

# Theory of Computation

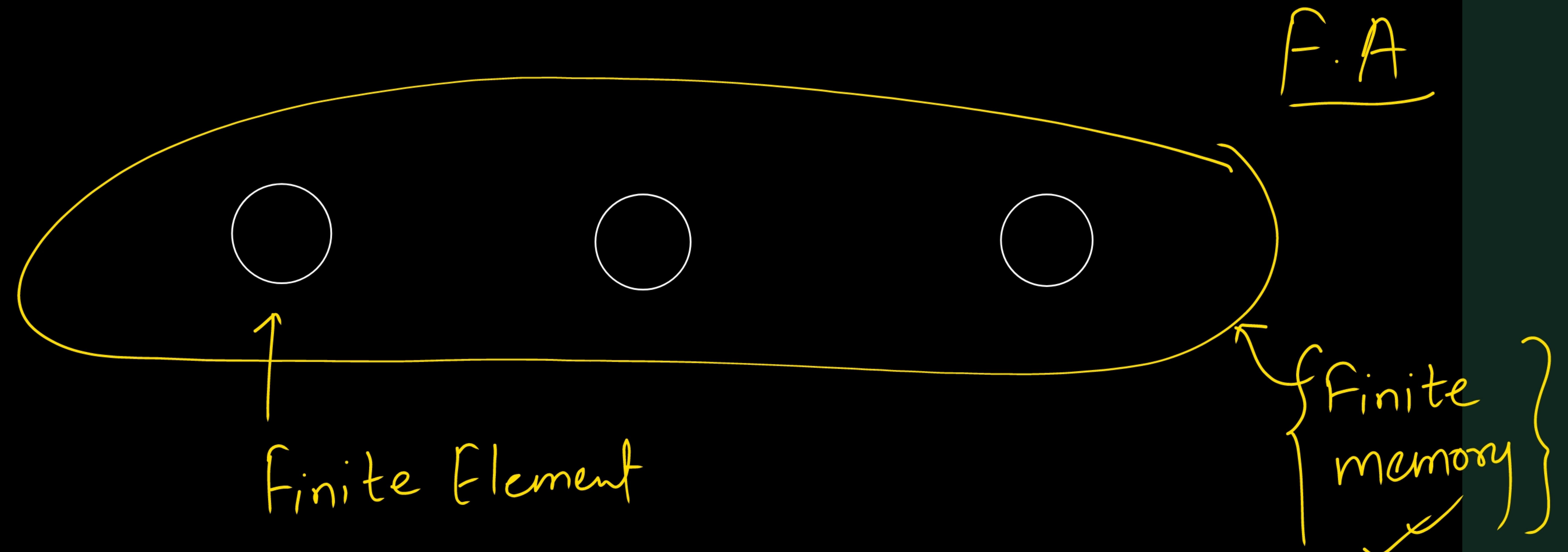
**Limitation of DFA**

**Lecture 21**

**Gaurav Raj**

## Limitation of DFA

1. Finite Memory
2. It can not do (unbounded)counting and comparing
3. Matching: two separated strings or palindrom



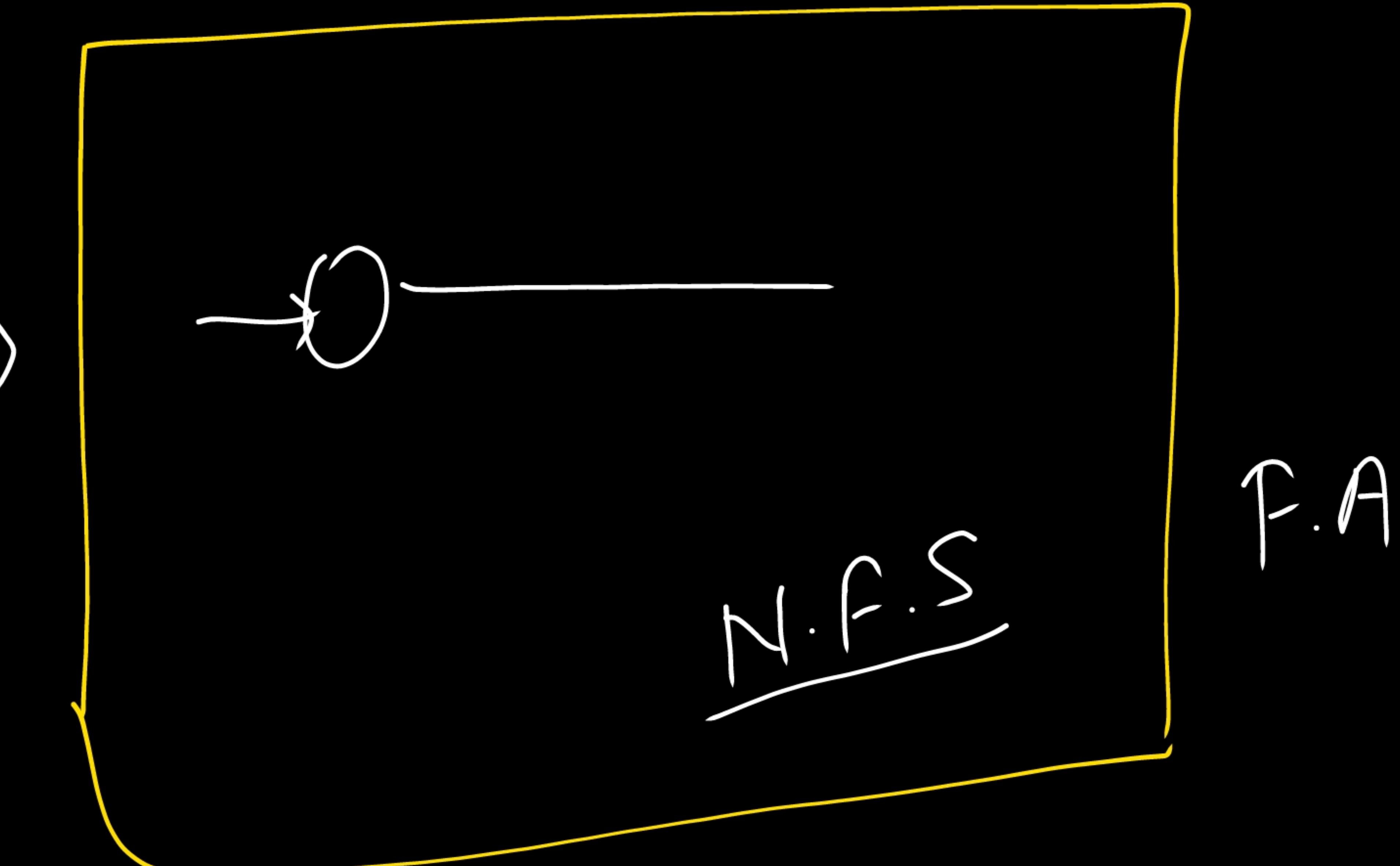
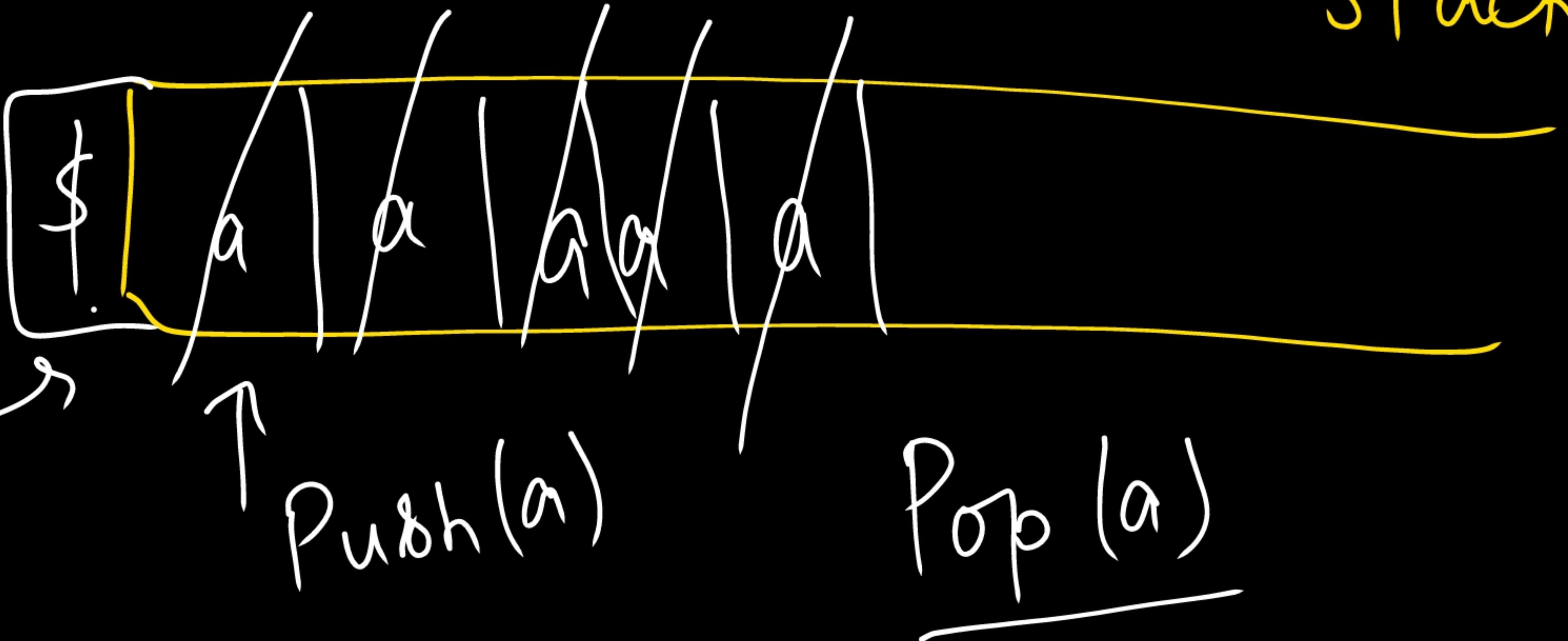
