

↳ Netflix ← Software Engineer

↳ new basic search system

↳ Harry

↓
user will give us
a prefix

Find all the movies that
start with this given
prefix.

Let's solve a simpler problem.

↳ if given a word, just check if that word
is exactly present in the db or not ??

HashMap ← ① Store all the names

Key → ② Search

$O(1)$

Space taken by hashmap is prohibitive

Harry Potter and the Prisoner of Azkaban
Harry Potter and the Goblet of Fire
Harry Potter and the Half Blood Prince

↓
~~Common~~ reference the H.M. stores them
multiple times

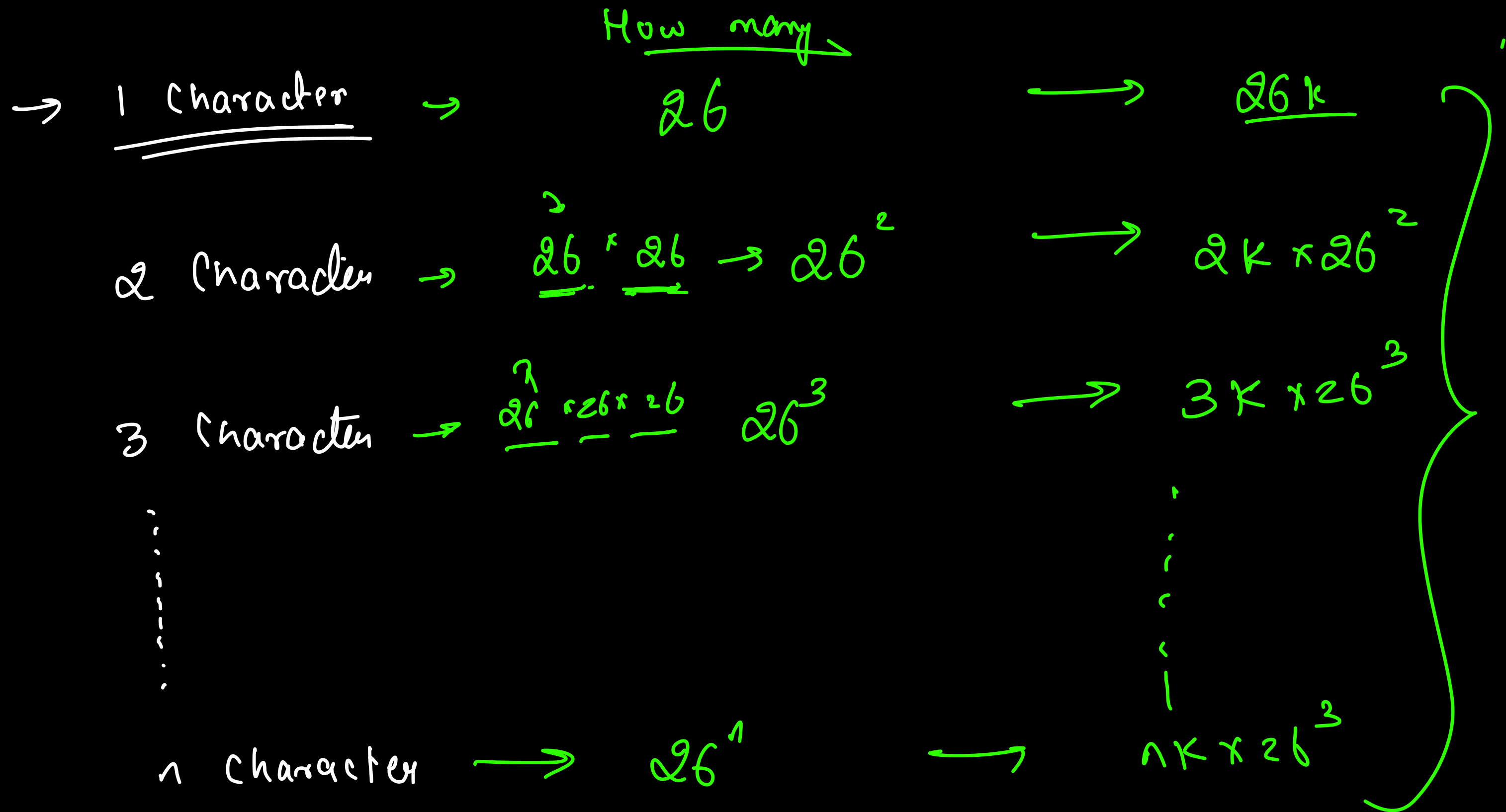
Consider

→ all the names we store in lower case char.

How much space might be taken

Worst case length of a name can be as big as 'i'.

(1 char → K bytes)



$$\rightarrow 26K + 2K \times 26^2 + 3K \times 26^3 + \dots + nK (26^n)$$

