Electromagnetics (II) Homework 7

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December 29, 2024

1. Max, Min number of internal, external nodes in a improper binary tree with n nodes.

$$n = n_0 + n_1 + n_2 \begin{cases} n_0 = \text{number of external nodes} \\ n_1 = \text{number of internal nodes with one child}, n_1 \geq 1 \\ n_2 = \text{number of internal nodes with two children} \end{cases}$$

The number of all not root nodes is $n-1$.Every n_1 nodes have 1 child, n_2 nodes have 2 children. Thearfore, we can get these equations:

$$\begin{cases} n = n_1 + 2n_2 + 1 \\ n_2 = n - n_0 - n_1 \end{cases}$$

So, $2n_0 = n - n_1 + 1$. When n is odd $n_1 \geq 2$, or $n_1 \geq 1$ when n is even. Therefore, the max and min number of internal, external nodes are:

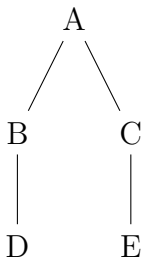
a. Max
   - The max number of internal nodes is $n-1$.
   - The max number of external nodes is $\lfloor \frac{n}{2} \rfloor$

b. Min
   - The min number of internal nodes is $n - \lfloor \frac{n}{2} \rfloor$
   - The min number of external nodes is 1.

example:

最大內部節點與最小外部節點
external nodes = 1, internal nodes = 4

最小內部節點與最大外部節點
external nodes = 2, internal nodes = 3



2. PreorderTraversal of a expression tree

$$- \ / \ \times \ + \ 3 \ 1 \ 3 \ + \ - \ 9 \ 5 \ 2 \ + \ \times \ 3 \ - \ 7 \ 4 \ 6$$

3. Draw the expression tree

$$(((5+2) \times (2-1))/((2+9) + ((7-2)-1)) \times 8)$$