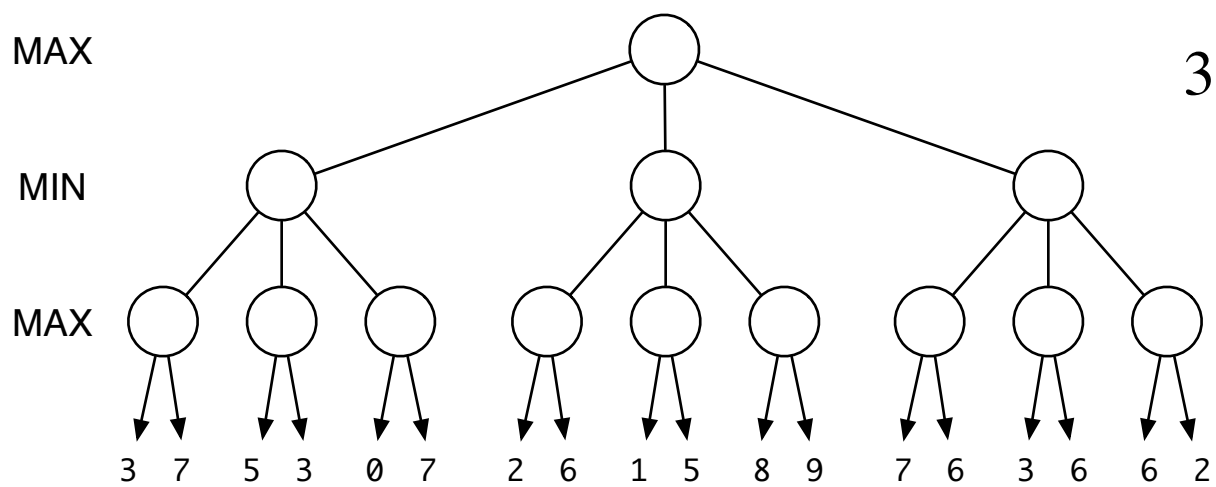
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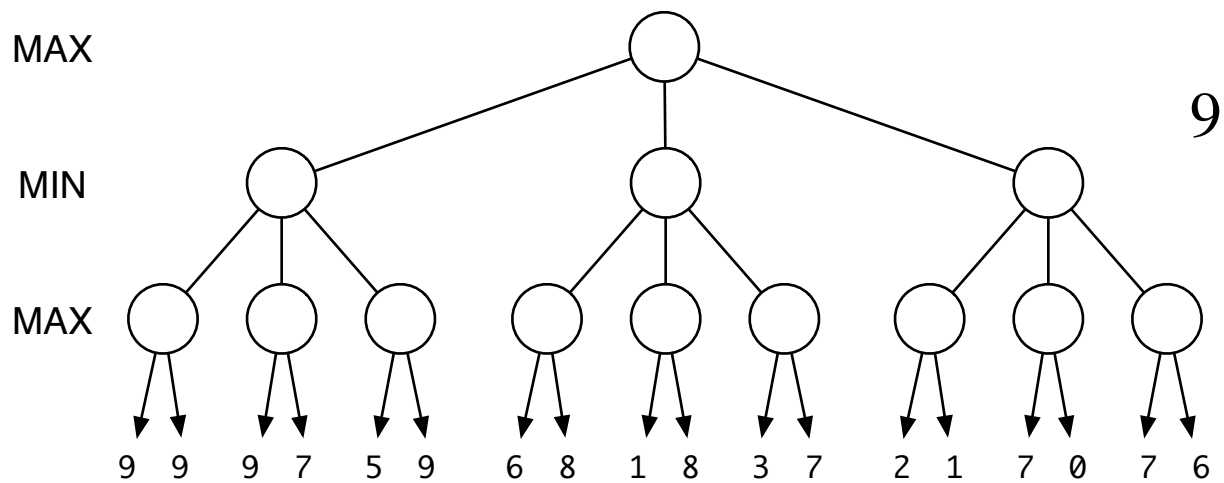
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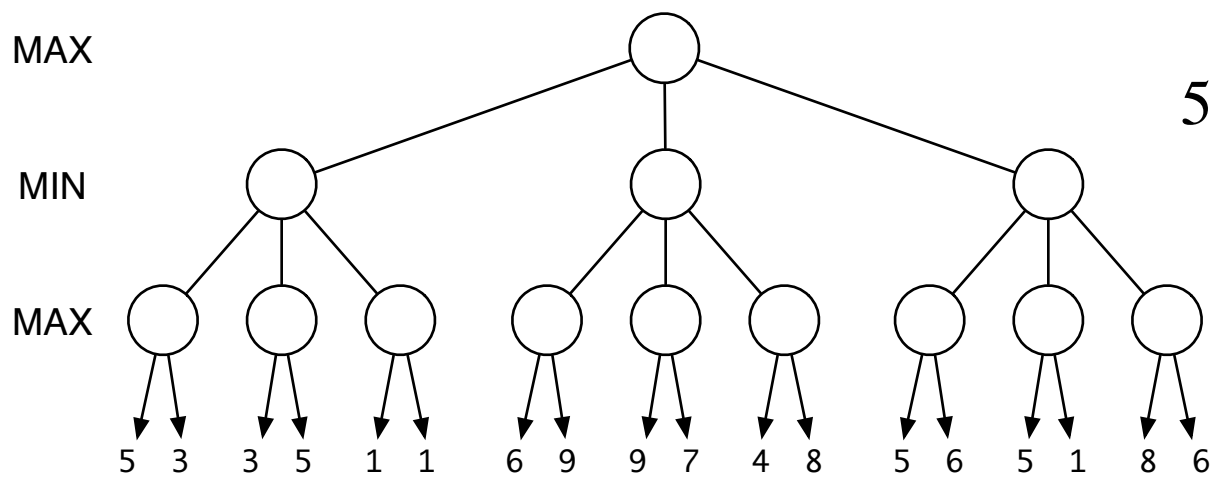
