Difference between NFA & DFA

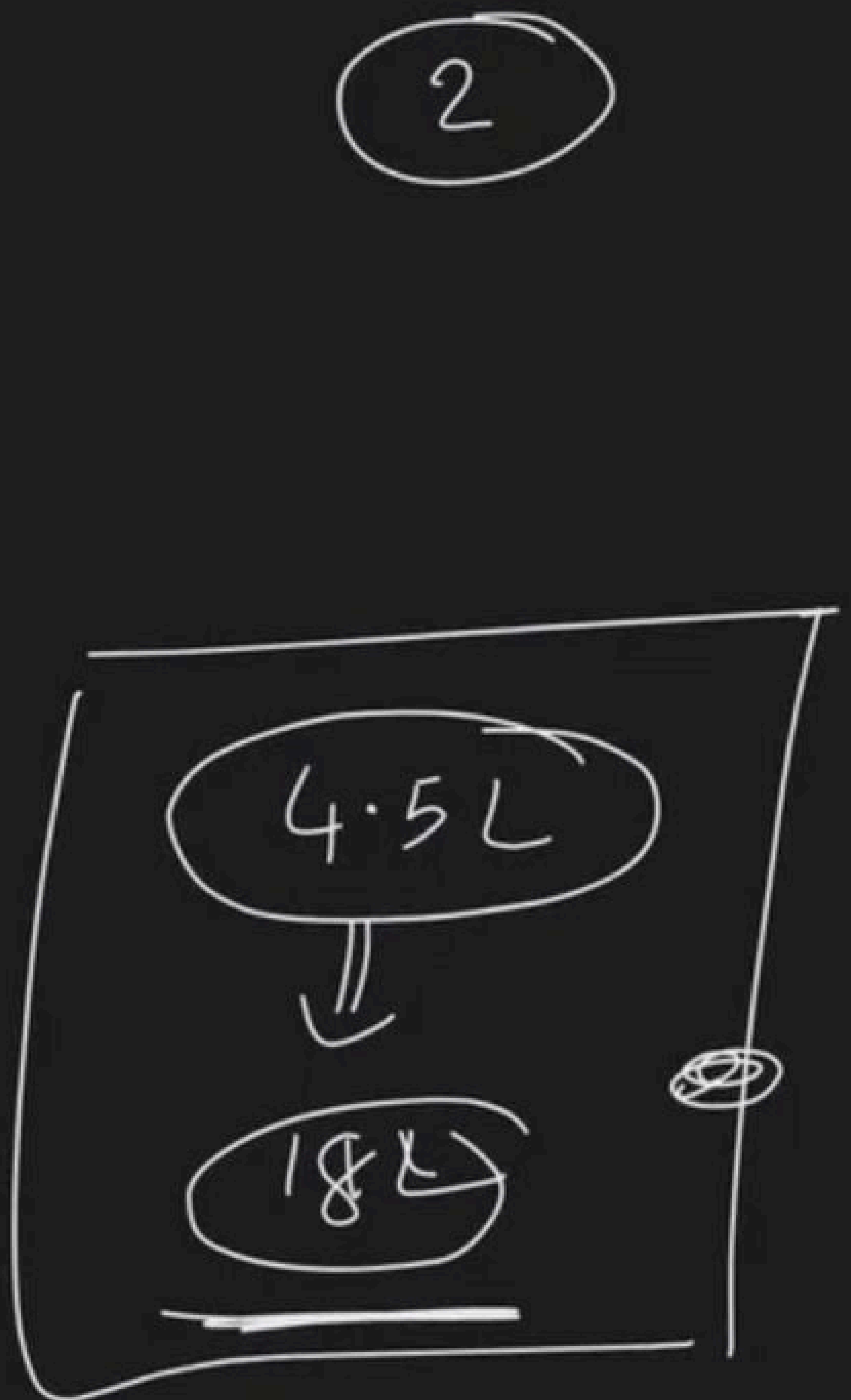
Complete Course on Theory of Computation

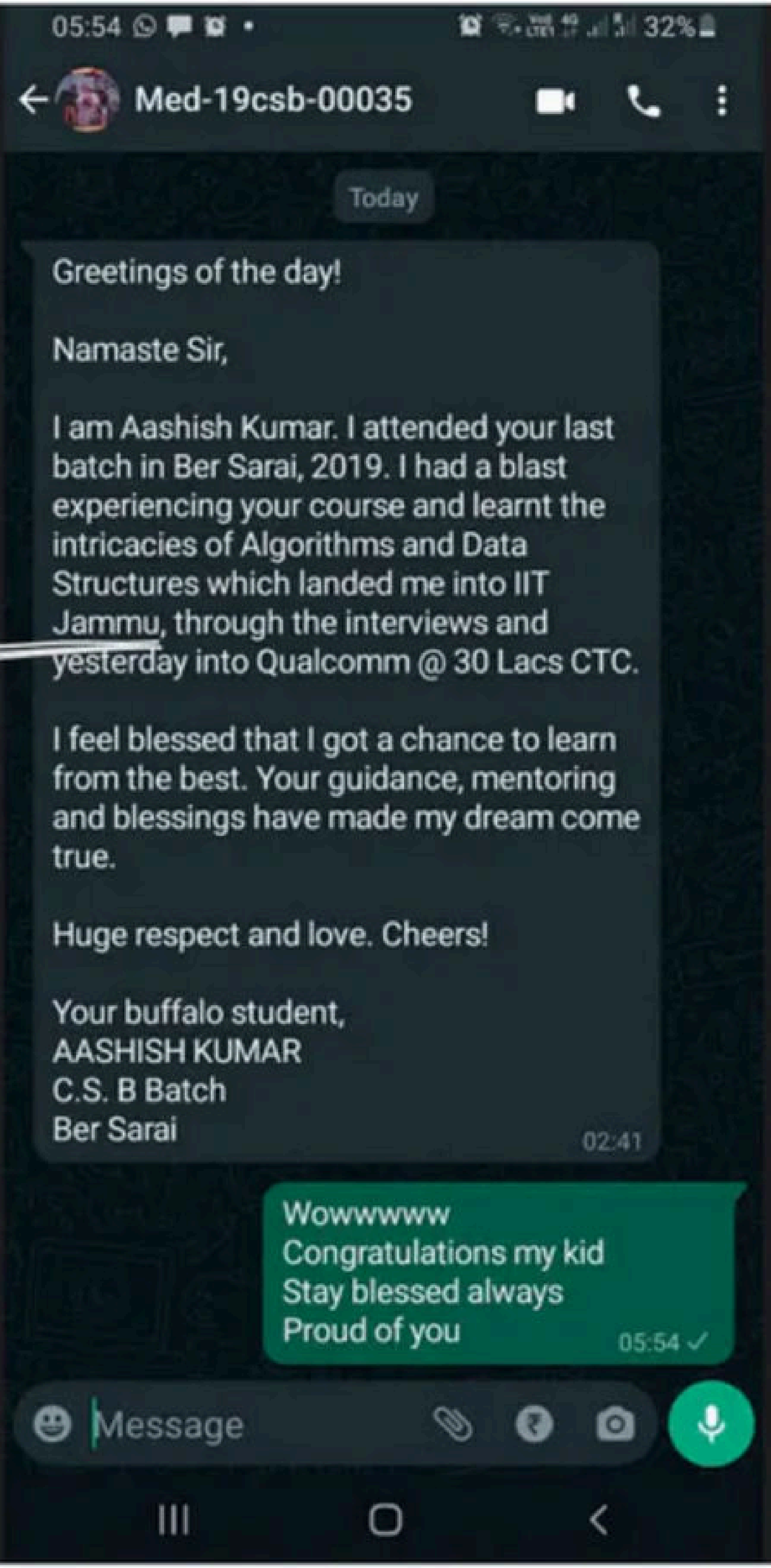
Subbarao Lingamgunta • Lesson 2 • Feb 3, 2022

