# Introduction to Theory of Computation

Complete Course on Theory of Computation

**Subbarao Lingamgunta** • Lesson 1 • Feb 2, 2022


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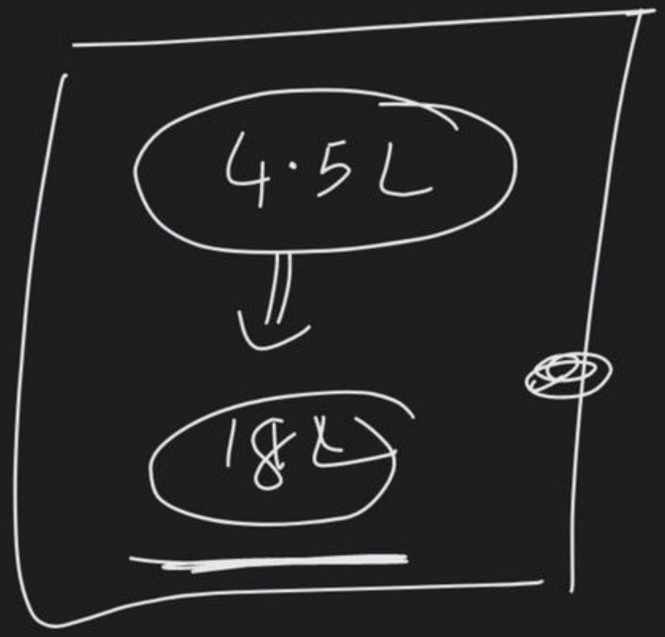
