

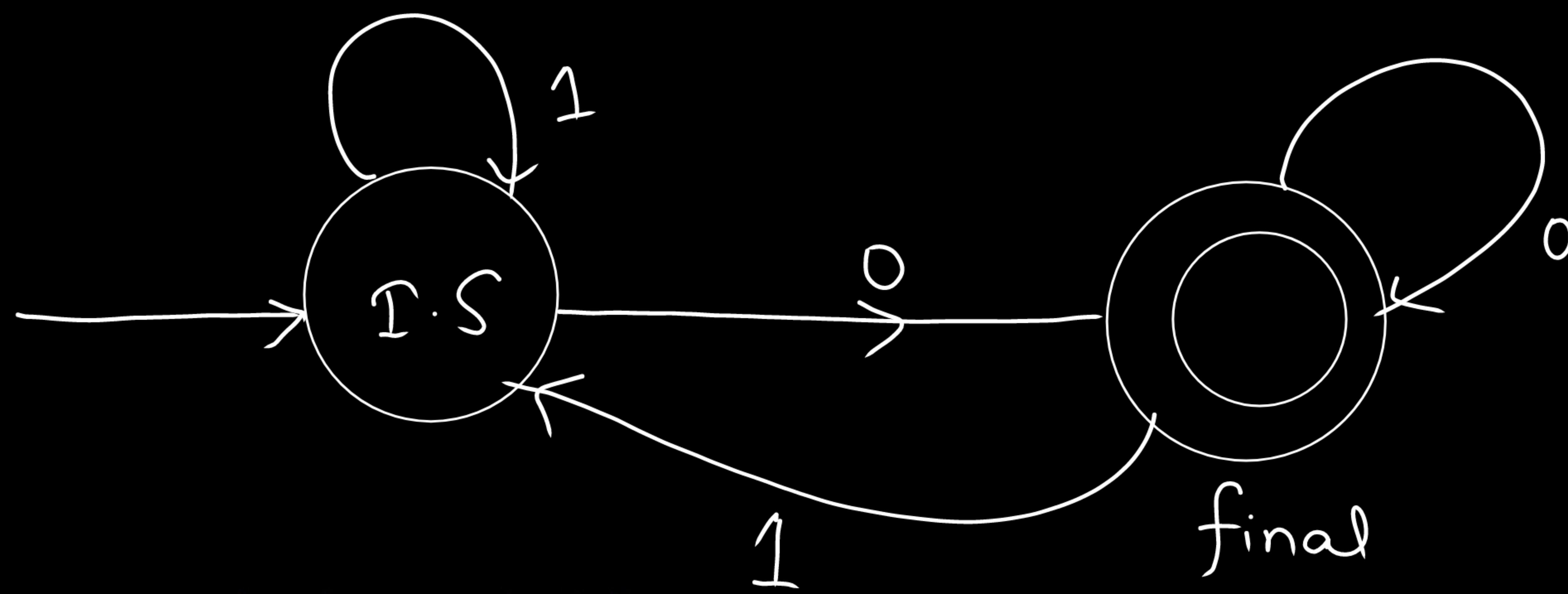
Theory of Computation

Introduction

Lecture 1

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Theory of Computation is the study of how a machine thinks, decides, and processes input step-by-step: just like software, compilers, and apps do internally.



No hardware is built first.


Every hardware starts as a mathematical model.

0, 1

$$\{ \underbrace{1^* 0}_\text{-} \underbrace{0^*}_\text{-} \underbrace{1}_\text{-} \underbrace{1^*}_\text{-} \underbrace{0 0^*}_\text{-} \dots \}$$