Introduction to Theory of Computation

Complete Course on Theory of Computation

Subbarao Lingamgunta • Lesson 1 • Feb 2, 2022





Greetings of the day!

Namaste Sir,

I am Aashish Kumar. I attended your last batch in Ber Sarai, 2019. I had a blast experiencing your course and learnt the intricacies of Algorithms and Data Structures which landed me into IIT Jammu, through the interviews and yesterday into Qualcomm @ 30 Lacs CTC.

I feel blessed that I got a chance to learn from the best. Your guidance, mentoring and blessings have made my dream come true.

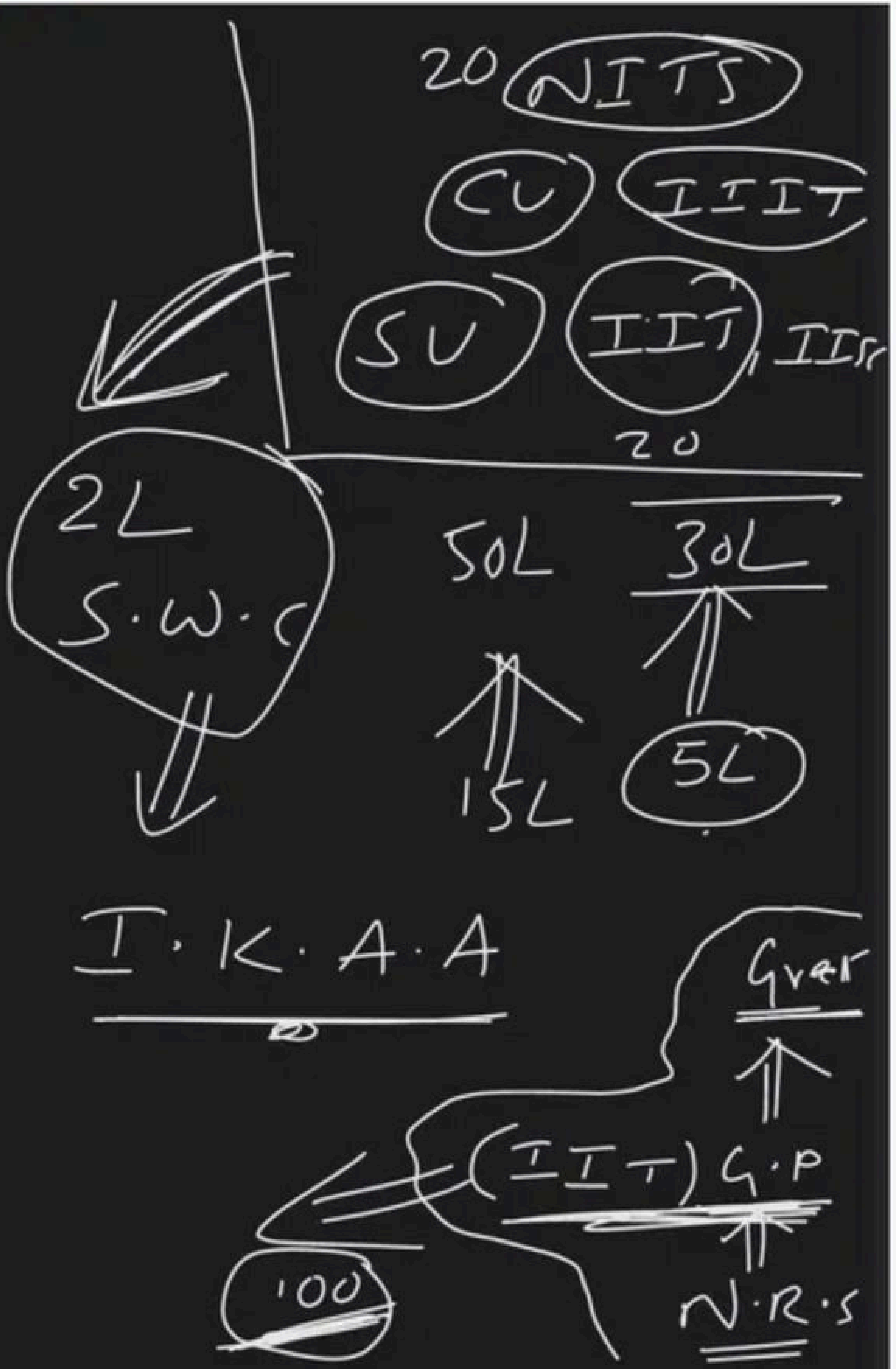
Huge respect and love. Cheers!