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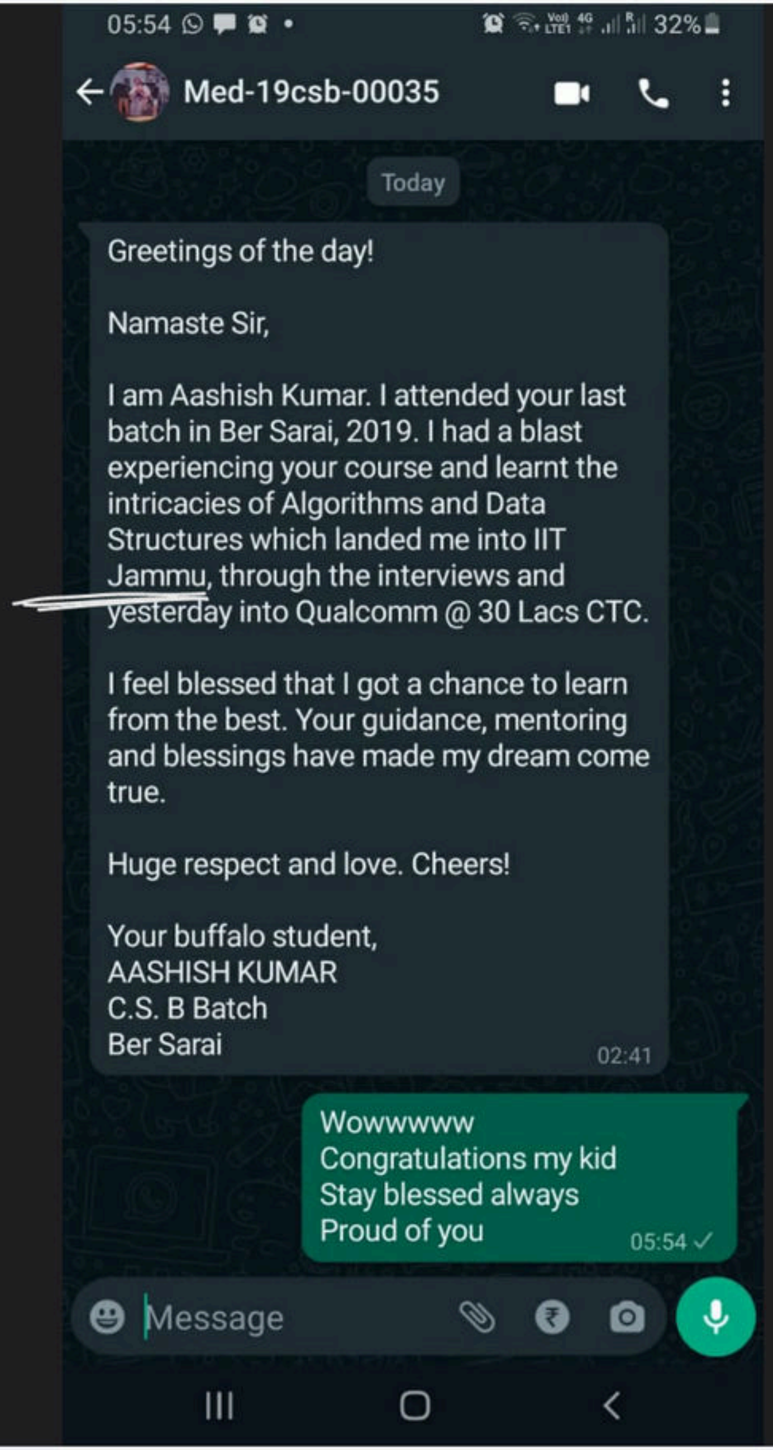
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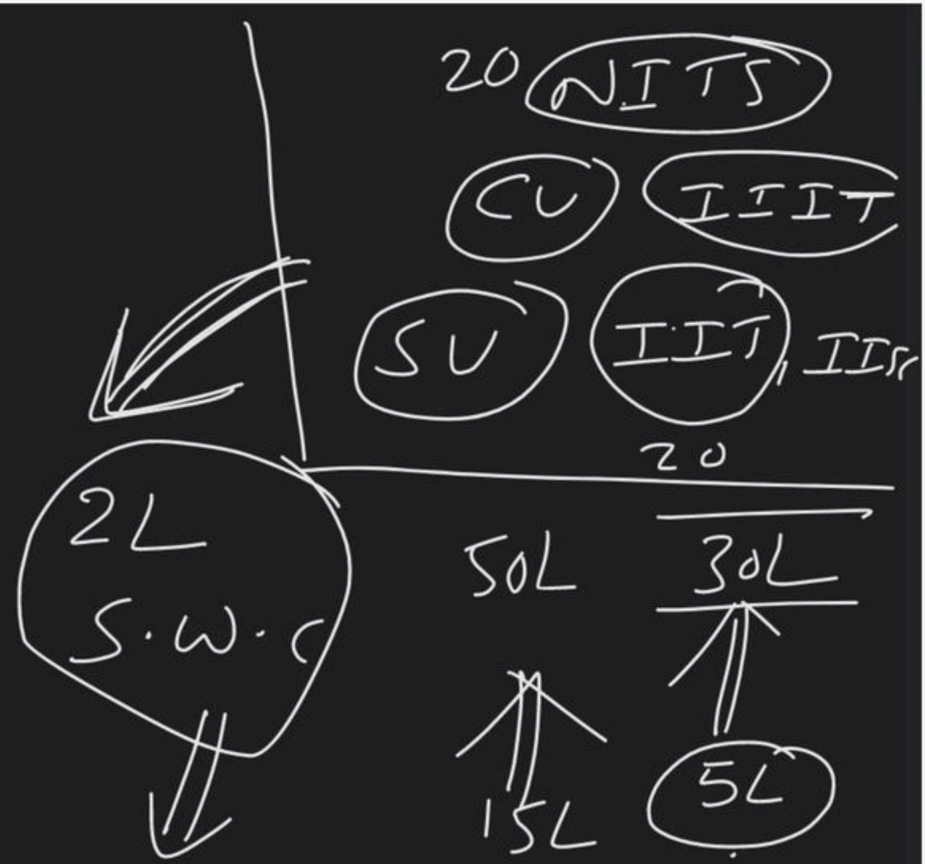
Today
Greetings of the day!
Namaste Sir,
I am Aashish Kumar. I attended your last batch in Ber Sarai, 