$$K \left(26 + 2 \times 26^2 + 3 \times 26^3 + 4 \times 26^4 + \dots + n \times 26^n \right)$$

A.G.P \rightarrow arithmetic geometric
progress

①

$$S = 1 \times 26 + 2 \times 26^2 + 3 \times 26^3 + 4 \times 26^4 + \dots + \underline{(n-1) \times 26^{n-1}} + \underline{n \times 26^n}$$

multiply 26 on both sides

②

$$26S = 1 \times 26^2 + 2 \times 26^3 + 3 \times 26^4 + 4 \times 26^5 + \dots + (n-1) \times 26^n + n \times 26^{n+1}$$

② - ①

$$26S - S = -1 \times 26 + (-26^2) + (-26^3) + (-26^4) + \dots + (-26^n) + n \times 26^{n+1}$$

$$25S = - \underbrace{(26 + 26^2 + 26^3 + \dots + 26^n)}_{\text{GP}} + n \times 26^{n+1}$$

$$25S = - \left(\frac{26 \times (26^n - 1)}{26 - 1} \right) + n 26^{n+1}$$

$$25S = - \left(\frac{26^{n+1} - 26}{25} \right) + n 26^{n+1}$$

$$\underline{\underline{\text{if}}}$$

$$\left(\frac{n 26^{n+1}}{25} - \left(\frac{26^{n+1} - 26}{25} \right) \right) / 25$$