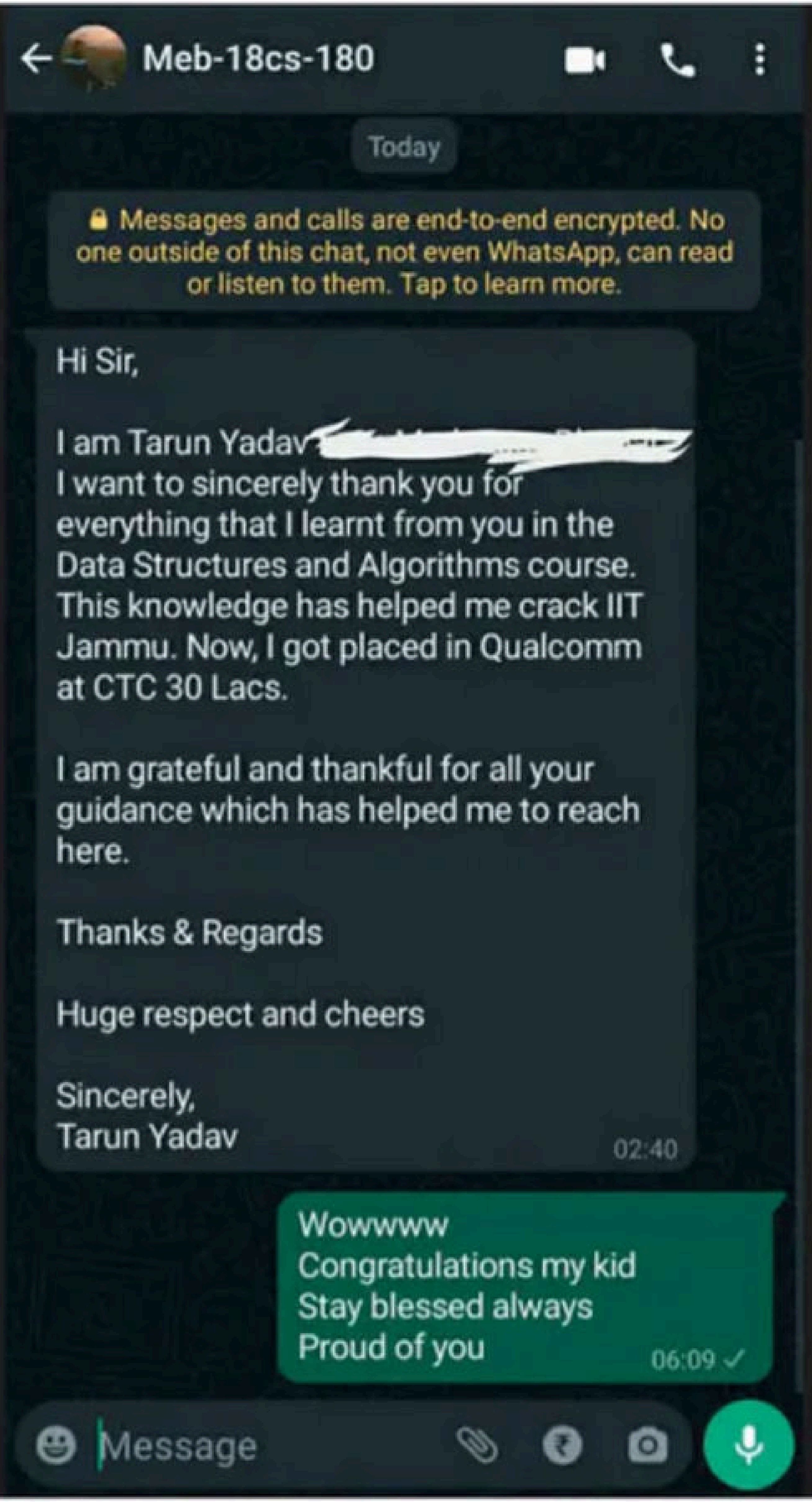
Your buffalo student,
AASHISH KUMAR
C.S. B Batch
Ber Sarai

02:41

Wowwwwww
Congratulations my kid
Stay blessed always
Proud of you

05:54 ✓





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Today

🔒 Messages and calls are end-to-end encrypted. No one outside of this chat, not even WhatsApp, can read or listen to them. Tap to learn more.

Hi Sir,

I am Tarun Yadav [redacted]
I want to sincerely thank you for everything that I learnt from you in the Data Structures and Algorithms course. This knowledge has helped me crack IIT Jammu. Now, I got placed in Qualcomm at CTC 30 Lacs.

I am grateful and thankful for all your guidance which has helped me to reach here.

Thanks & Regards

Huge respect and cheers

Sincerely,
Tarun Yadav
02:40

Wowwwww
Congratulations my kid
Stay blessed always
Proud of you
06:09 ✓

Theory of computation (TOC)

Study
(or)

TOC is nothing but mathematical representation of computing machine and its capabilities.

a^2b^2

$\boxed{aabb}$ a^3b^3

$a^{10}b^{10}$

Formal language

It is also collection of strings only but meaning of the string not important but formate of the string important.

3a 3b 3c

aabb ✓ aabb(2a's && 2b's) , aaabbbccc ✓

abbbba

abbbba

$$L = \{ \underline{w} \, \underline{w^R} \mid w \text{ is combination of } \underline{\text{a's \& b's}} \}$$

set of pallindromes

baab

$$L_2 = \left\{ a^n b^n \mid n \geq 1 \right\}$$

ab, a^2b^2, a^3b^3, - - - - - -

(or)

n- number of a's followed by n- num of b's

$$L = \{\underline{a}^m b^n \mid m, n \geq 1\}$$

ab, abbbb, ~~bbaaa~~, ~~aaab~~, ...

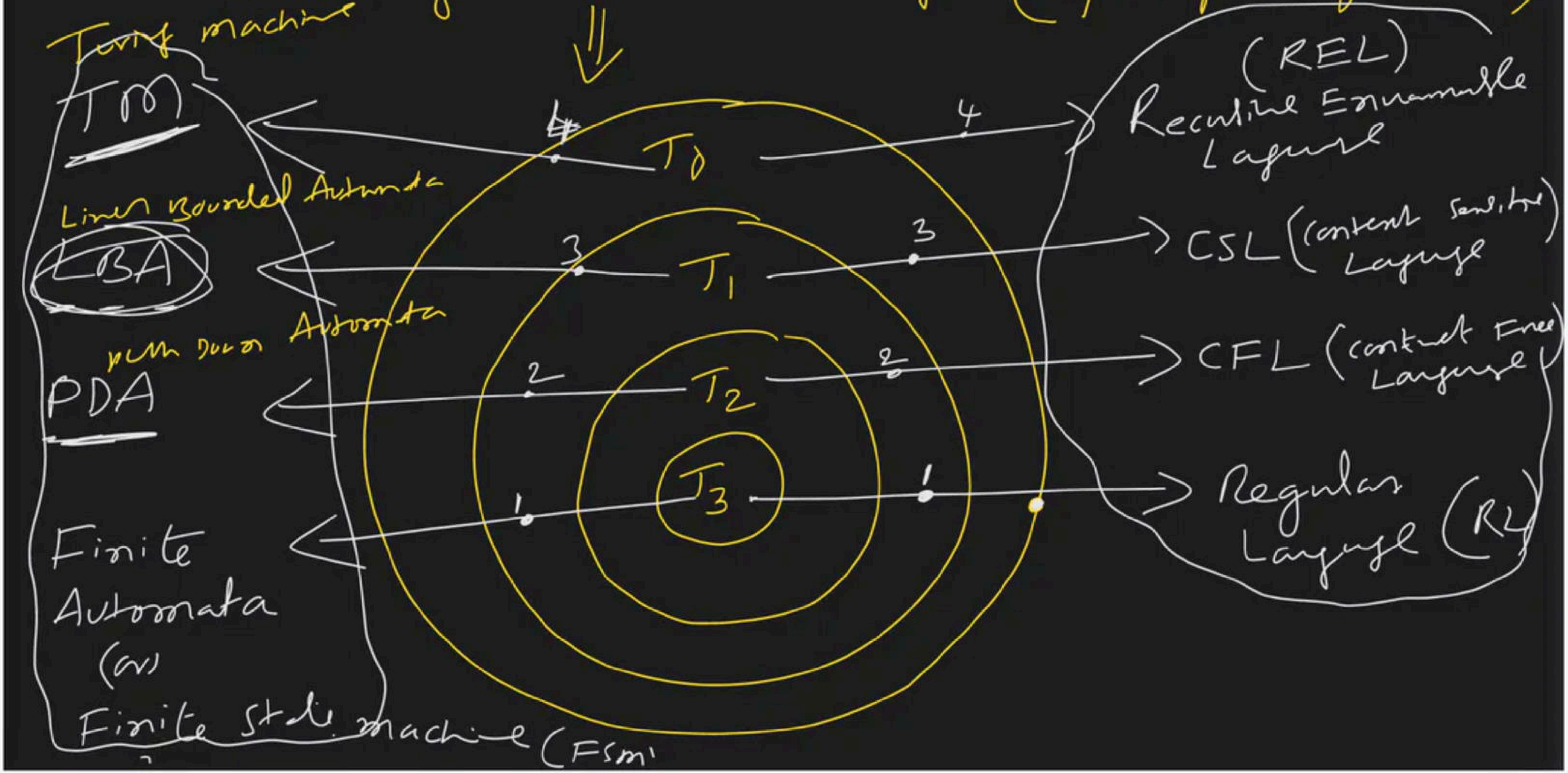
(or)