2019. I had a blast experiencing your course and learnt the intricacies of Algorithms and Data Structures which landed me into IIT Jammu, through the interviews and yesterday into Qualcomm @ 30 Lacs 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
Wowwwww
Congratulations my kid
Stay blessed always
Proud of you
05:54
Message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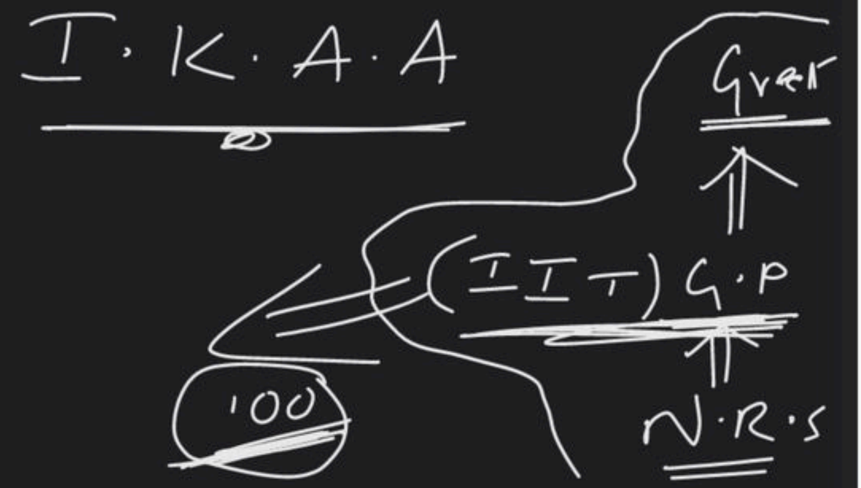
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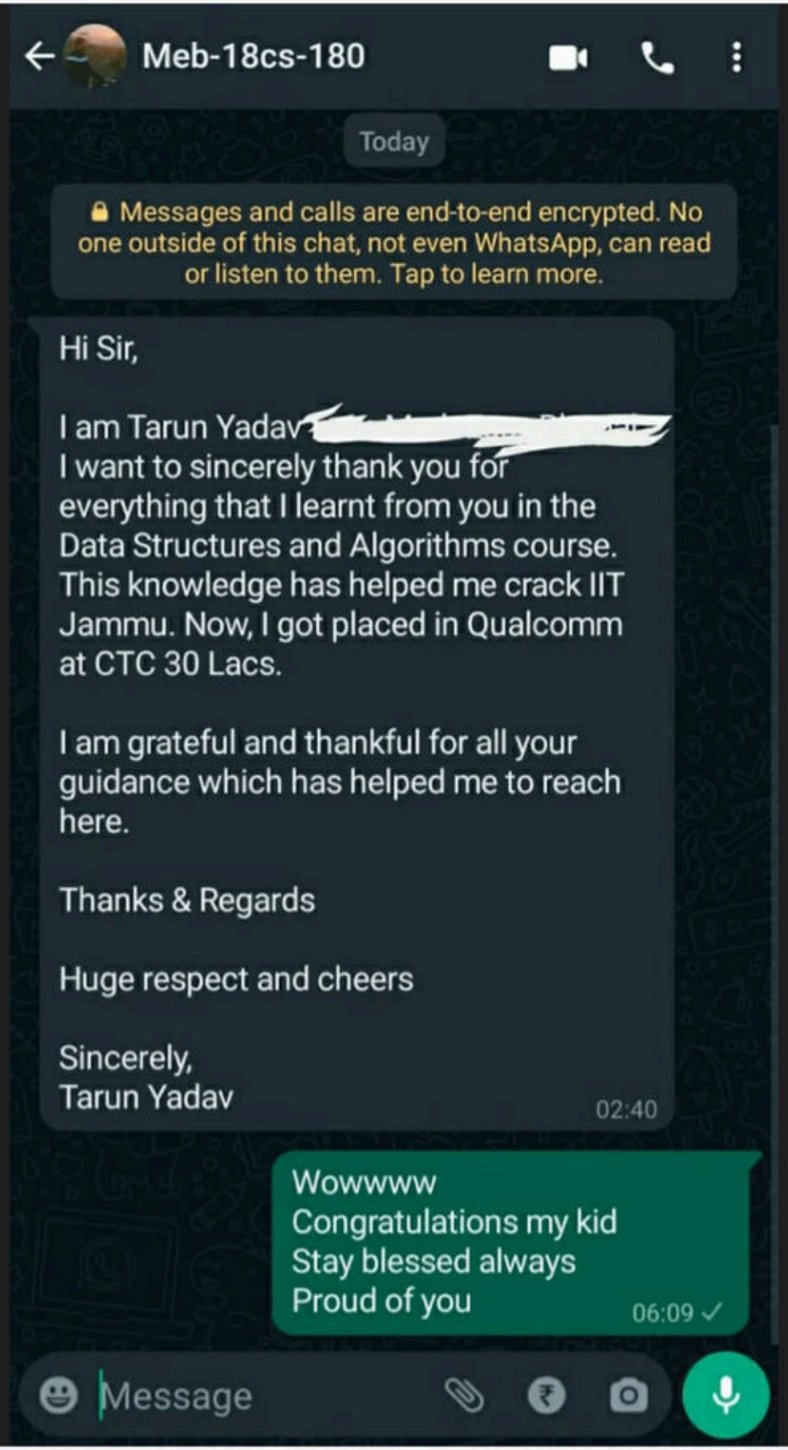

