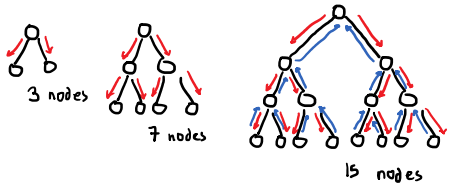
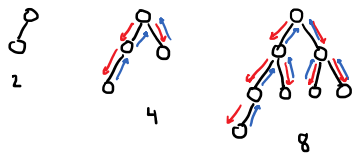
Monday, March 21, 2022 6:54 PM

(d.) What's the problem when trying to use a communication network of type Commuted - Direct - Binary Tree?



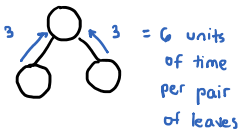
The first problem is that the number of elements (n size) must grow as $n = 2^{kn}$, but this will generate an unbalanced number of nodes in the tree, as shown below: the binary tree is not completely balanced if n grows as $n = 2^{kn}$.



The second, and probably more troubling, is that even if we have a balanced tree, the connections are done in such a way that, whenever a leaf node wants to send its partial sum to another processor, it's faster to send it to its parent node, but that means that the other child needs to wait until the sum of that child and its parent is done so that the partial sum of the other child can be sent to its parent too, which increases the synchronization among the leaves, which are the highest proportion of a tree's nodes:

$$\text{number of leaves} = \text{int}\left(\frac{\text{nodes}}{2}\right) + 1$$

Which would double the communication time, instead of allowing the other child to send it to another available node.



And this would need to happen for any interior node that has two children. But since leaves are more than 50% of a tree, the communication time is very affected by this shape.