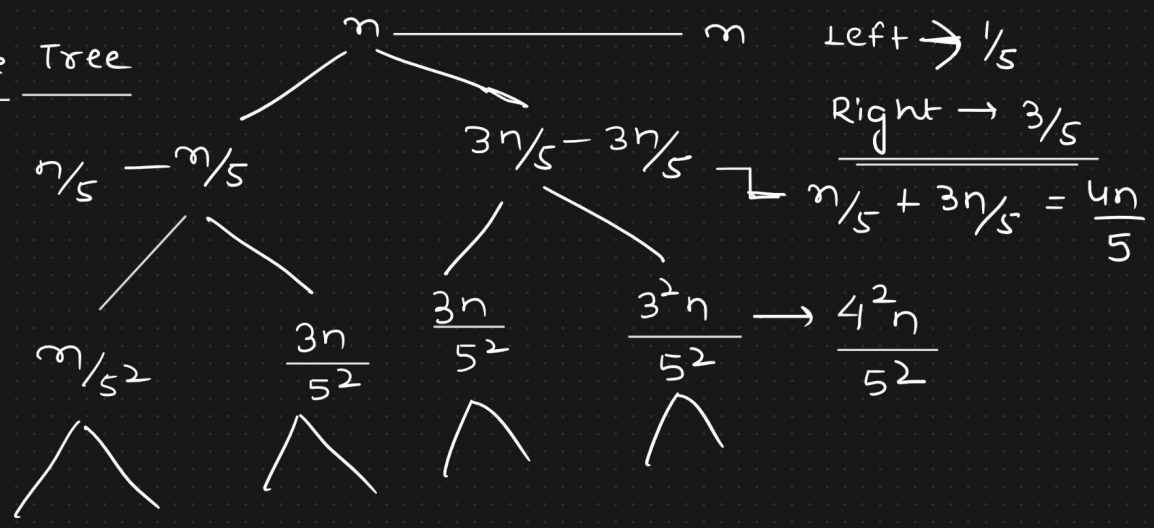
## Recurrence Relation

$$T(n) = \begin{cases} 1 & n = 1 \\ T(n/5) + T(3n/5) + n & n > 1 \end{cases}$$

## Recursive Tree Approach

$$T(n) = T(n/5) + T(3n/5) + n$$

## Recursive Tree




Left side → $\frac{n}{5^k} = 1$

$n = 5^k$

$$k = \log_5 n \quad \text{— (1)}$$

Right side → $\frac{n}{(5/3)^k} = 1$

High value

$$k = \log_{5/3} n \quad \text{— (2)}$$

$$\left(\frac{4}{5}\right)^0 n + \left(\frac{4}{5}\right)^1 n + \left(\frac{4}{5}\right)^2 n + \cdots + \left(\frac{4}{5}\right)^{\log_{5/3} n} n$$

$$n\left(\left(\frac{4}{5}\right)^0 + \left(\frac{4}{5}\right)^1 + \left(\frac{4}{5}\right)^2 + \cdots + \left(\frac{4}{5}\right)^{\log_{5/3} n}\right)$$

↳ GP Series

$a = \left(\frac{4}{5}\right)^0 = 1$

$r = 4/5$ $\quad r < 1$

$$S = \frac{a(1-r^n)}{1-r} * n$$

↳ $O(1) * n$

$\Rightarrow O(n)$