Meb-18cs-180
Today
Messages and calls are end-to-end encrypted. No one outside of this chat, not even WhatsApp, can read or listen to them. Tap to learn more.
Hi Sir,
I am Tarun Yadav
I want to sincerely thank you for everything that I learnt from you in the Data Structures and Algorithms course. This 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
Wowwww
Congratulations my kid
Stay blessed always
Proud of you
06:09
Message

# Theory of computation (TOC)

Study (or) mathematical representation of computing machine and its capabilities.

TOC is nothing but of computing machine and its capabilities.

## Formal language

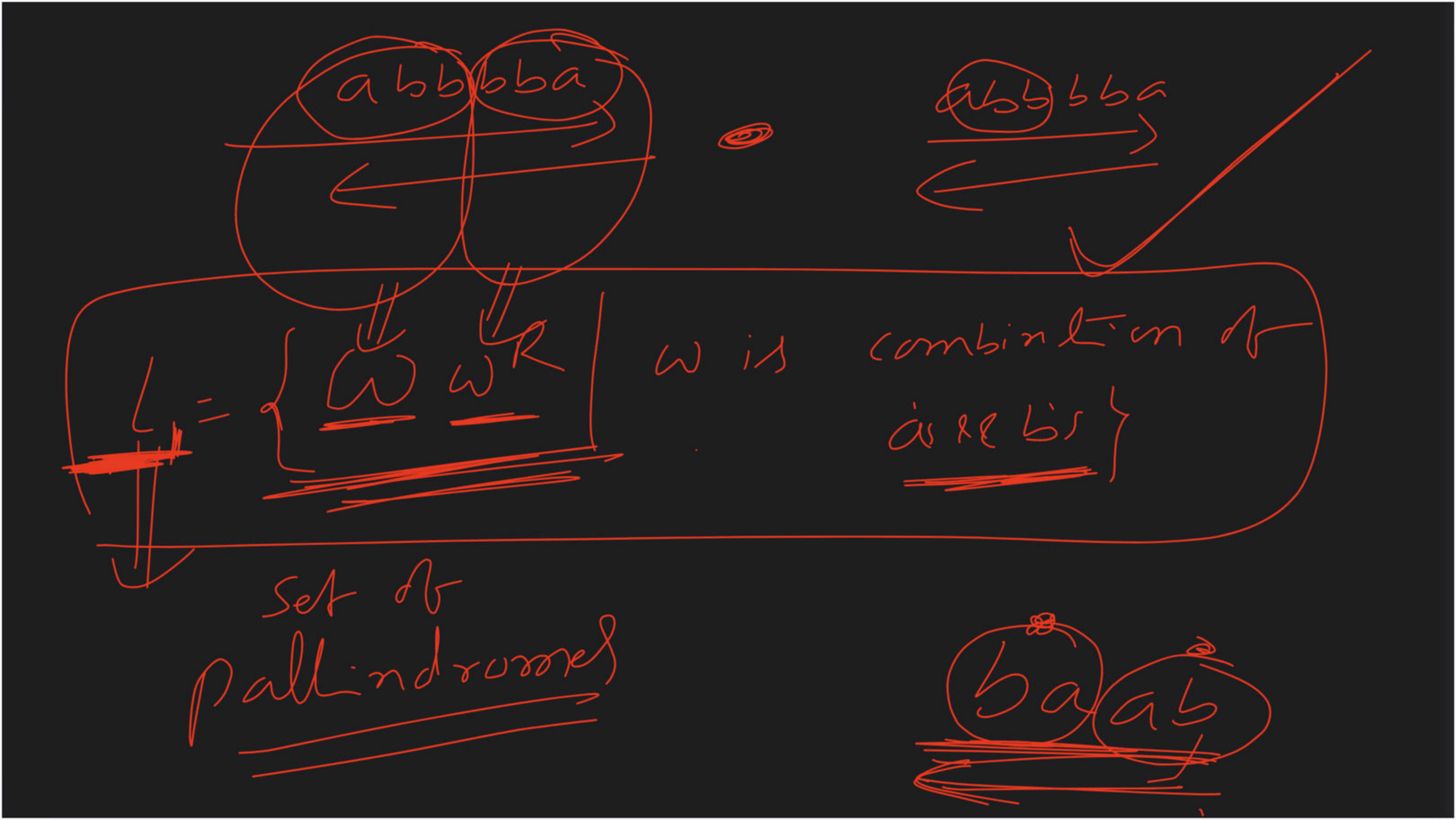
It is also collection of strings only but meaning of the strings not important but format of the string important.

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

$a^2b^2$ $a^3b^3$ $a^{10}b^{10}$

aabb

$3a\ 3b\ 3c$


abbbba
abbbba
$L = \{ w w^R \mid w$ is combination of a & b $\}$
Set of palindromes
baab

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

$ab, a^2b^2, a^3b^3, \ldots\ldots$

(or)

$n$ – number of $a$'s followed by $n$ – num of $b$'s

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

ab, abbbb, ~~bbaaa~~, ~~aaaab~~, ----

(or)

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

⋮ like these many more formal languages.