$$\frac{|\omega| \leq 3}{|\omega| = 3}$$

Bounded Counting

$$a^n b^n : n \geq 0$$

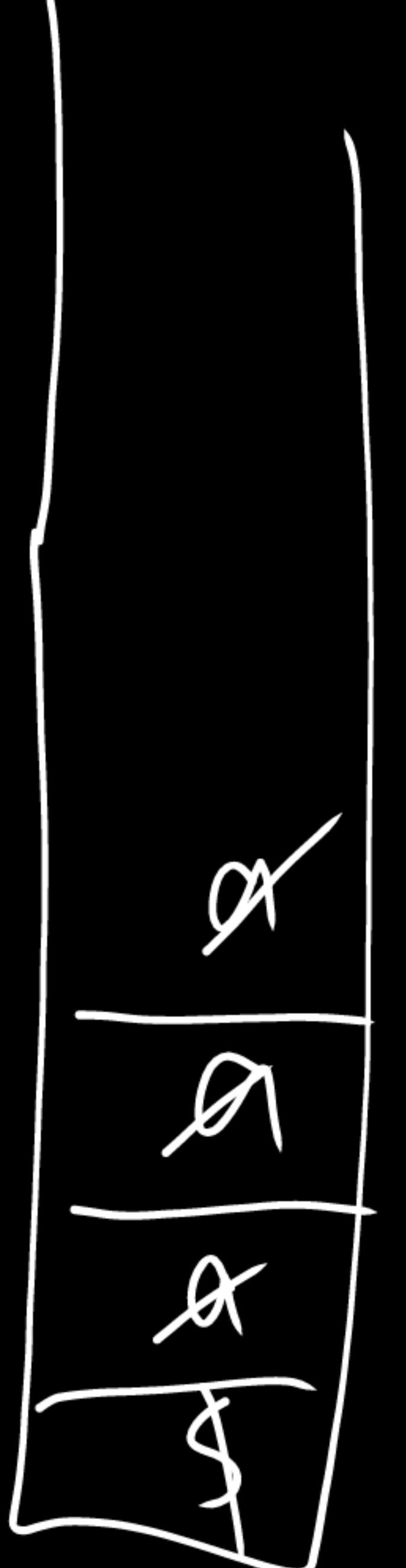
Unbounded Counting

$$\frac{a^5 b^5}{a^5 b^6}$$



$$L = a^n b^n c^n \quad \boxed{X}$$

$\overbrace{a^3 b^3 c^3}$

$F.A$  +   
infinite

a

$\times 3 \Rightarrow L = \underbrace{a^n b^m c^n d^m}_{n+m=m+n}$

Push (aa)