m - No. of a's followed by n - no. of b's

like these many formal languages.

$L_1 = \{ww^R\}$, $L_2 = \{a^n b^n\}$, $L_3 = \{a^m b^n\}$, $L_4 = \{ww\}$ ....

According to Chomsky (4-types of F.L)


Turing machine
TM
Linear Bounded Automata
LBA
push Down Automata
PDA
Finite Automata (or) Finite state machine (FSM
4
3
2
1
T_0
T_1
T_2
T_3
(REL)
Recursive Enumerable Language
CSL (content Sensitive Language)
CFL (context Free Language)
Regular Language (RL)

① FA && RL ⇒ 50% ~~60%~~ ✓

② PDA && CFL ⇒ 30% ✓

③ TM && REL ⇒ 10% ✓

④ Undecidability ⇒ 10% ✓

$T_3 \subset T_2 \subset T_1 \subset T_0$

$\downarrow$ In general

$T_{i+1} \subset T_i \quad \left[0 \le i \le 2 \right]$

By default all formal languages are Type-0

No. of Languages an Automata accepts is known as Expressive power of that automata

$E(FA) = \underline{\underline{1}}\,(RL)$

$E(TM) = \underline{4}\,(All)$

$E(PDA) = \underline{2}\,(CFL, RL)$

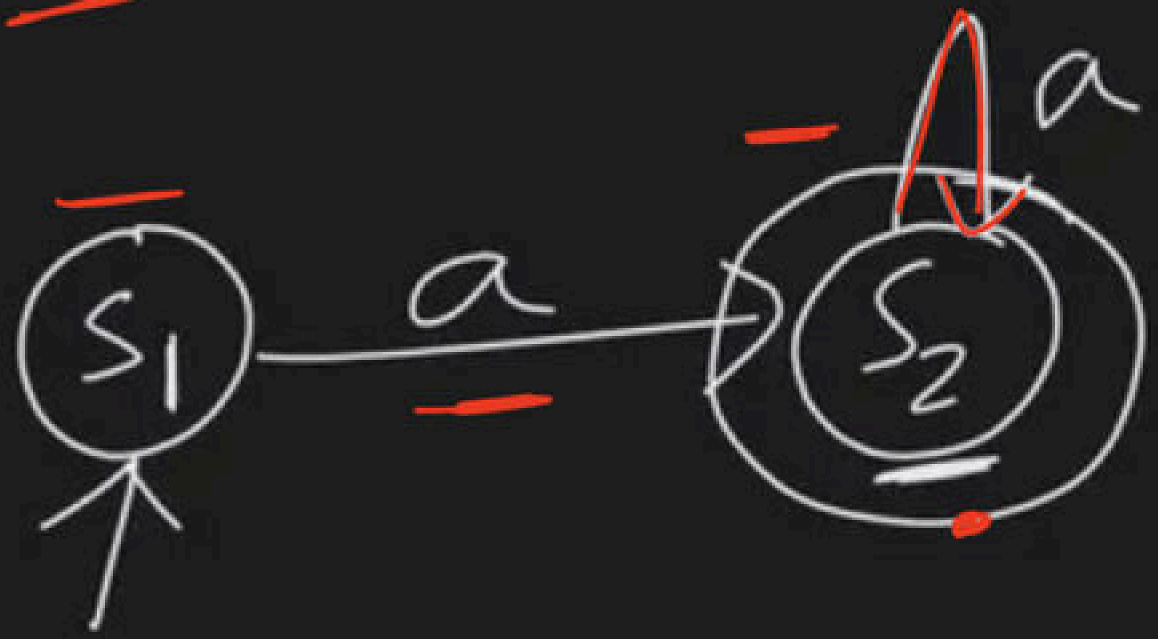
$E(LBA) = \underline{3}\,(CSL, CFL, RL)$

$E(FA) < E(PDA) < E(LBA) < E(TM)$

Why these many Automata's ?

$$L_1 = \{ a^n \mid n \geq 1 \}$$ ✓ Regular Language.

a, aa, aaa, ...



FSM (or) FA

a ✓

aa ✓

aaa ✓

⋮

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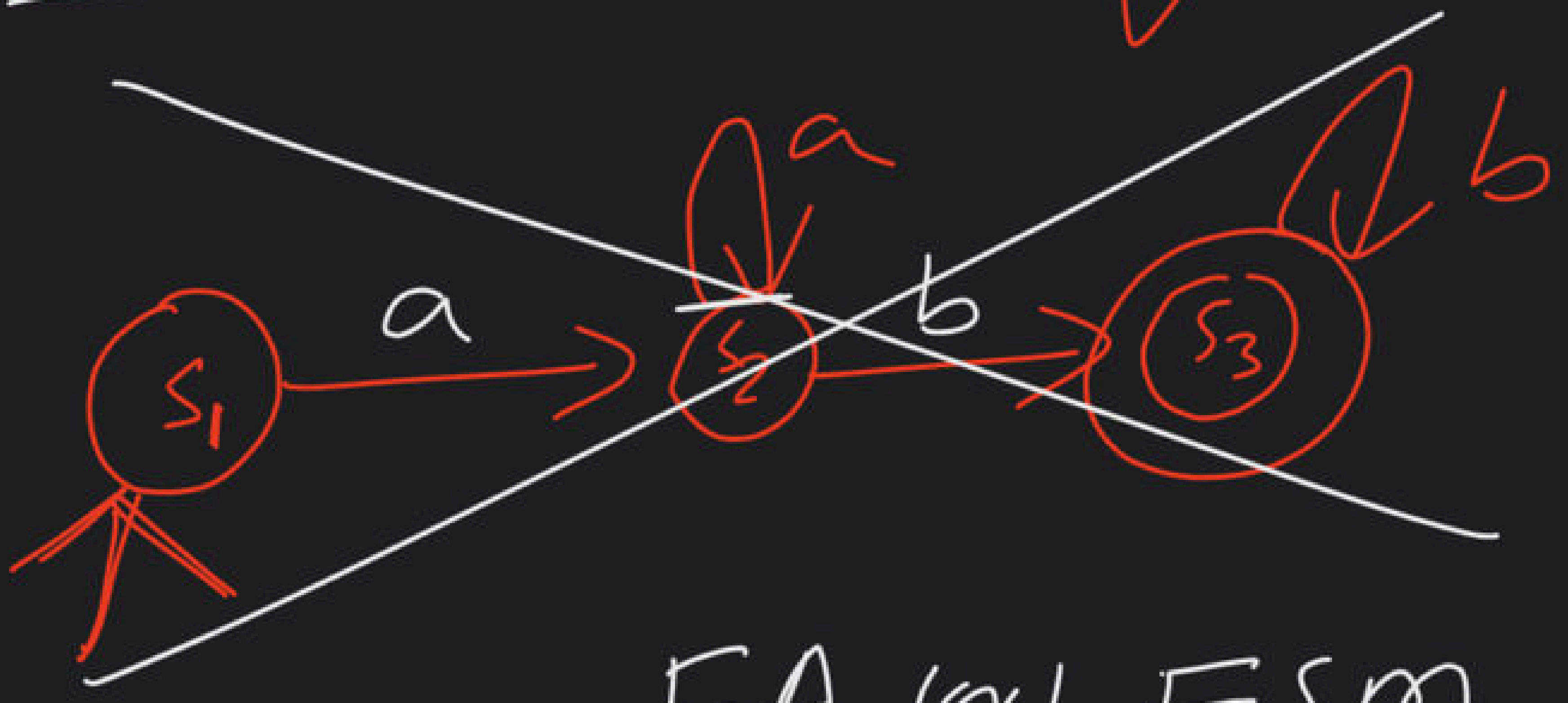
8882089903