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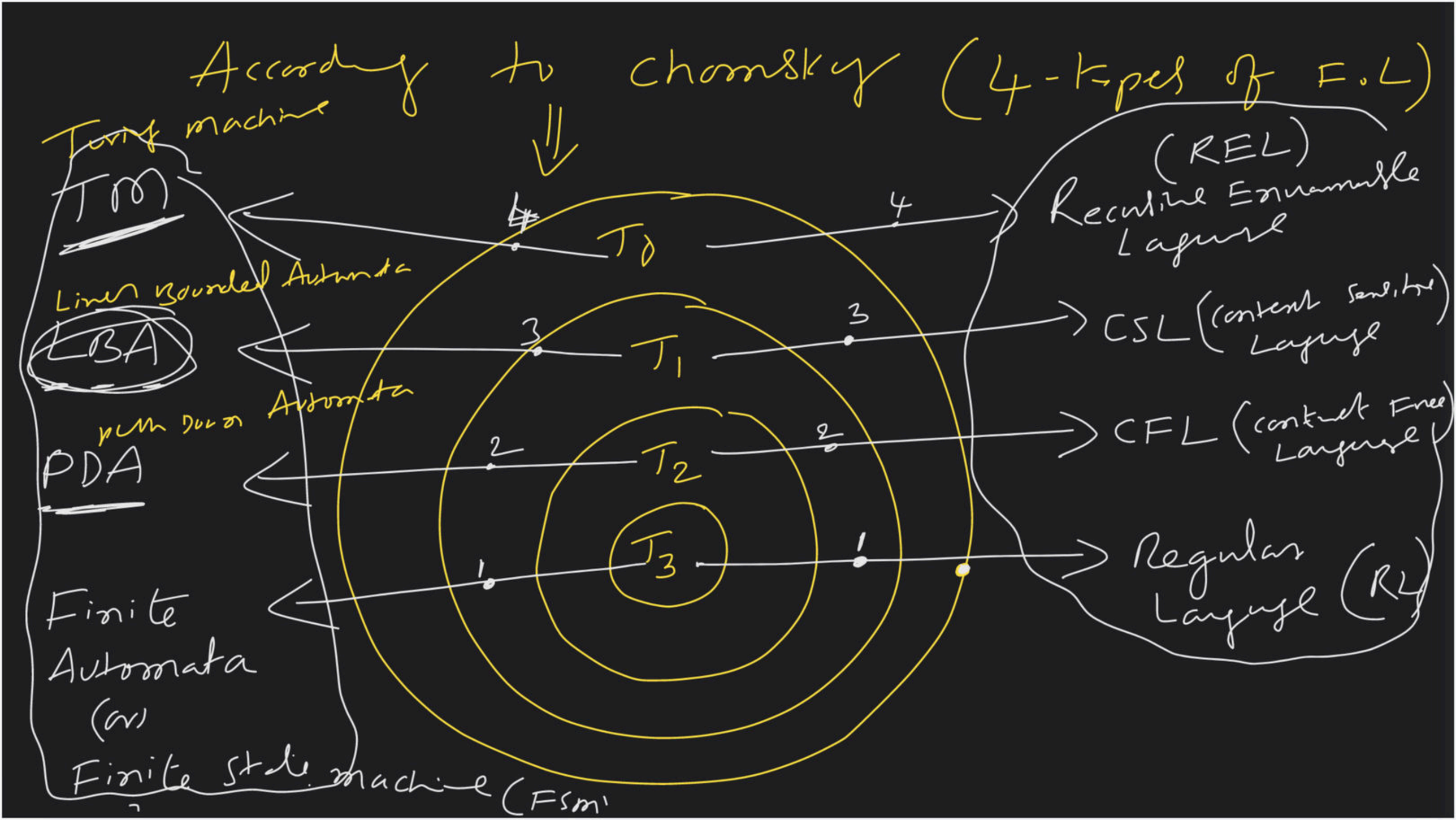
$L_1 = \{ ww^R \}$, $L_2 = \{ a^n b^n \}$, $L_3 = \{ a^m b^n \}$, $L_4 = \{ ww \}$ ------


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)
$T_0$
$T_1$
$T_2$
$T_3$
4
3
2
1
(REL)
Recursive Enumerable Language
CSL (context sensitive) Language
CFL (context Free Language)
Regular Language (RL)

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

$\Big\downarrow$ In general

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

By default all formal languages are Type-0

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

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$E(FA) = 1$ (RL)

$E(PDA) = 2$ (CFL, RL)

$E(LBA) = 3$ (CSL, CFL, RL)

$E(TM) = 4$ (All)

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

# Why these many Automata's ?

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


FSM (or) FA

a ✓

a a ✓

a a a ✓

⋮

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