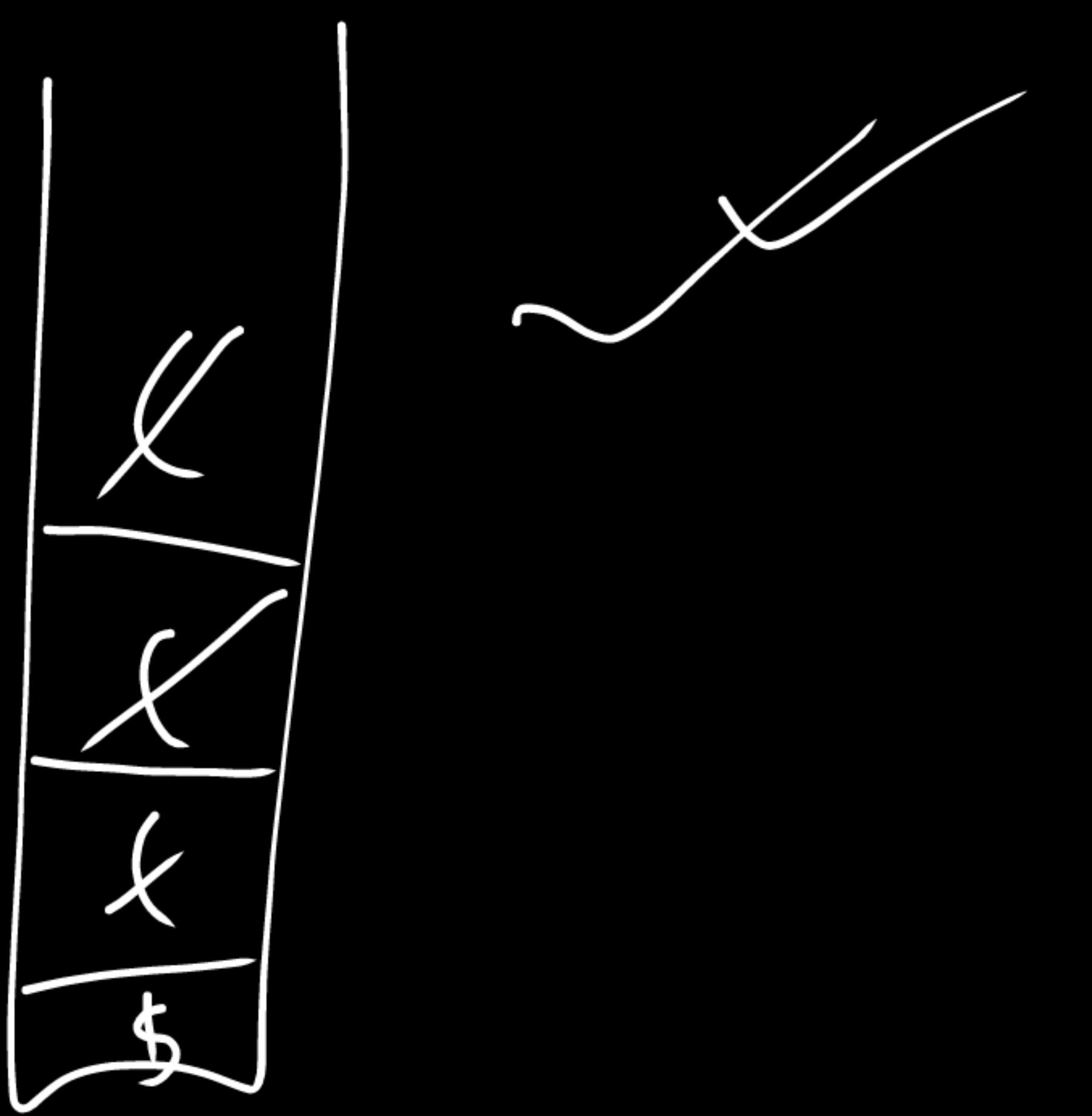
$\overbrace{a^3 b^2 c^4}$

$\boxed{6a}$

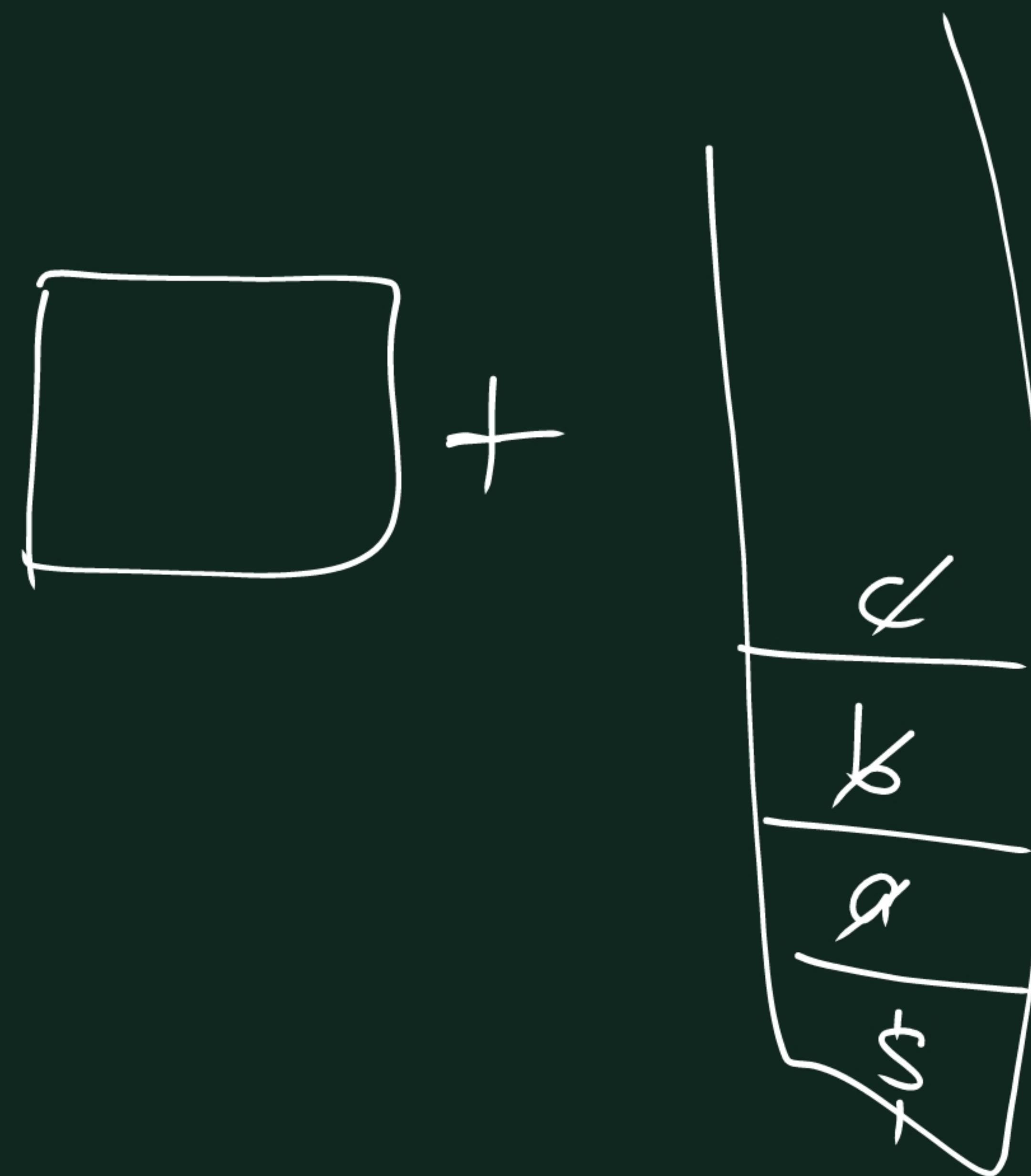
$n+m = m+n$