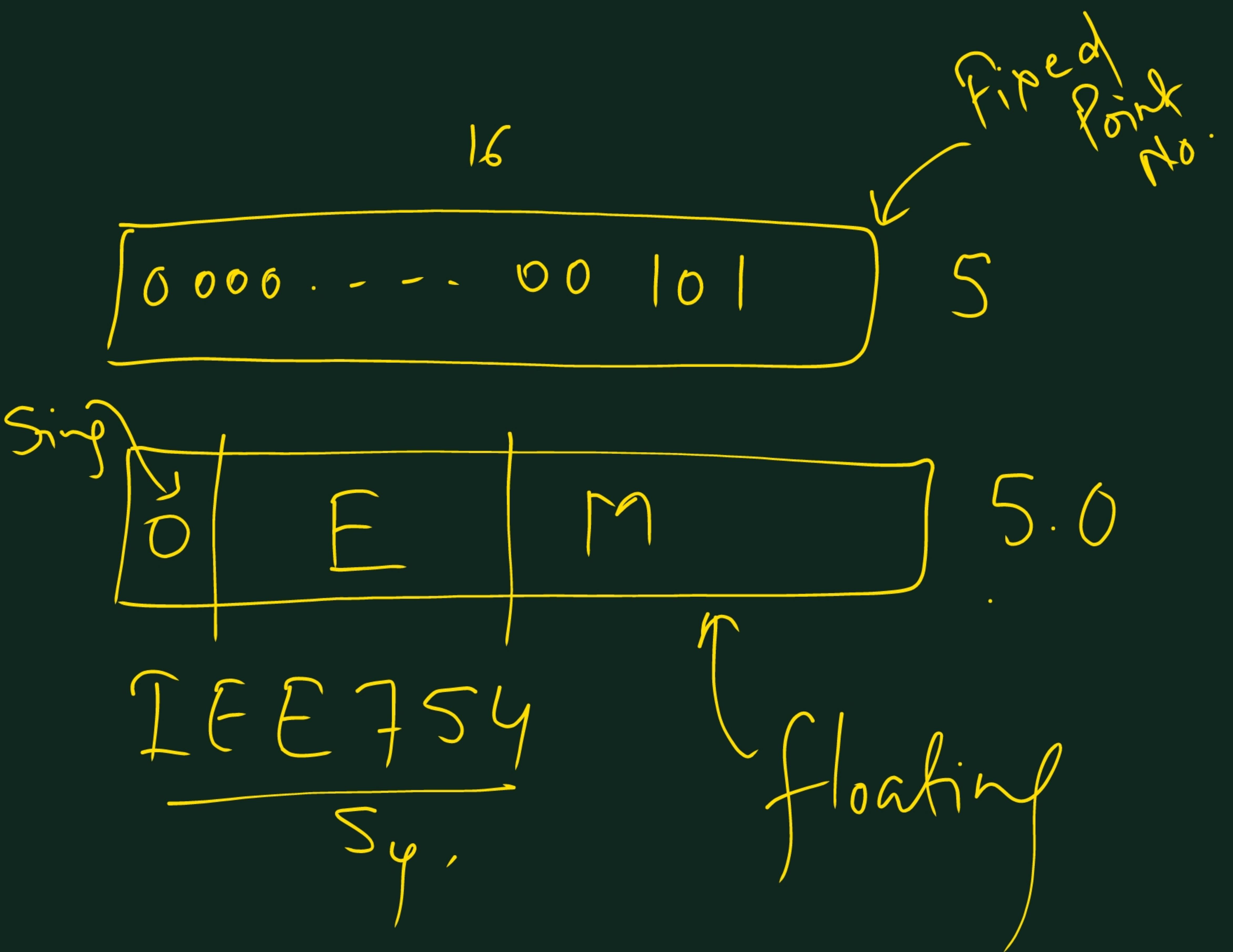
$$\begin{array}{c} 0 \\ 1 0 \\ \hline \end{array} \quad \left. \begin{array}{c} 0 \\ 1 0 \\ \hline \end{array} \right\} \text{Even}$$

Grammar : Set of rules



Exp: Typecast
int b = (int)(5.0)

int a = 5;
int b = 5.0; implicit conversion
if (a == b)
{
 cout << "Hello"
}
else {
 cout << "Bye";}



MOV A, B

↓
:
:

$$a = b + c + d + f$$

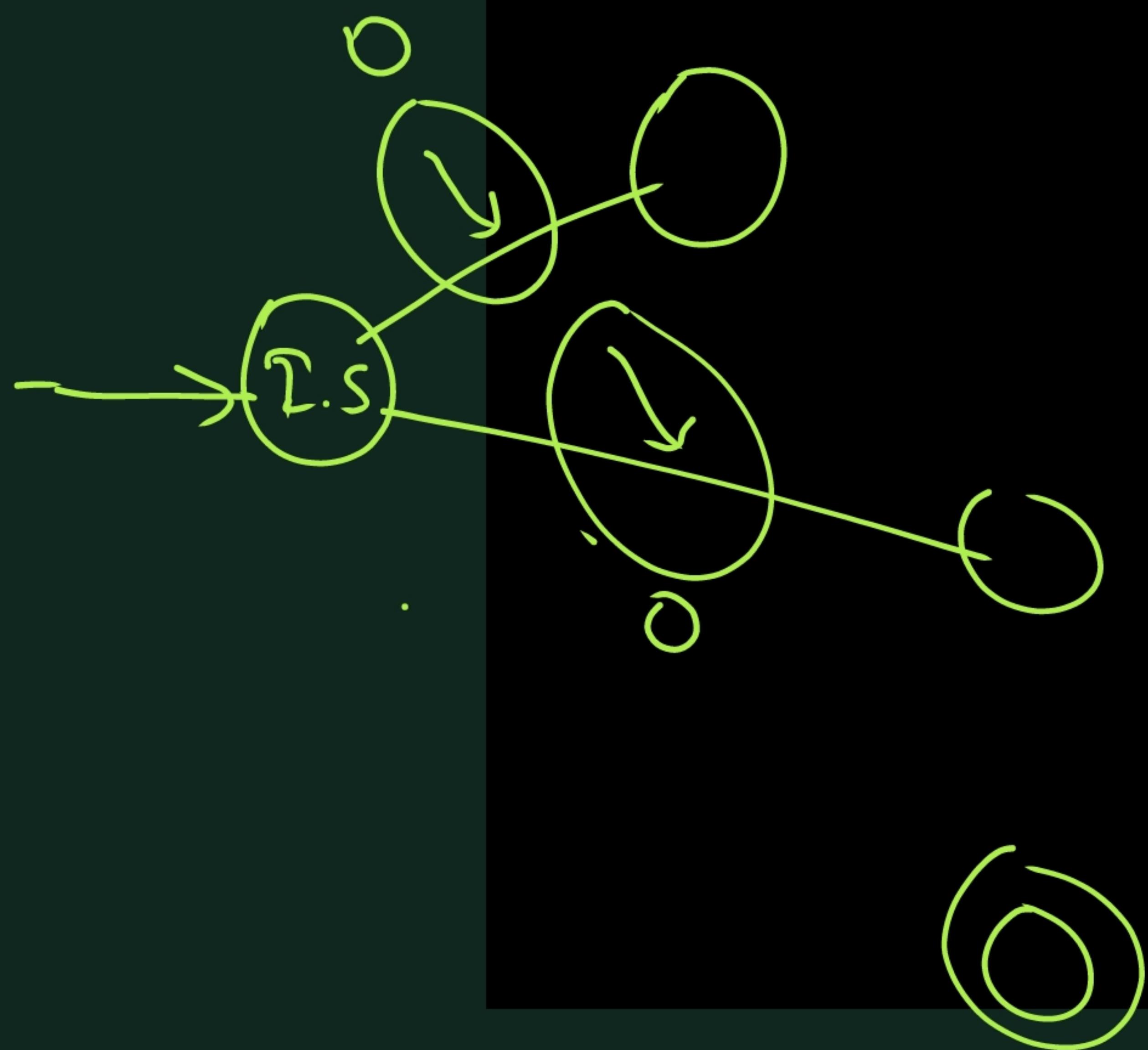
The diagram illustrates the components of the equation $a = b + c + d + f$. It shows four separate rectangles labeled b , c , d , and f arranged in a 2x2 grid. A large bracket on the right side groups all four rectangles together, and an arrow points from this bracket to the term $b + c + d + f$ in the equation.

Imagine a DFA as a dumb but disciplined intern

Rules:

- Intern has **fixed states (moods)**
- Intern follows **clear rules only**
- Intern cannot think extra

Deterministic Mc



DFA Concept	Funny Real-World Version
States	Intern's mood
Input symbols	Instructions from boss
Transition	Mood change
Start state	Monday morning
Final state	Task completed / rejected