waty

$L_2 = \{a^n b^n / n \geq 1\} \Longrightarrow ab, aabb, aaabbb, \ldots\ldots$



FA (or) FSM ✗

ab ✓

aabb ✓

aaabbb ✓

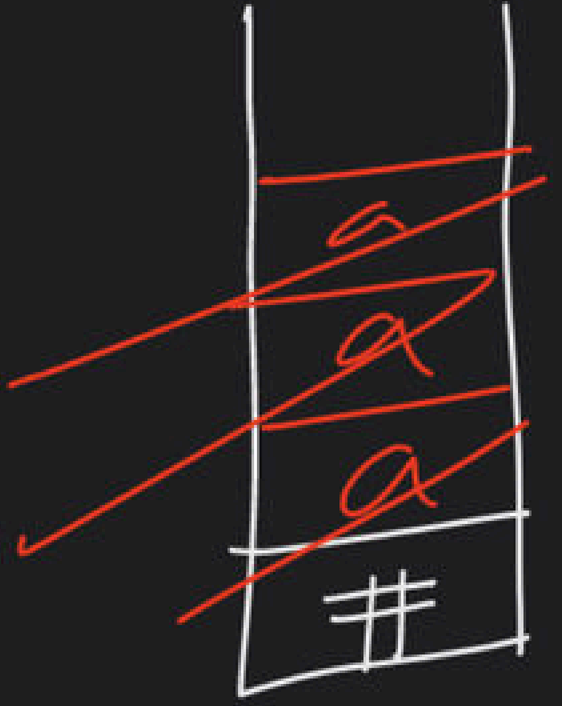
abbb ✓

FA fails to accept above language, so we are going to PDA

⇓

FA + 1-Stack

~~aaabbb~~ $



a - push

a - push

a - push

b ⇒ pop - a

b ⇒ pop - a

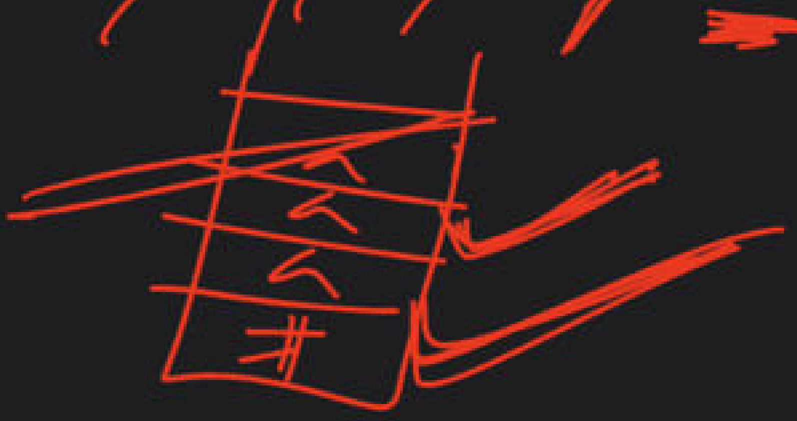
b ⇒ pop - a

$	#
String over	Stack empty
‖	‖
b's over ✓	a's over ✓

no - a's == no - b's

Stack empty ✓

~~aaab~~ $



a's more

⇓

rejected

(at the end Stack empty then only accepted)