Epp:  $((a+b) + d + \underline{(e * f)})$

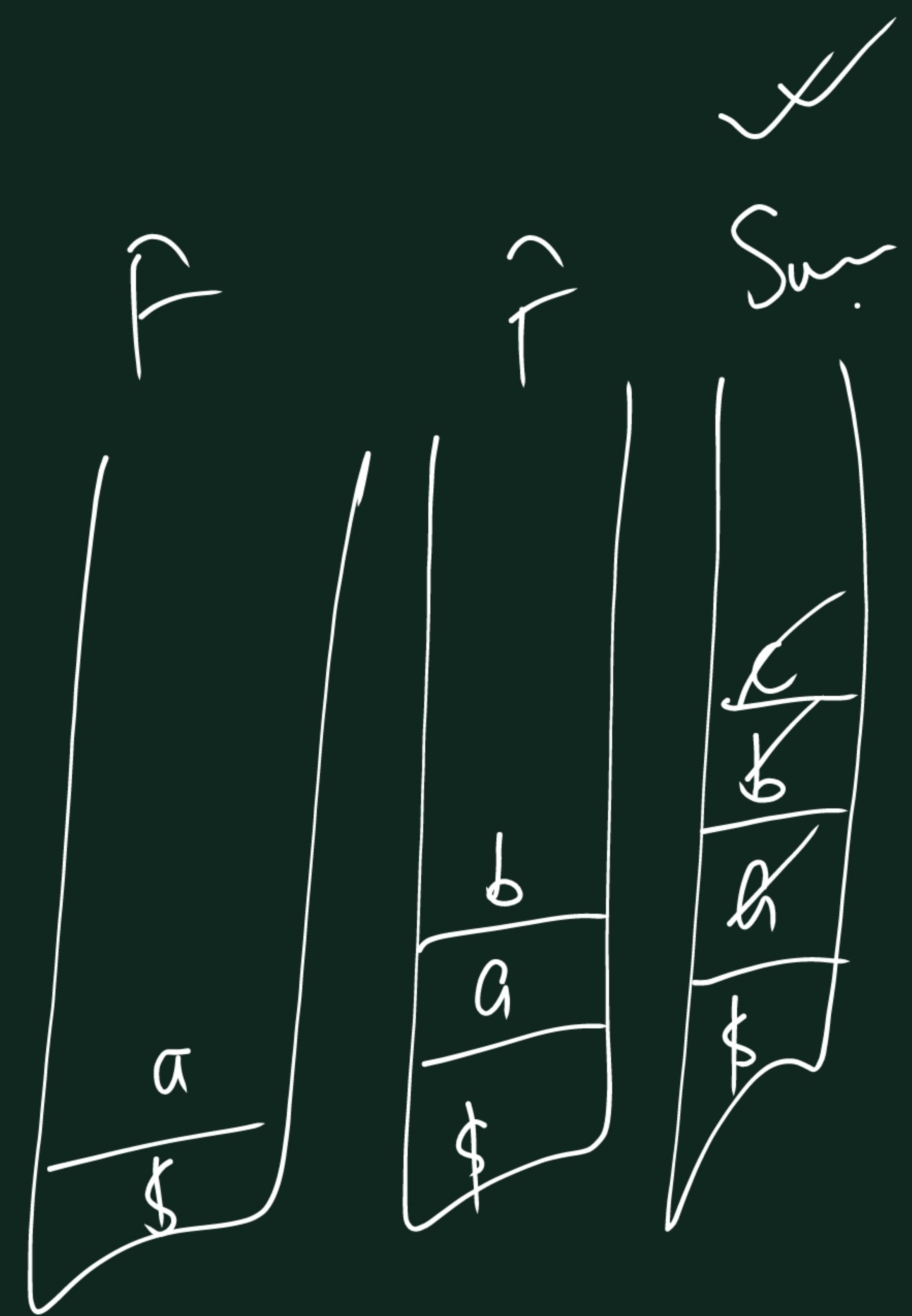
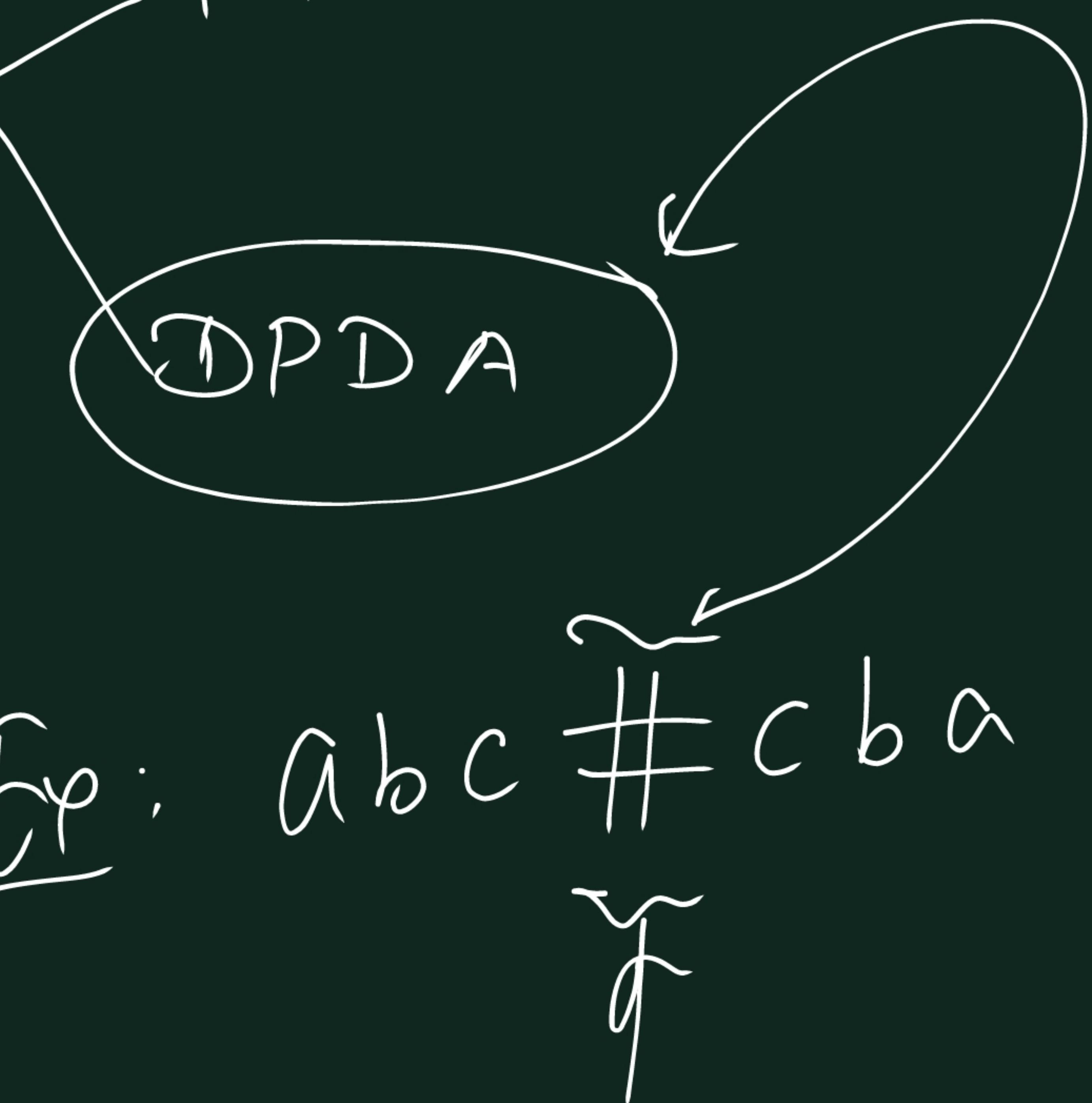
( ( )