$$S \rightarrow O(n 26^n) \rightarrow \text{space}$$

→ $M \rightarrow \underline{\text{char}}$

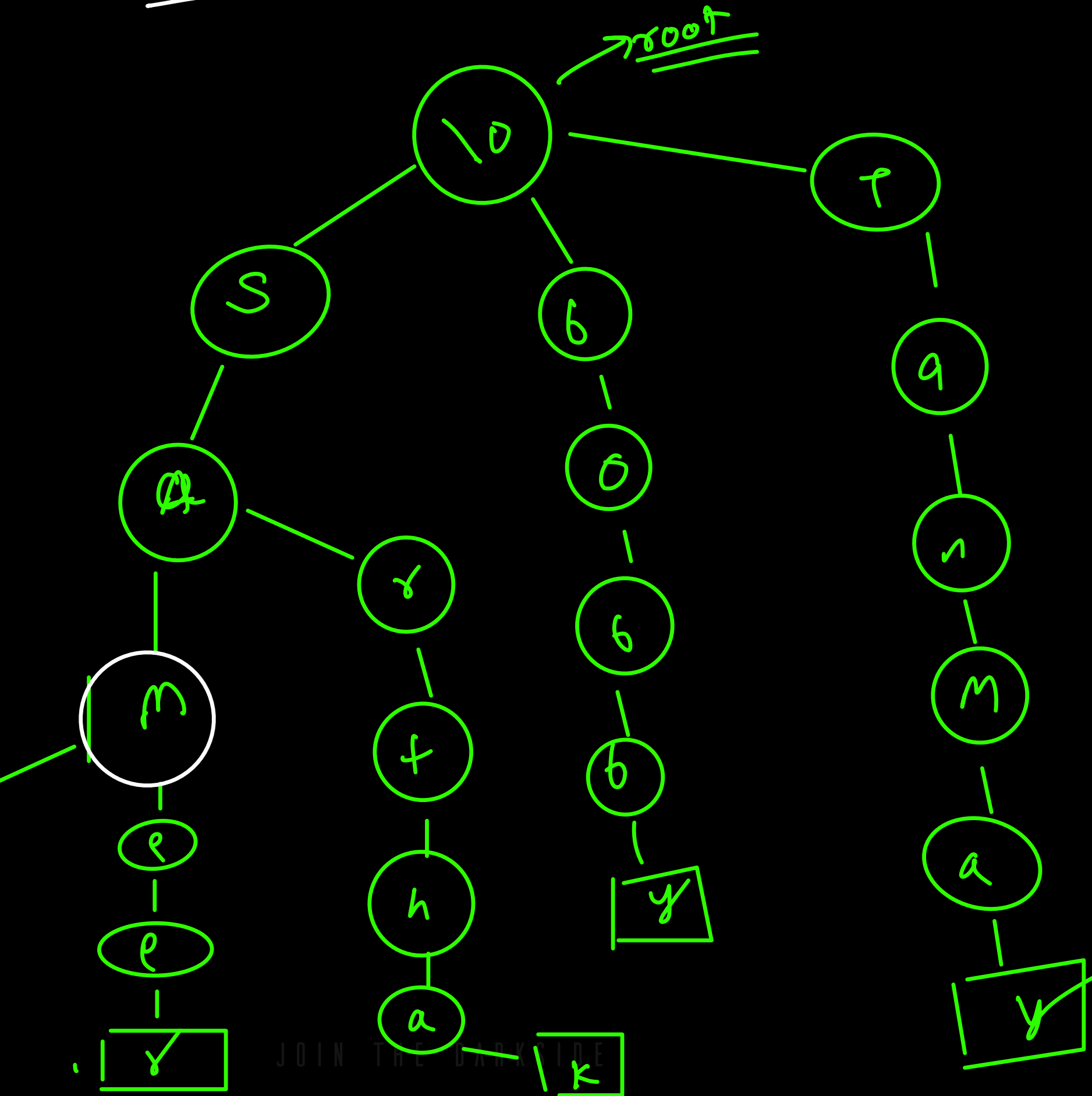
$O(n \times M^n)$

→ Hashmap

Can we improve on the Space??