$L = \{w \mid w \text{ ends with } 01\}$

$L = \{w \mid \text{number of } 0\text{s is even}\}$

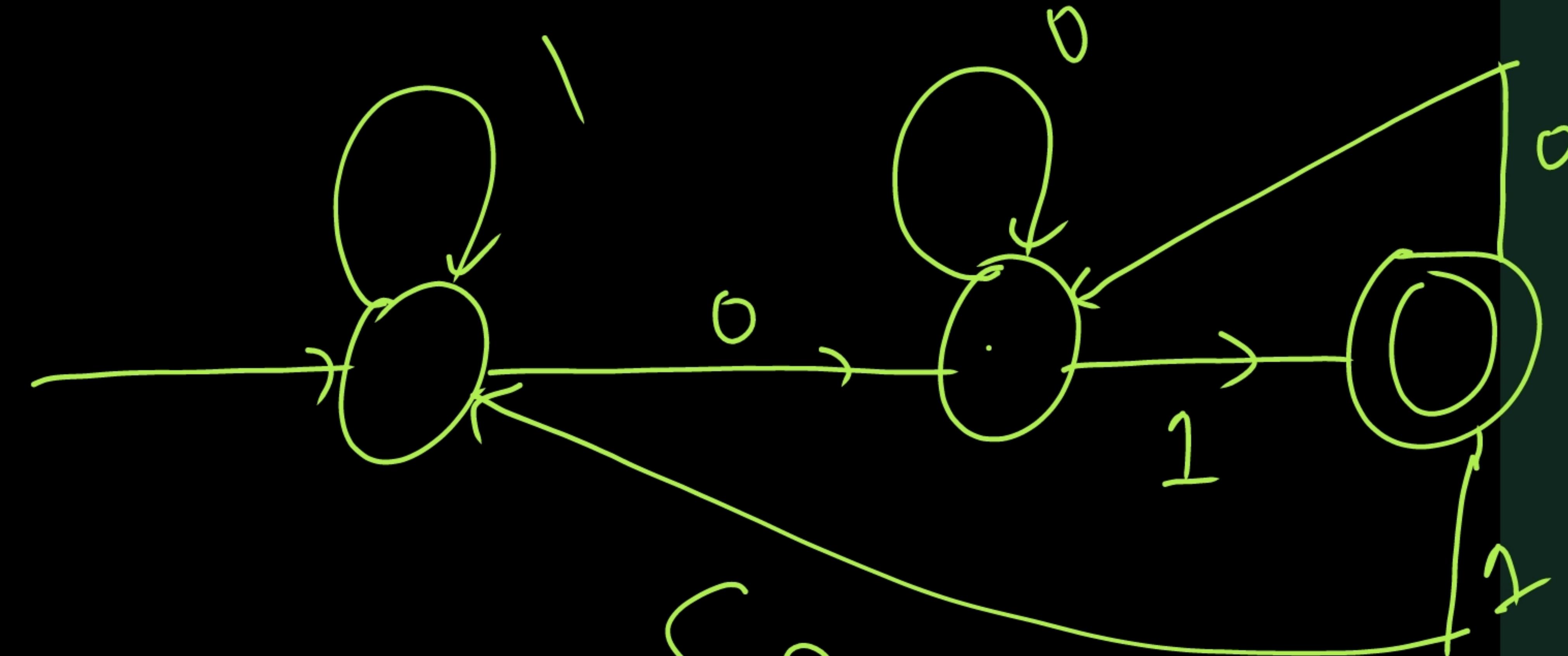
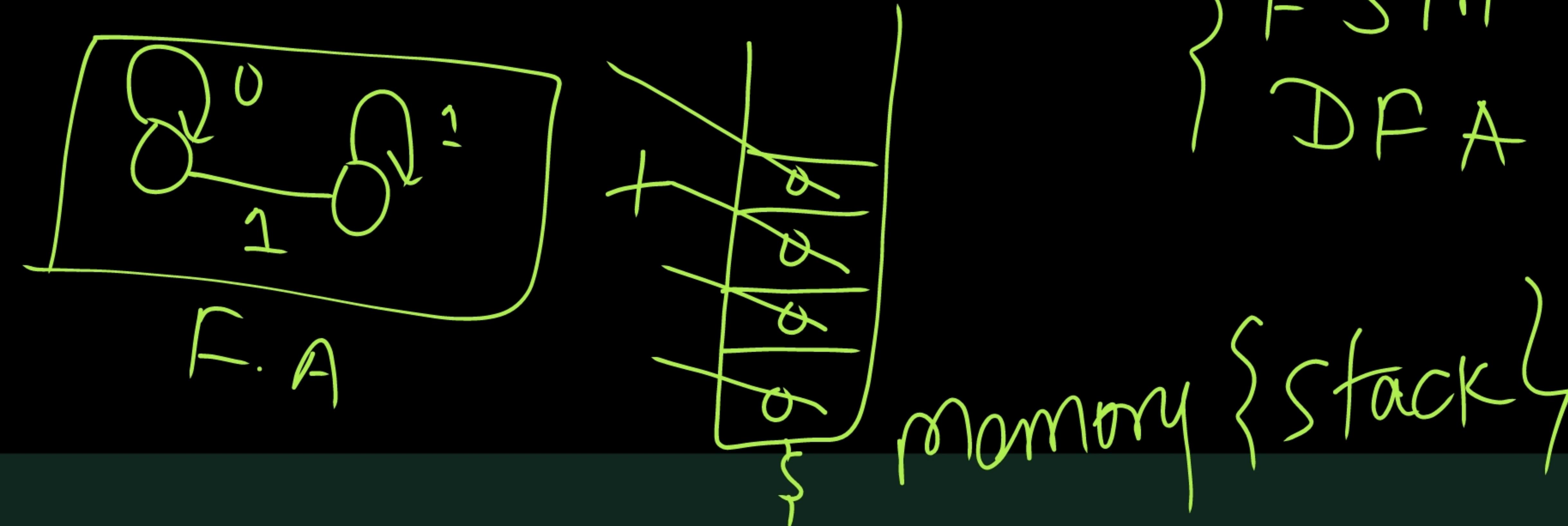
$L = \{0^n 1^n \mid n \geq 0\}$