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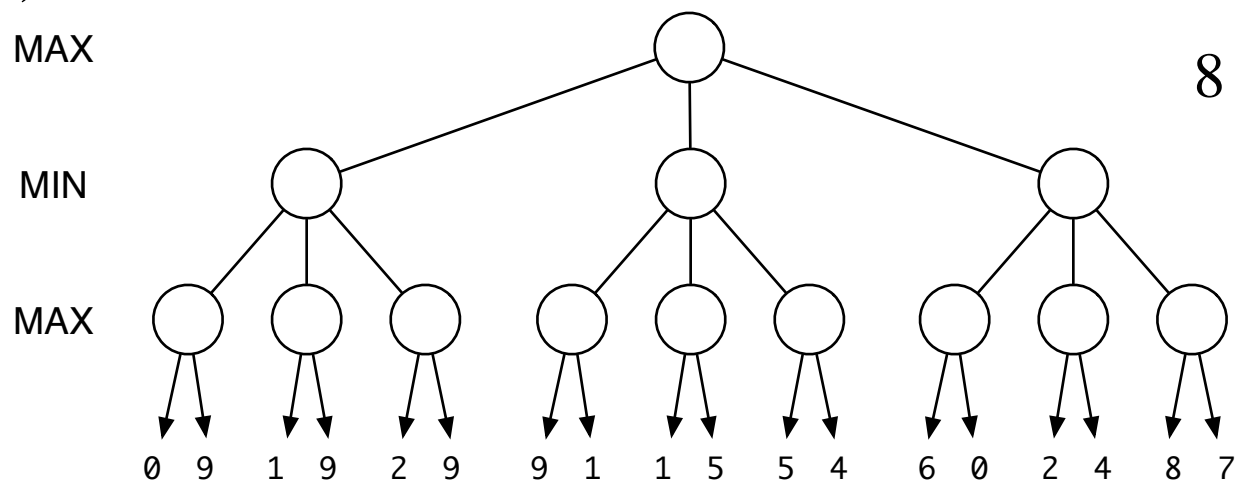
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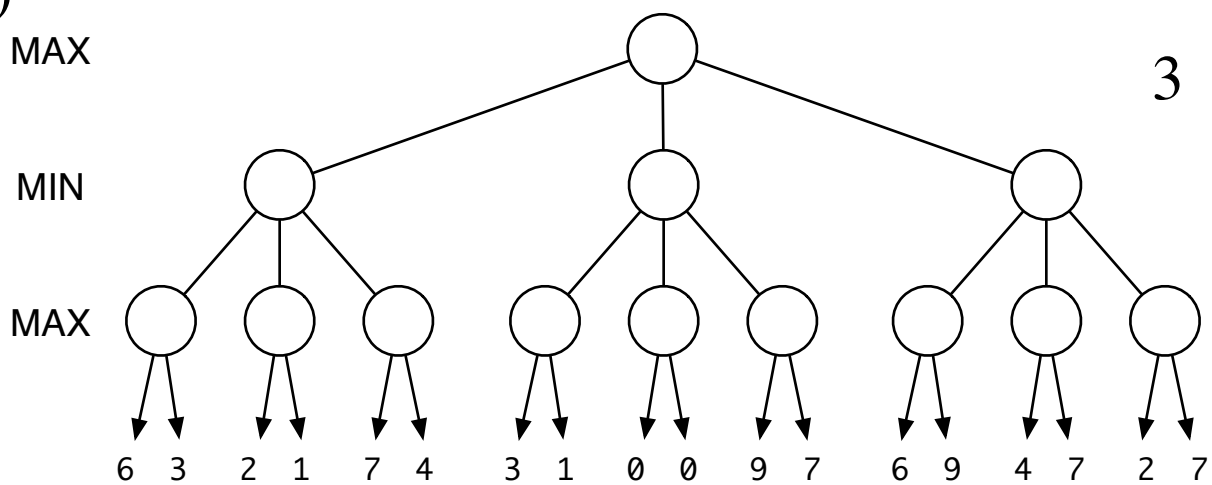
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(10)



(11)



(12)