Ex  $L = abc \mid cba$



PDA  $\xrightarrow{\quad}$  NPDA



$$L = a^n b^n c^n$$

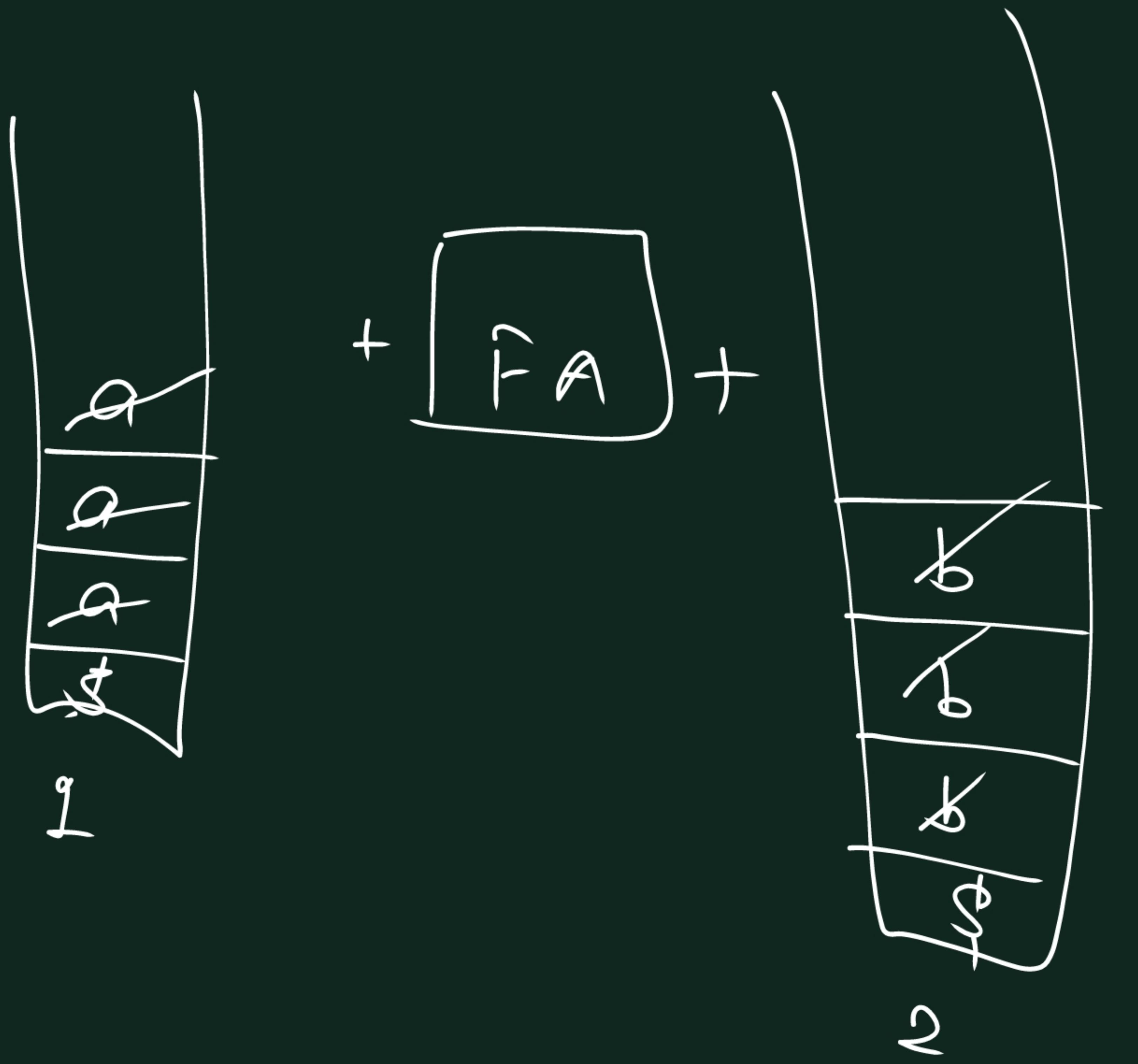
$$a^3 b^3 c^3$$