$L = \{ww^R \mid w \in \{0,1\}^*\}$

$L = \{a^n b^n\}$

$L = \{\text{balanced parentheses}\}$

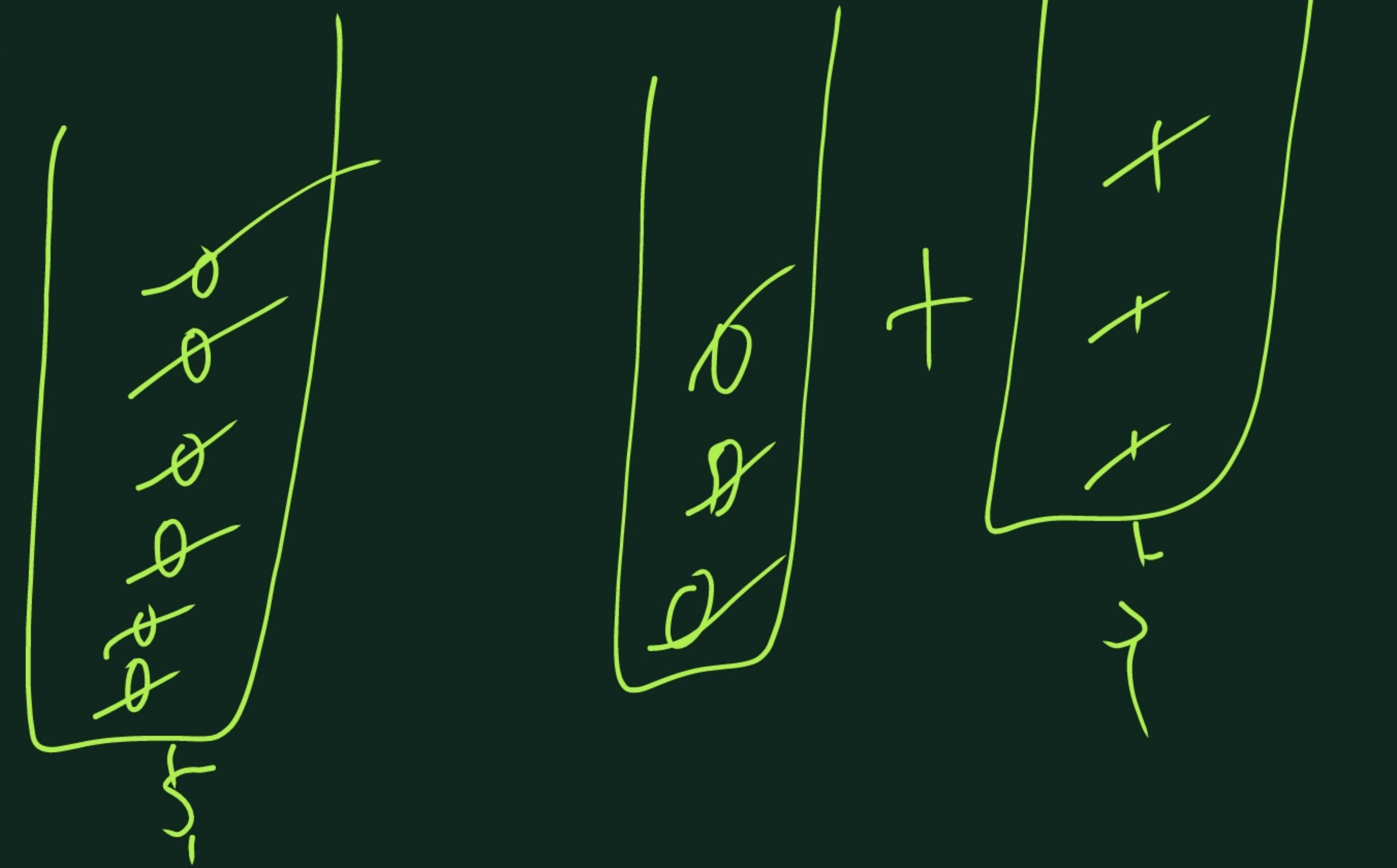