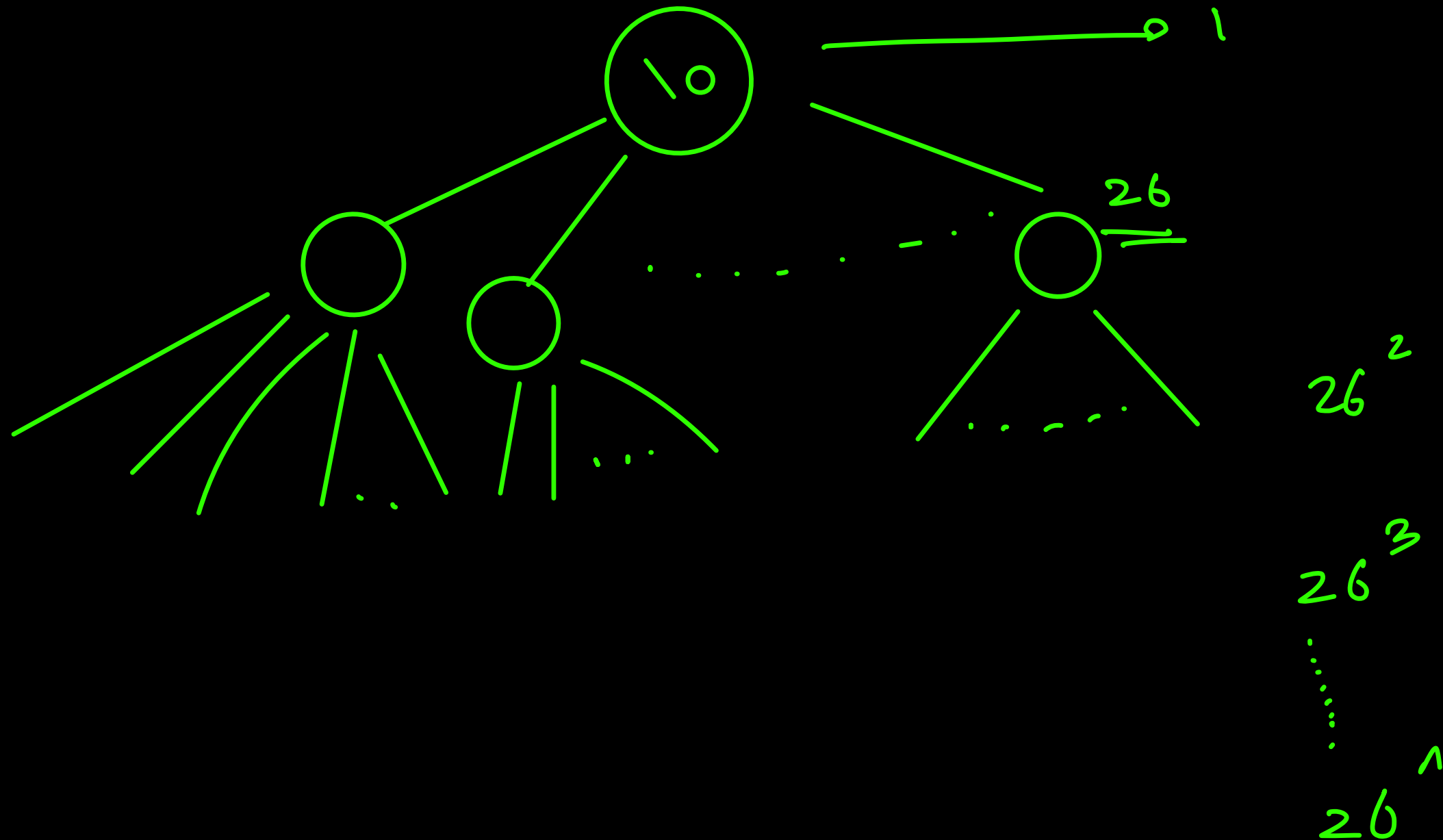
n-ary tree

TRIE (Prefix Tree)



