Solve $T(n) = \begin{cases} T(n-1) + \log n & , n > 0 \\ 1 & , n = 0 \end{cases}$

by Recursion Tree Method

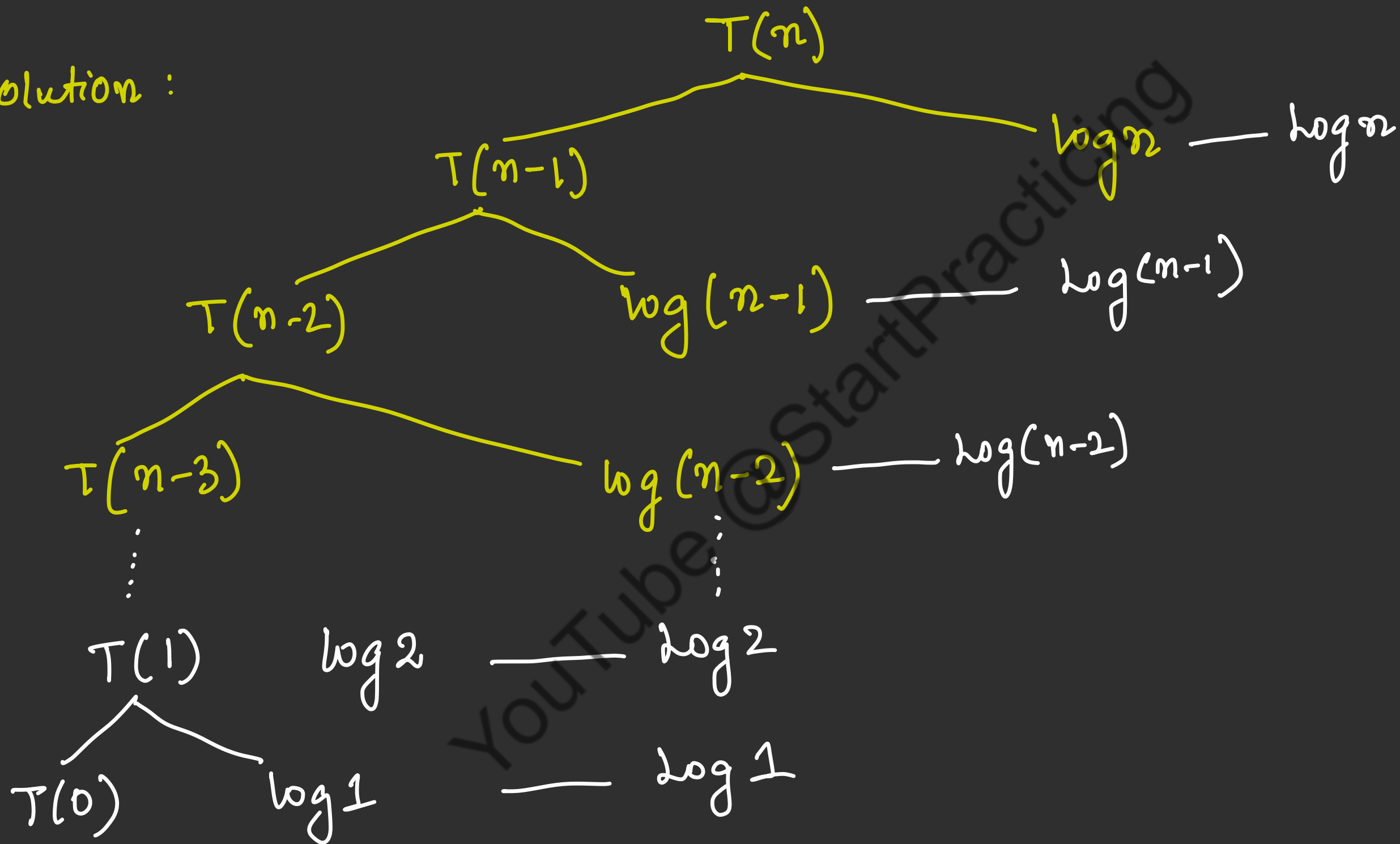Solve $T(n) = \begin{cases} T(n-1) + \log n & , n > 0 \\ 1 & , n = 0 \end{cases}$

$T(n) = 1 \quad ; n = 0$

$T(0) = 1$

Solution :

$T(n)$

$T(n-1)$ $\log n$ —— $\log n$

$T(n-2)$ $\log(n-1)$ —— $\log(n-1)$

$T(n-3)$ $\log(n-2)$ —— $\log(n-2)$

$\vdots$ $\vdots$

$T(1)$ $\log 2$ —— $\log 2$

$T(0)$ $\log 1$ —— $\log 1$

$$T.C = \log n + \log(n-1) + \log(n-2) + \cdots + \log 2 + \log 1.$$

$$= \log\left(n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1\right)$$

$$T.C = \log(n!) \qquad\qquad T.C = O(n\log n)$$

$$T.C = O\log(n!)$$

We know,

$$n! \leqslant n^n$$

$$\log n! \leqslant \log n^n$$

$$\log n! \leqslant n\log n$$

upper bound for $\log n!$ is $O(n\log n)$

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