$\xrightarrow{a}$  Push(a)  
1

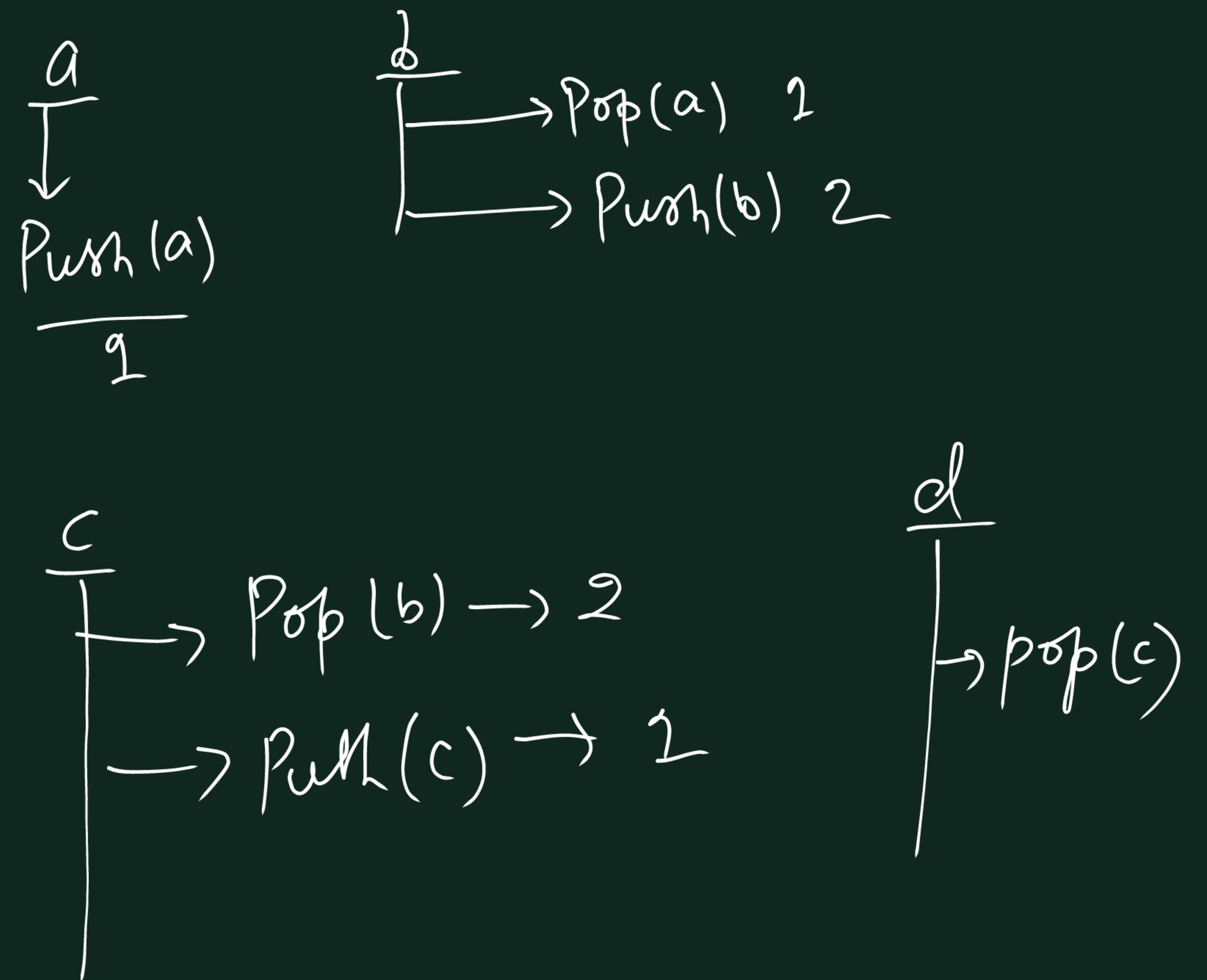
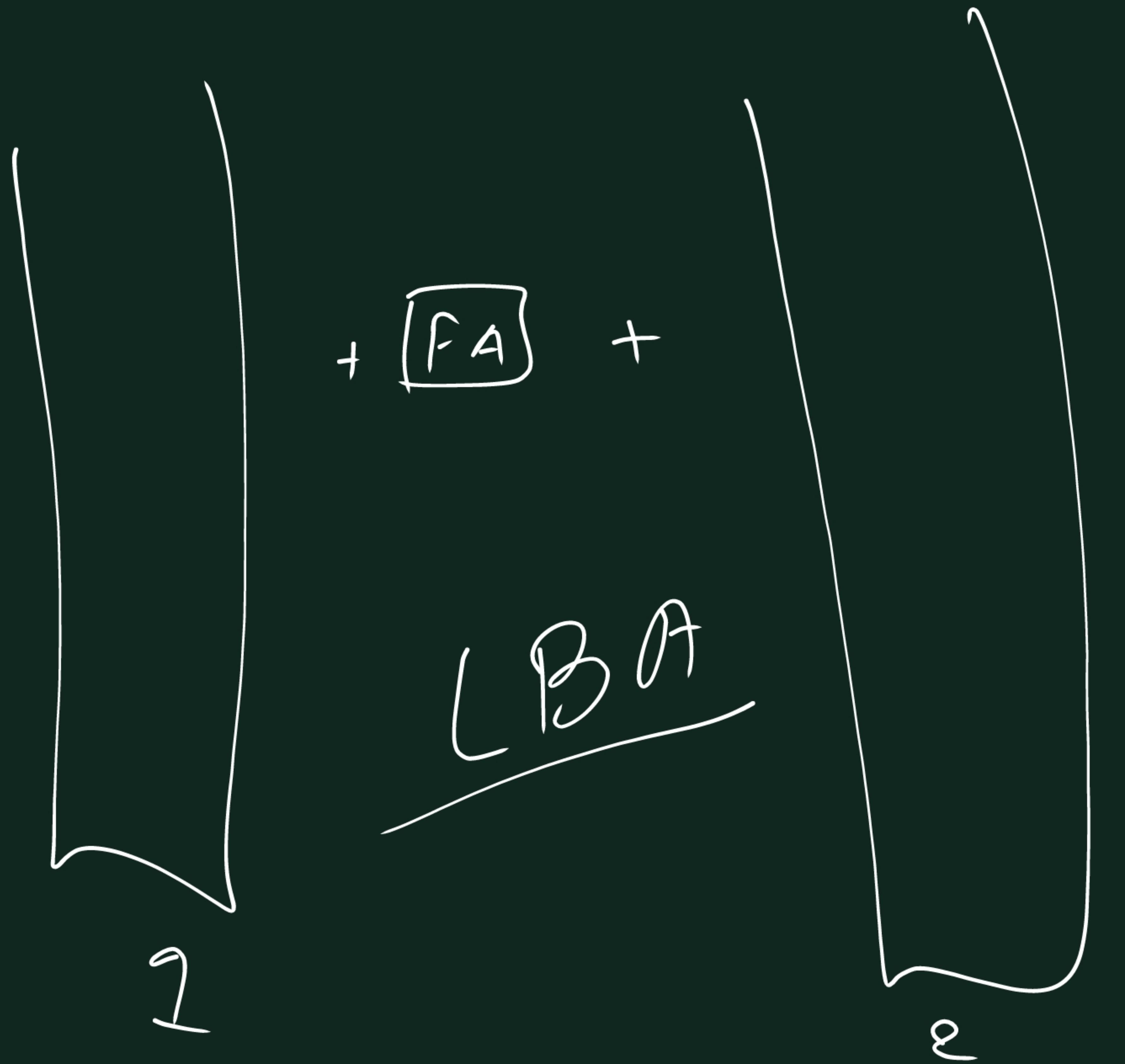
$\xrightarrow{b}$  Push(b)  
2