Sameer
Sarthak
Bobby
Pannay
Samarth

26



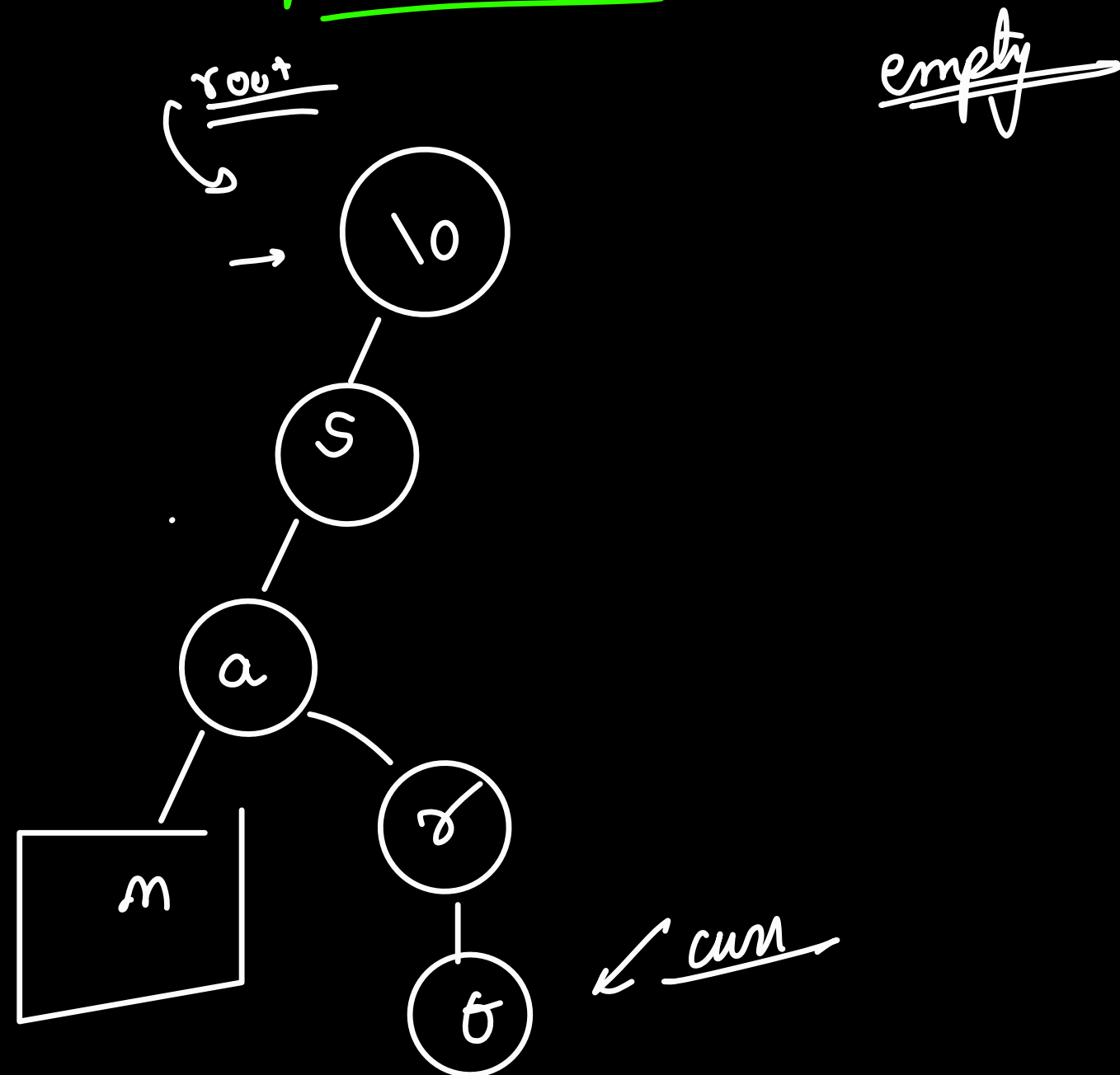
$$\begin{aligned} & 26^0 + 26 + 26^2 + 26^3 + \dots + 26^n \\ \hookrightarrow & \frac{1 \times (26^{n+1} - 1)}{26 - 1} \rightarrow \frac{26^{n+1} - 1}{25} \rightarrow \underline{\underline{O(26^n)}} \end{aligned}$$