$L_3 = \{a^n b^n c^n \mid n \geq 1\}$

abc ✓

aabbcc ✓

aaabbbccc ✓

Here 2-compari needed, so PDA fails becz it can handle max 1-comp

⇓

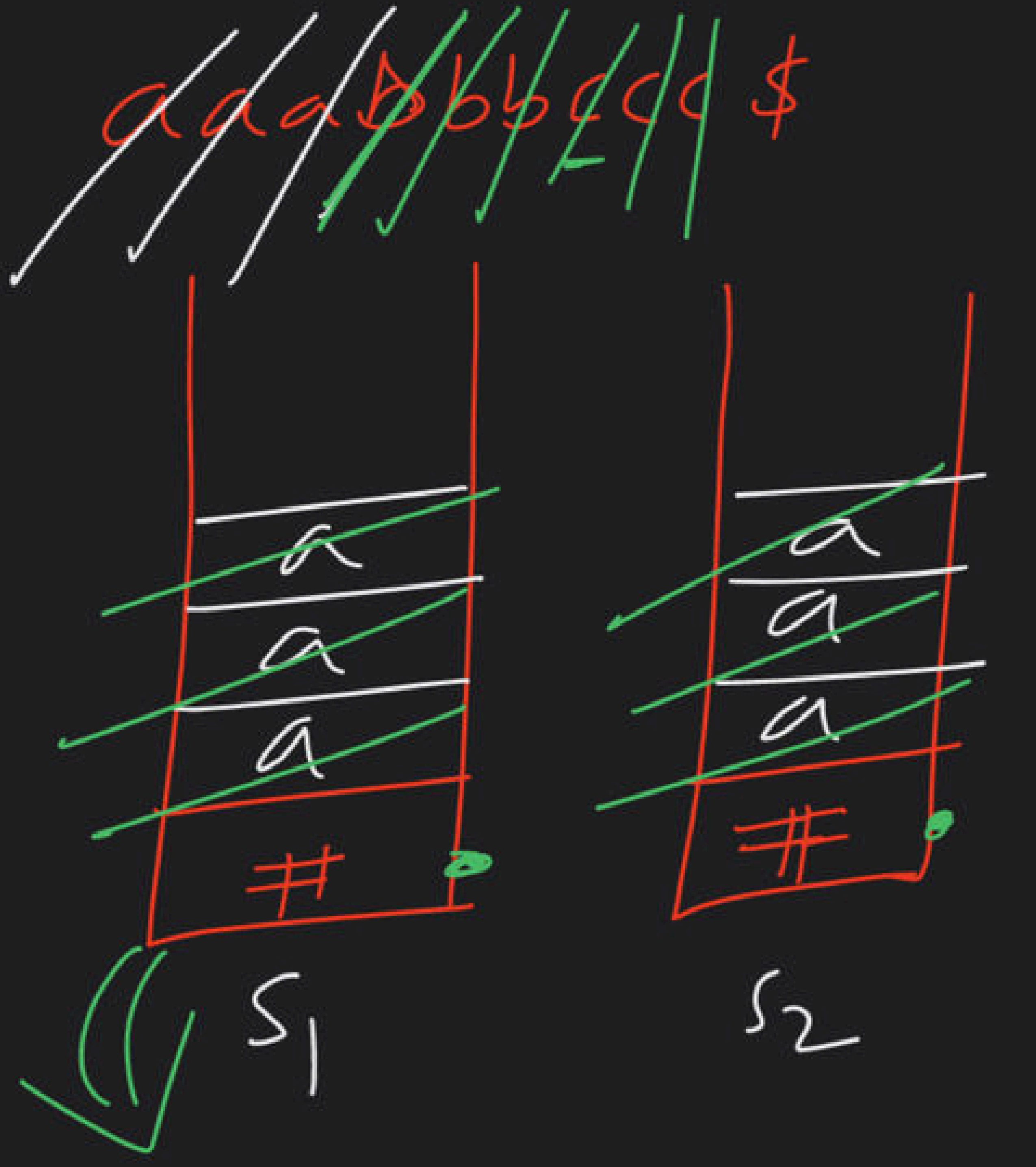
TM

⇓

PDA + 1-Stack

(or)

FA + 2 stacks



a's == b's

a – push in S_1 && S_2

b ⇒ pop only in S_1

b ⇒ ||

b ⇒ ||

c ⇒ pop only in S_2

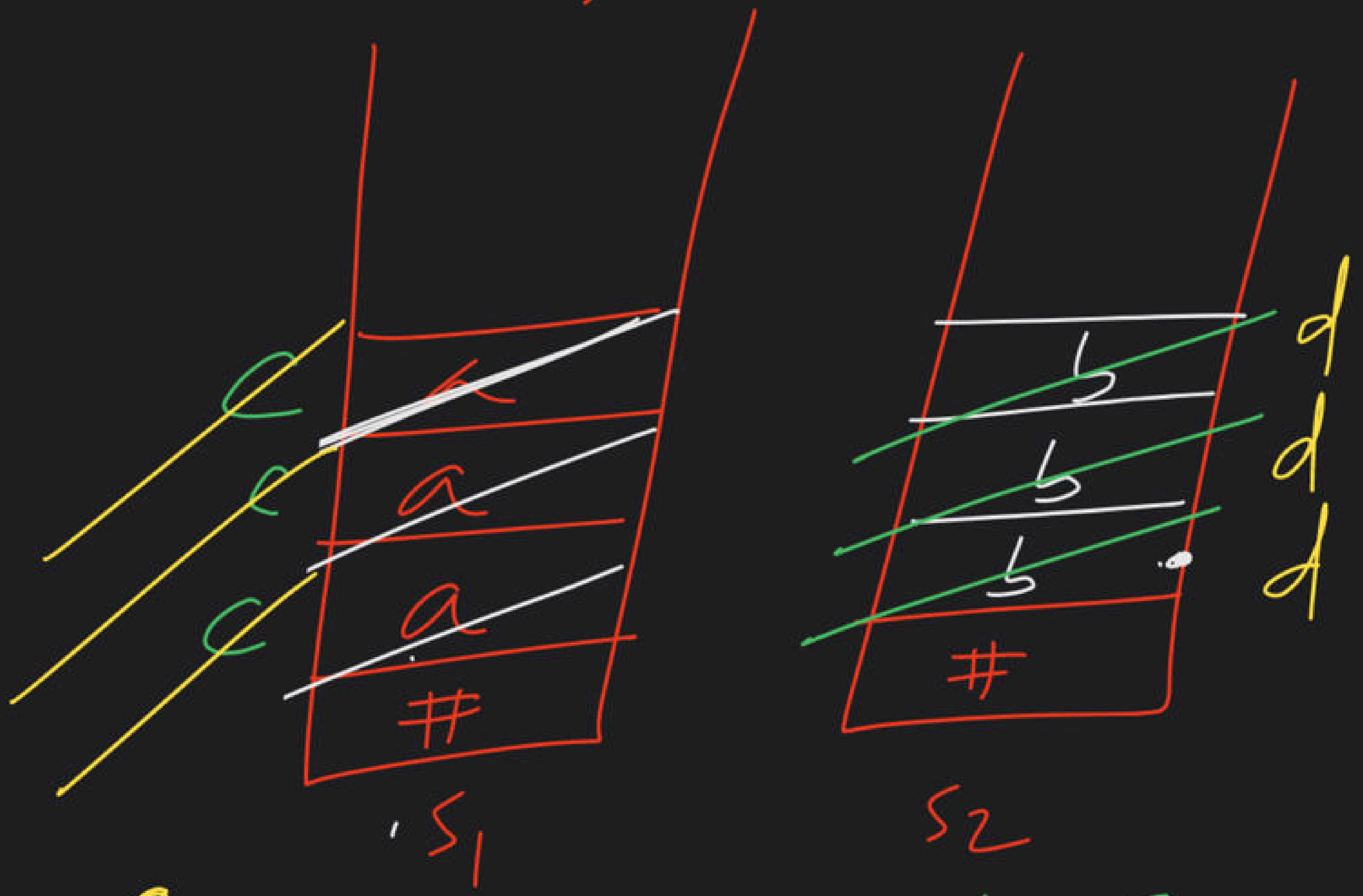
c ⇒ ||

c ⇒ ||

a's == c's

$L_4 = \{ \underline{a}^n \underline{b}^n \underline{c}^n \underline{d}^n \mid n \geq 1 \}$ ✓