$L = \{a^n b^n c^n \mid n \geq 1\}$



0ⁿ 1ⁿ

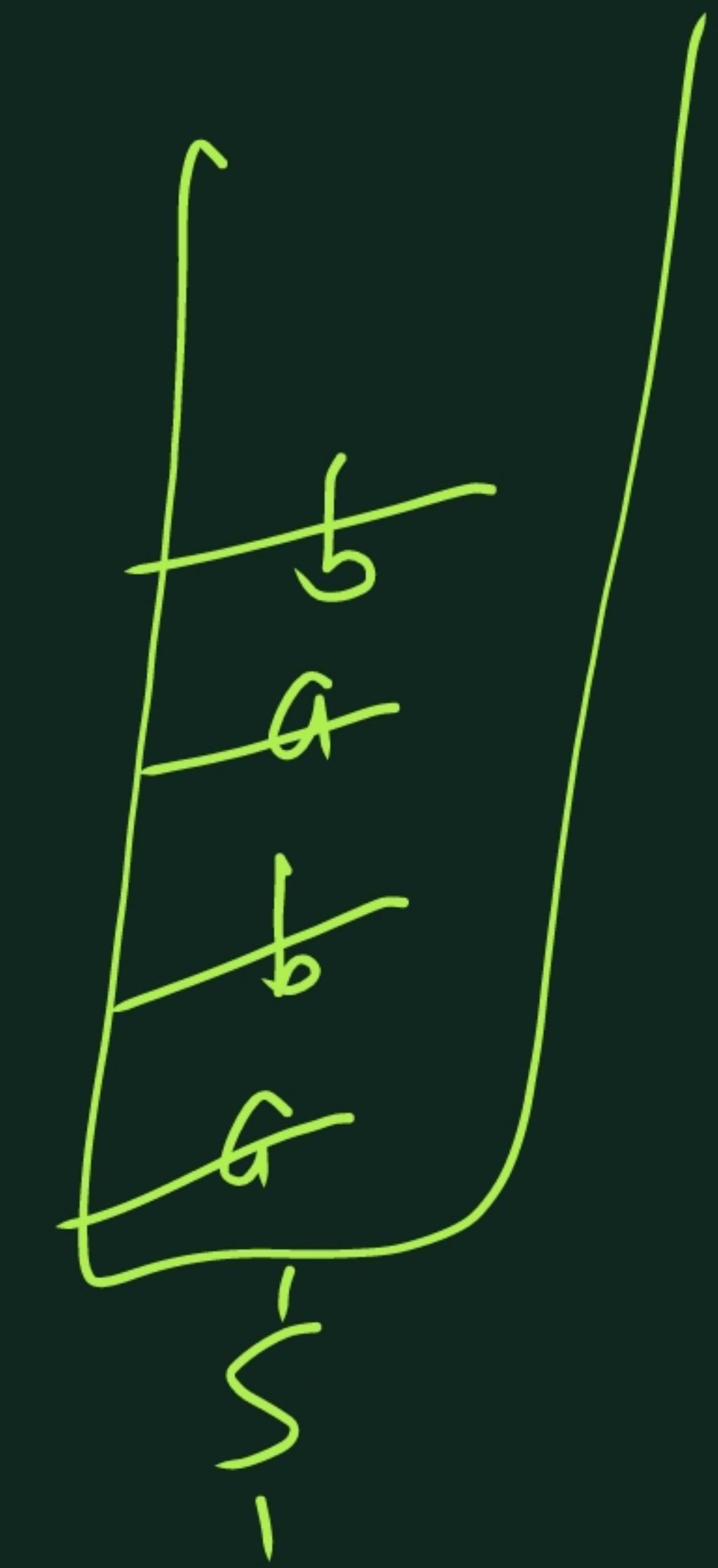