$O(m^n)$

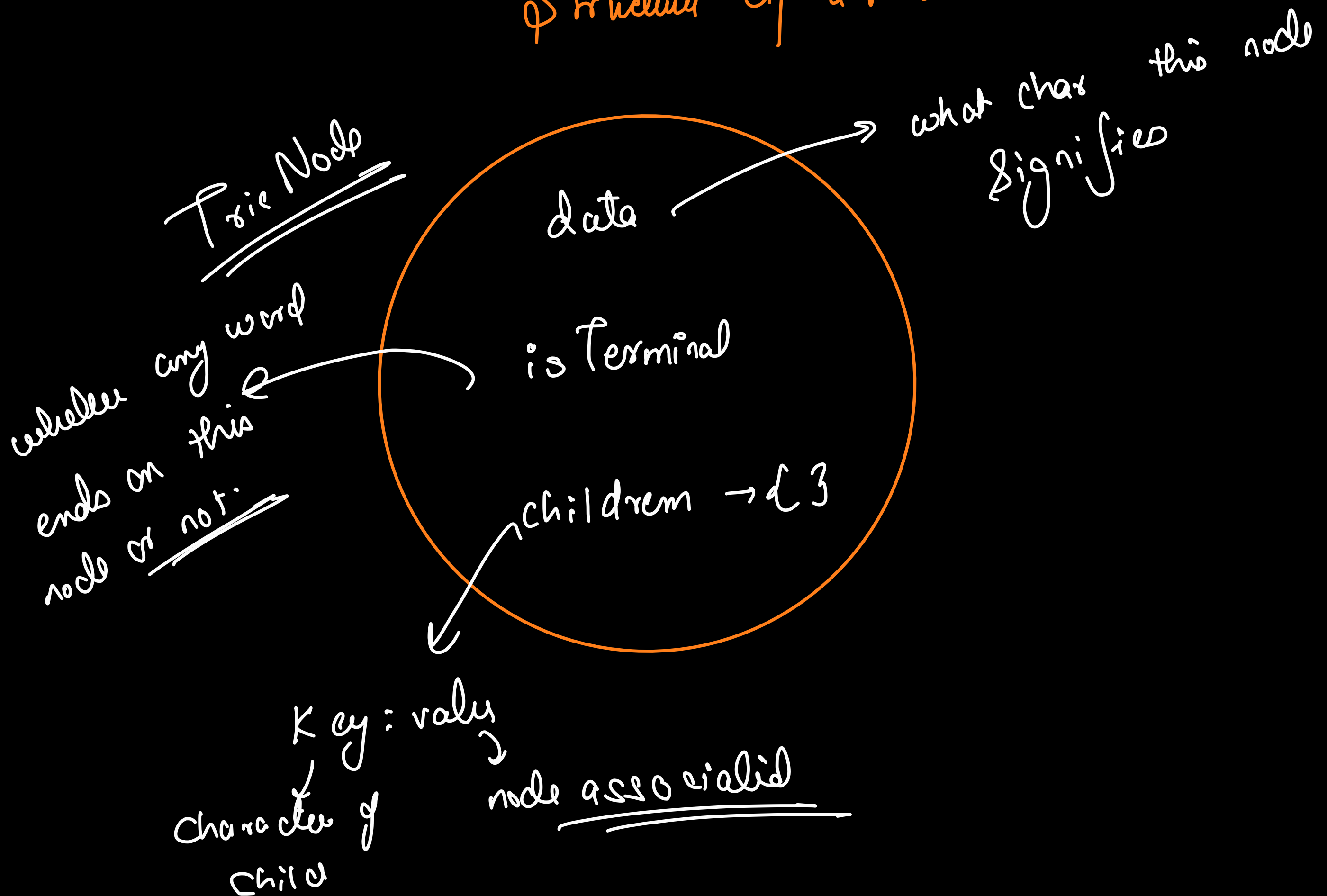
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Operations On Trie