~~aaabbbcccddd~~ $\underline{d}$ eee fff ggg hhh

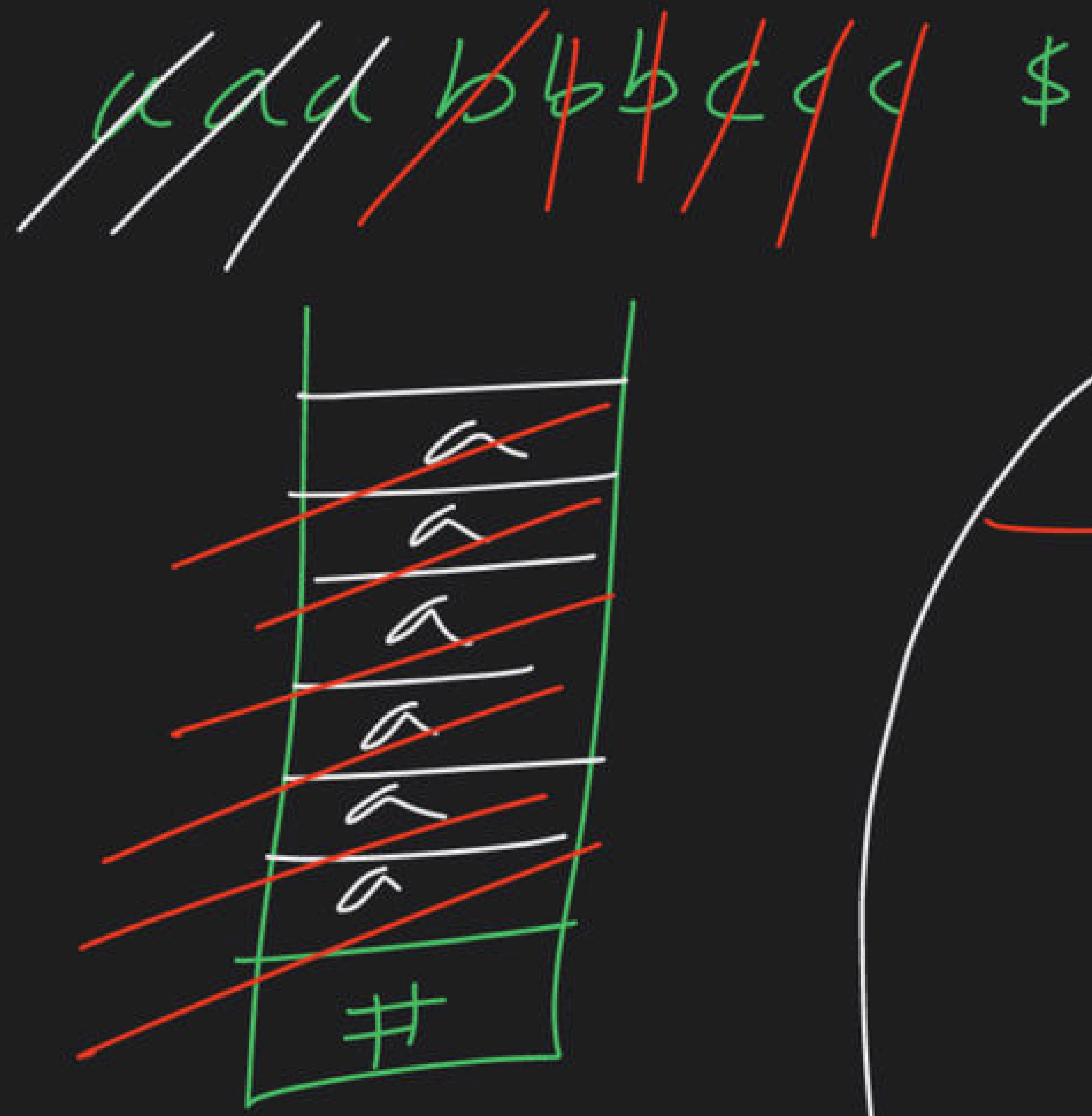


a = = b
c = d

b = c

L$\boxed{B}$A

P(TM) = P(computer)



a => push - a - 2 times

b => pop - a

b => ''

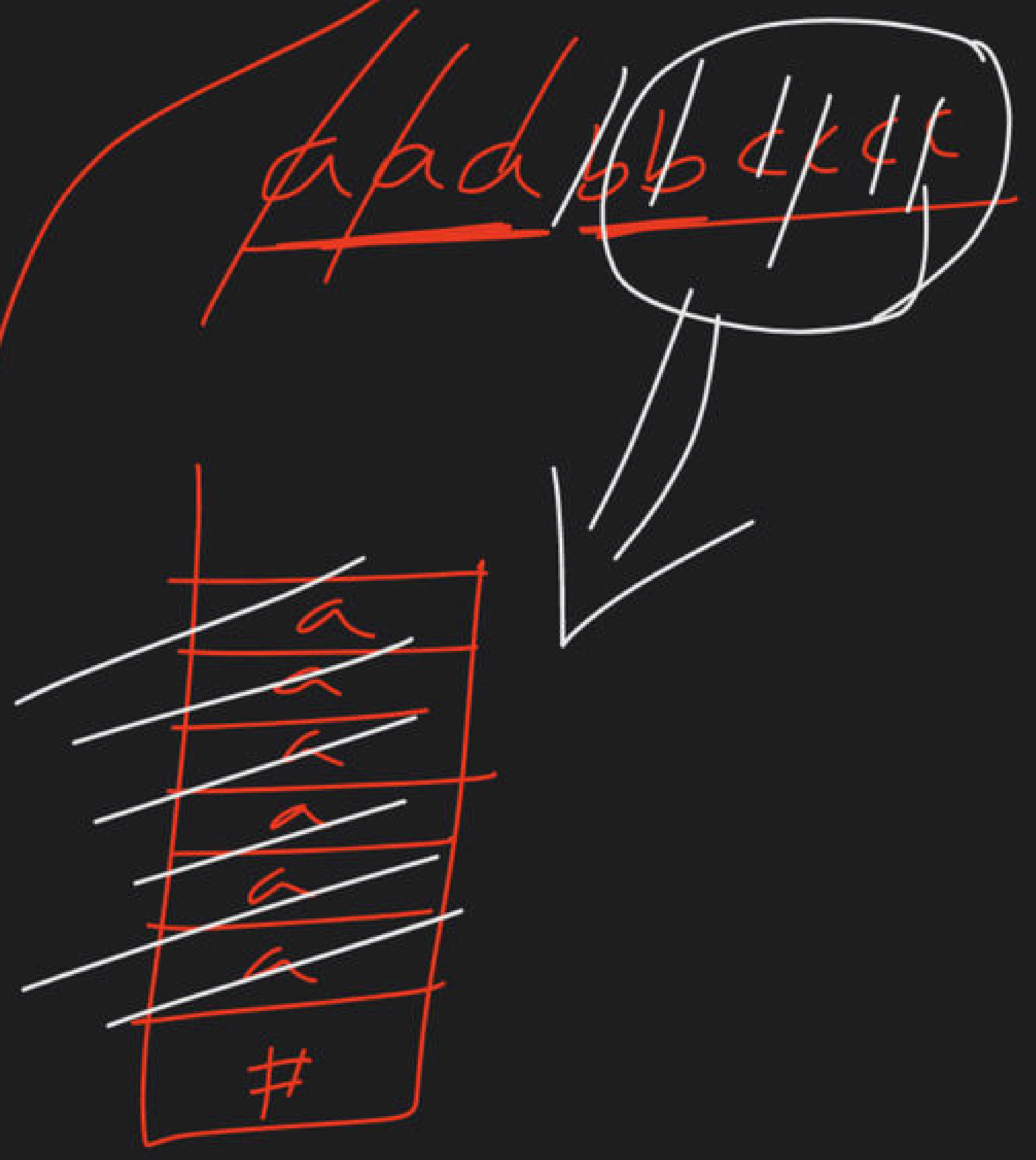
b => ''