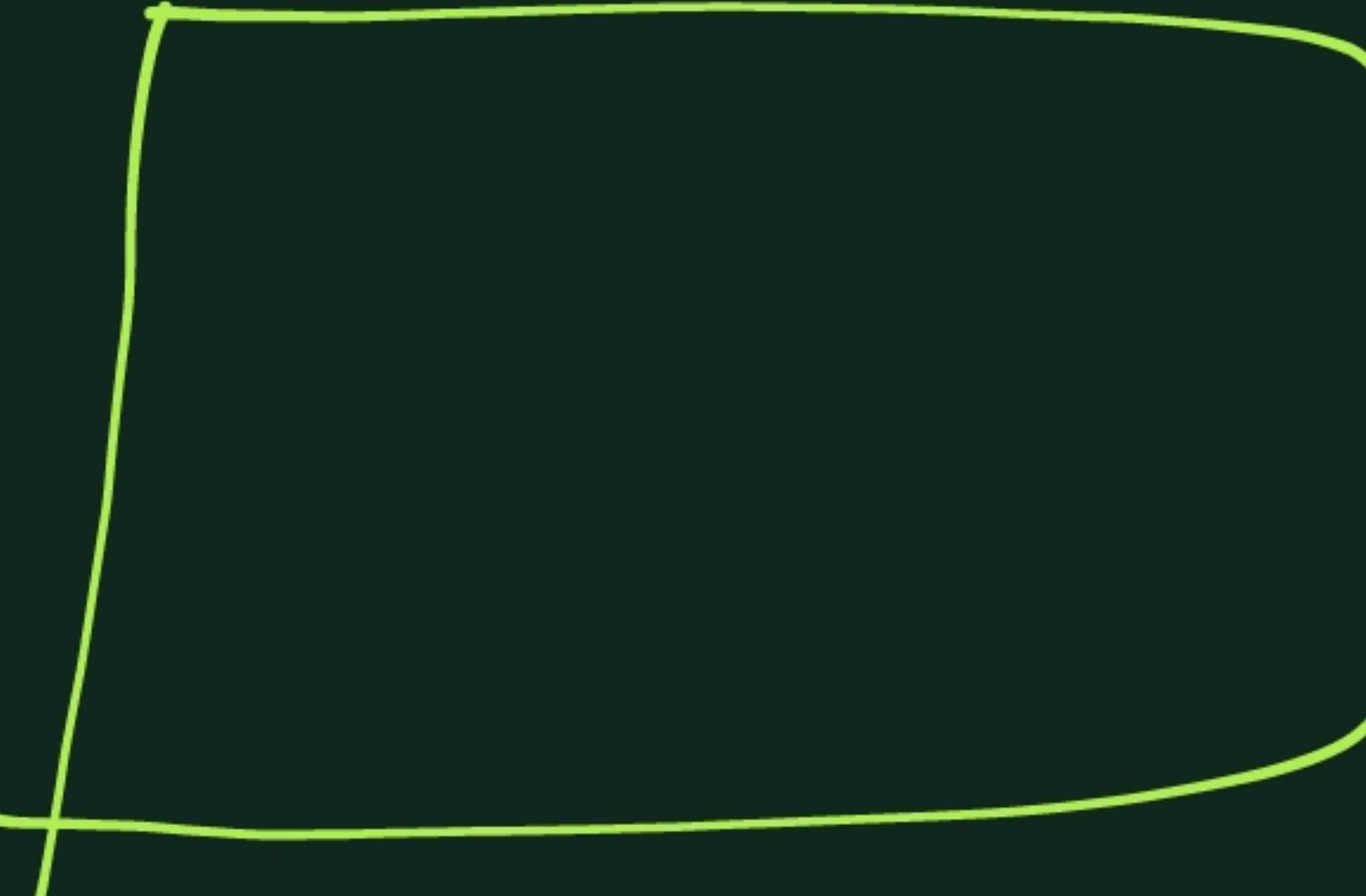
FA + 1 Stack

0ⁿ 1ⁿ 0ⁿ



0³ 1³ 0³
0² 1² 0⁴

a b a b b a b a
w w^R





Thank You