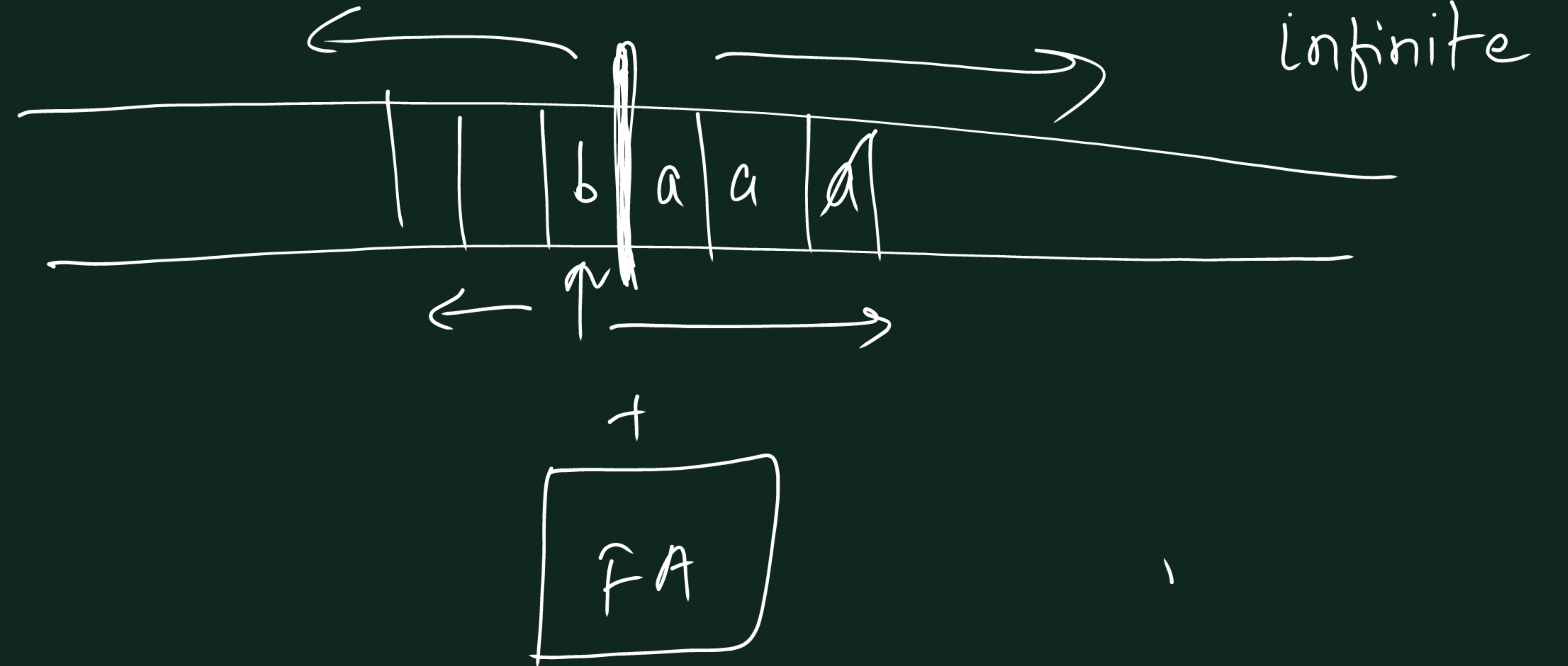
$\xrightarrow{c}$  Pop(b)  
2

$$L = a^n b^n c^n d^n$$



$$L = a^n b^n c^n d^n$$





$$L = \overbrace{a^n b^n c^n d^n}^{\text{Yes}}$$

T.M

1)  $L = aac \rightarrow FA$

2)  $L = a^n c^n b^m \leftarrow PDA$

3)  $L = a^m c^n b^n d^m \rightarrow PDA$

4)  $L = \omega \omega^R \rightarrow PDA$

5)  $L = a^{n^2} : n \geq 0$

PDA (Limitations) = Can not do multiplication & div.

$w = abc$   
 $w^R = cba$

R.L	R.G	F.A
CFL	CFG	PDA
CSL	CSG	LBA
R.E	UG	TM
(REC)		

$$6) L = \underline{\omega\omega} \rightarrow LBA$$

$$7) L = a^n b^m c^r d^q$$

$$n+r=m+q$$

$$\begin{array}{c} a^3 \quad b^7 \quad c^8 \quad d^4 \\ \hline \end{array}$$

$\sum$

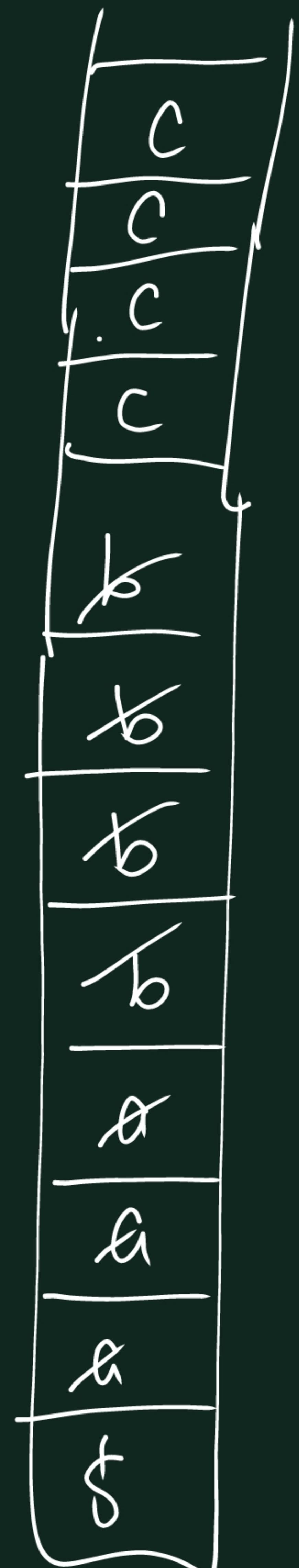
$$\begin{array}{c} q^{11} \quad b^7 \quad c^6 \quad d^4 \\ \hline \end{array}$$