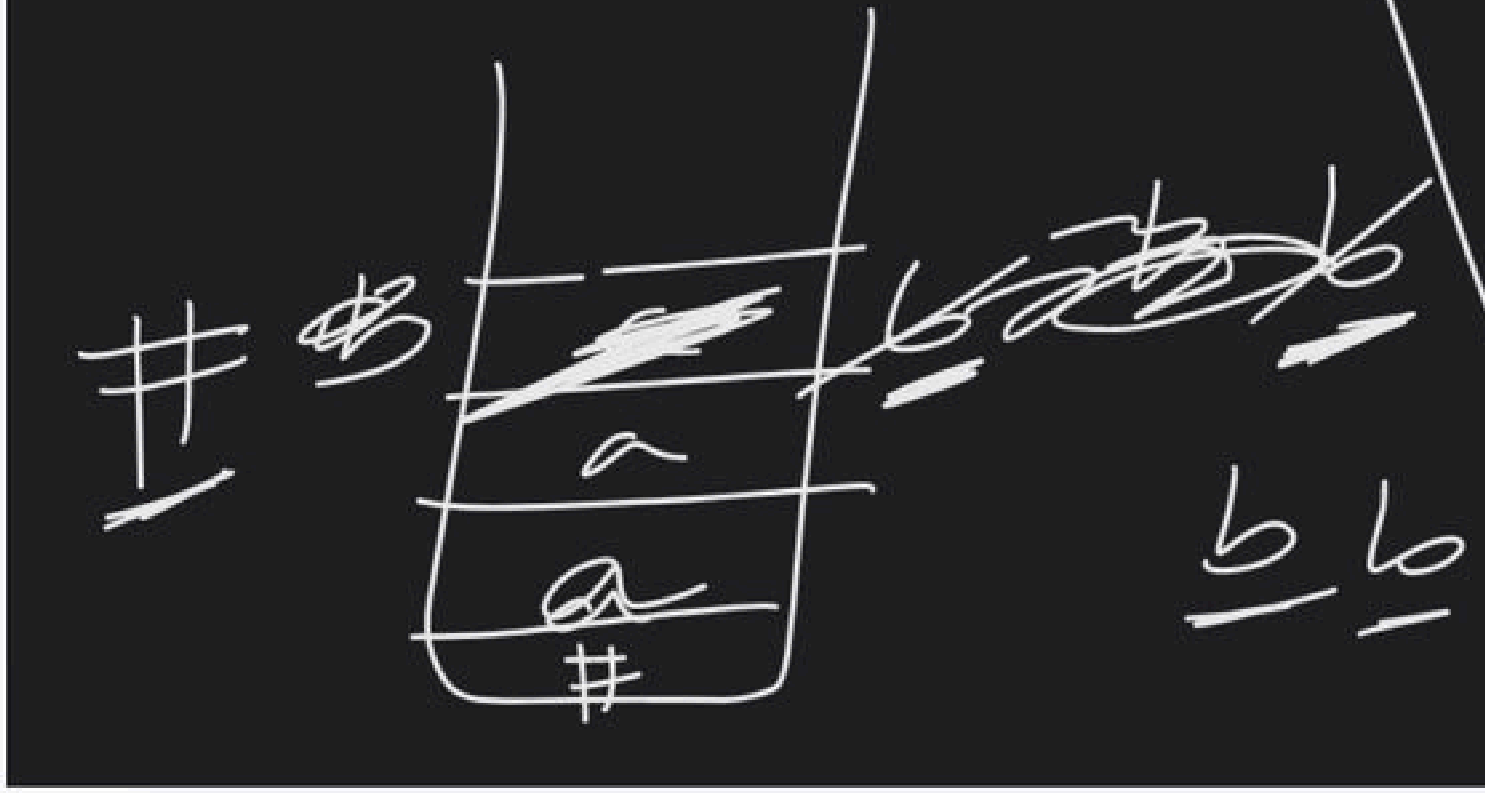
c => pop - a

c => ''

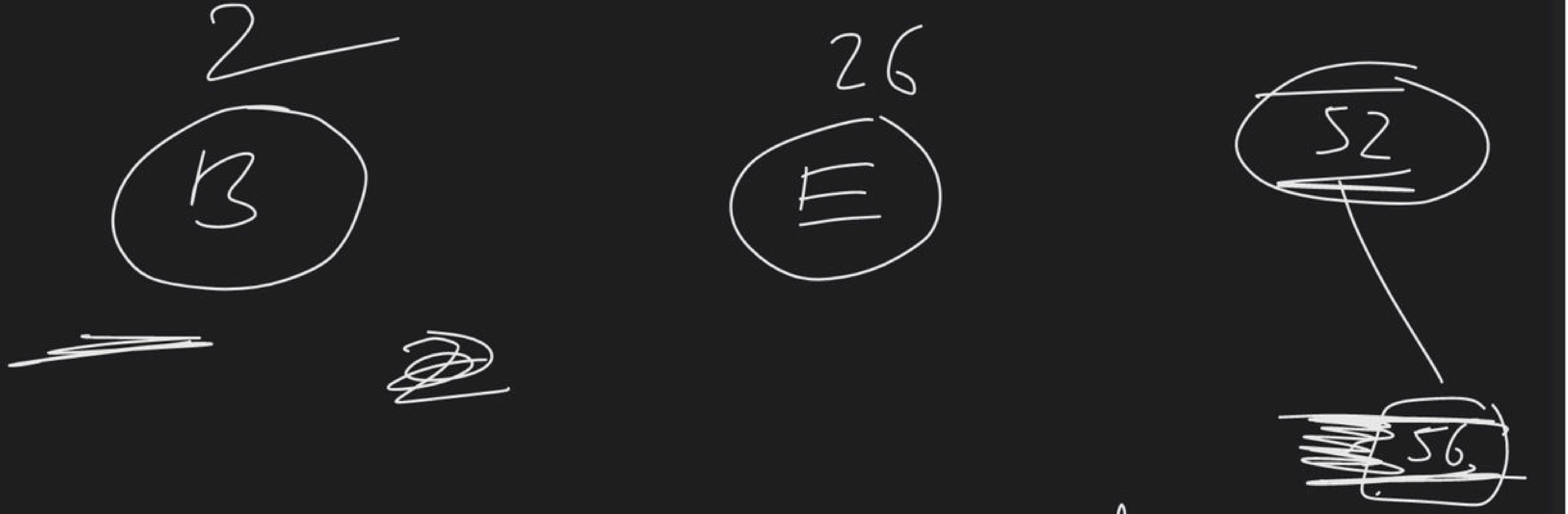
c => ''

accepted





Alphabet : It is finite non-empty set of symbols.



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