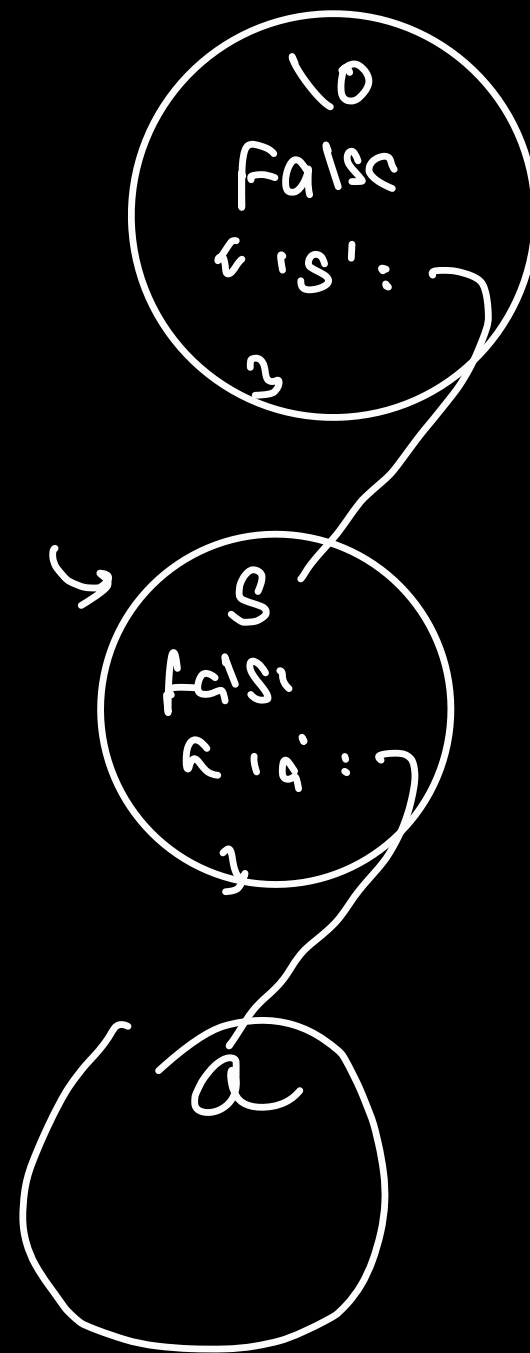
Sam ↙
Sas that
Sameer



Structure Of a Node

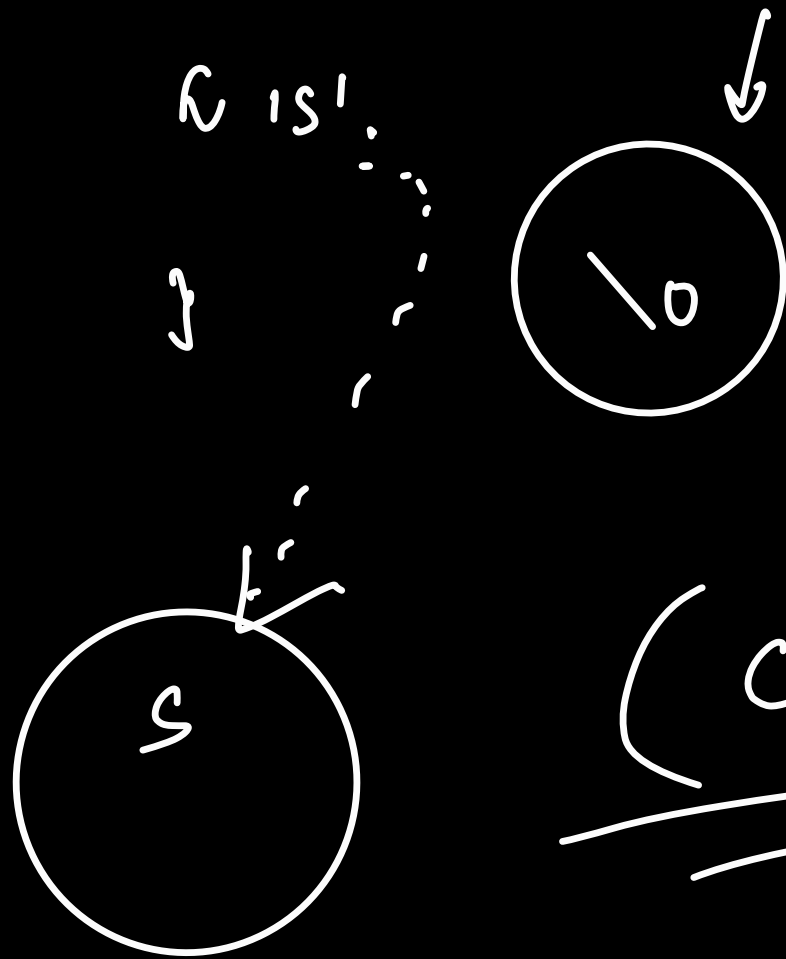


Sam
Sartha



Sam

cur



$N = \text{new Node}(s)$

$(\text{curr.children}[\underline{\underline{'s'}}]} = N)$