$$a^{11} \quad b^7 \quad c^2 \quad d^6$$

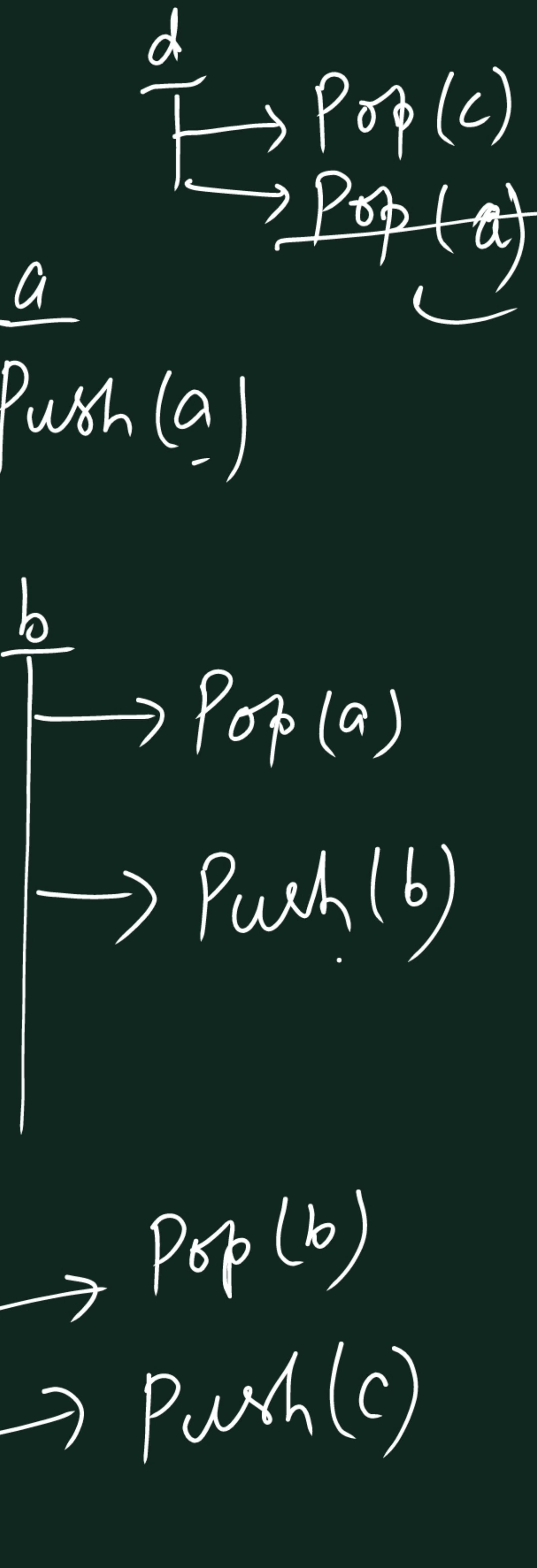
$c \quad a \quad a \quad a \quad a$

$F_A$

+



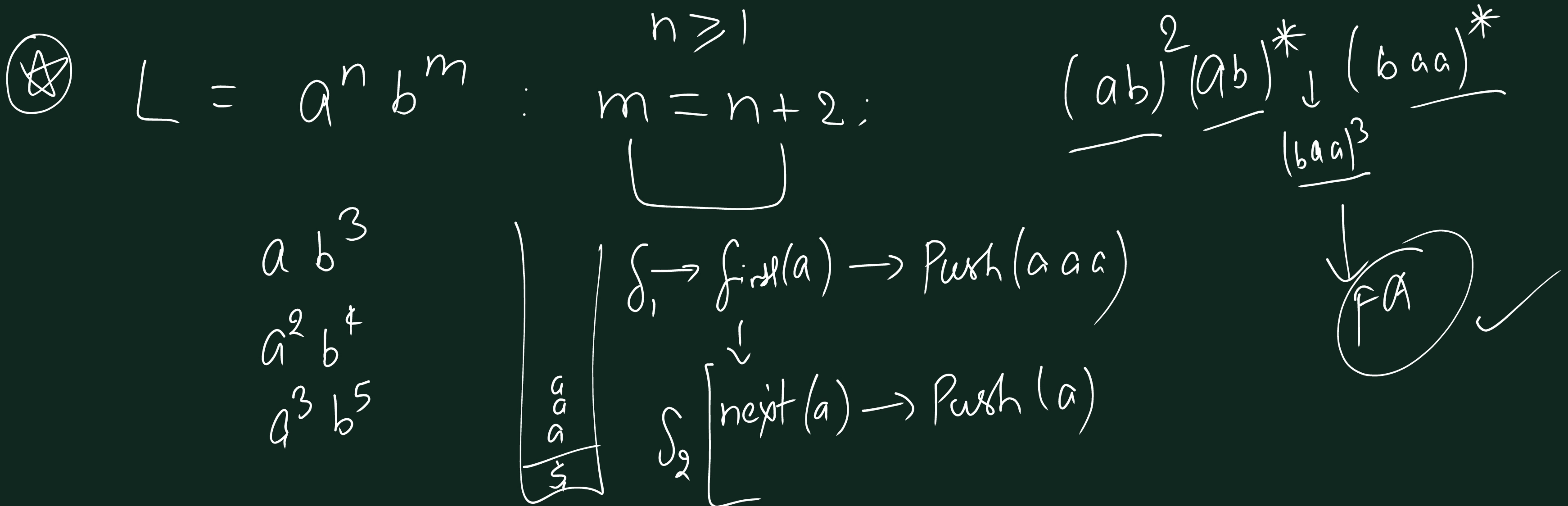
$s$



$$a^3 b^7 c^6 d^4$$

c
c
b
b
b
b
a
a
a
x

(\*)  $L = \left\{ (ab)^n (baa)^m : n \geq 2, m \geq 3 \right\}$



$$L = a^m b^n$$

$$m = n - 3;$$

PDA



Thank You

