Theory of Computation

Basics/DFA

Lecture 5/6

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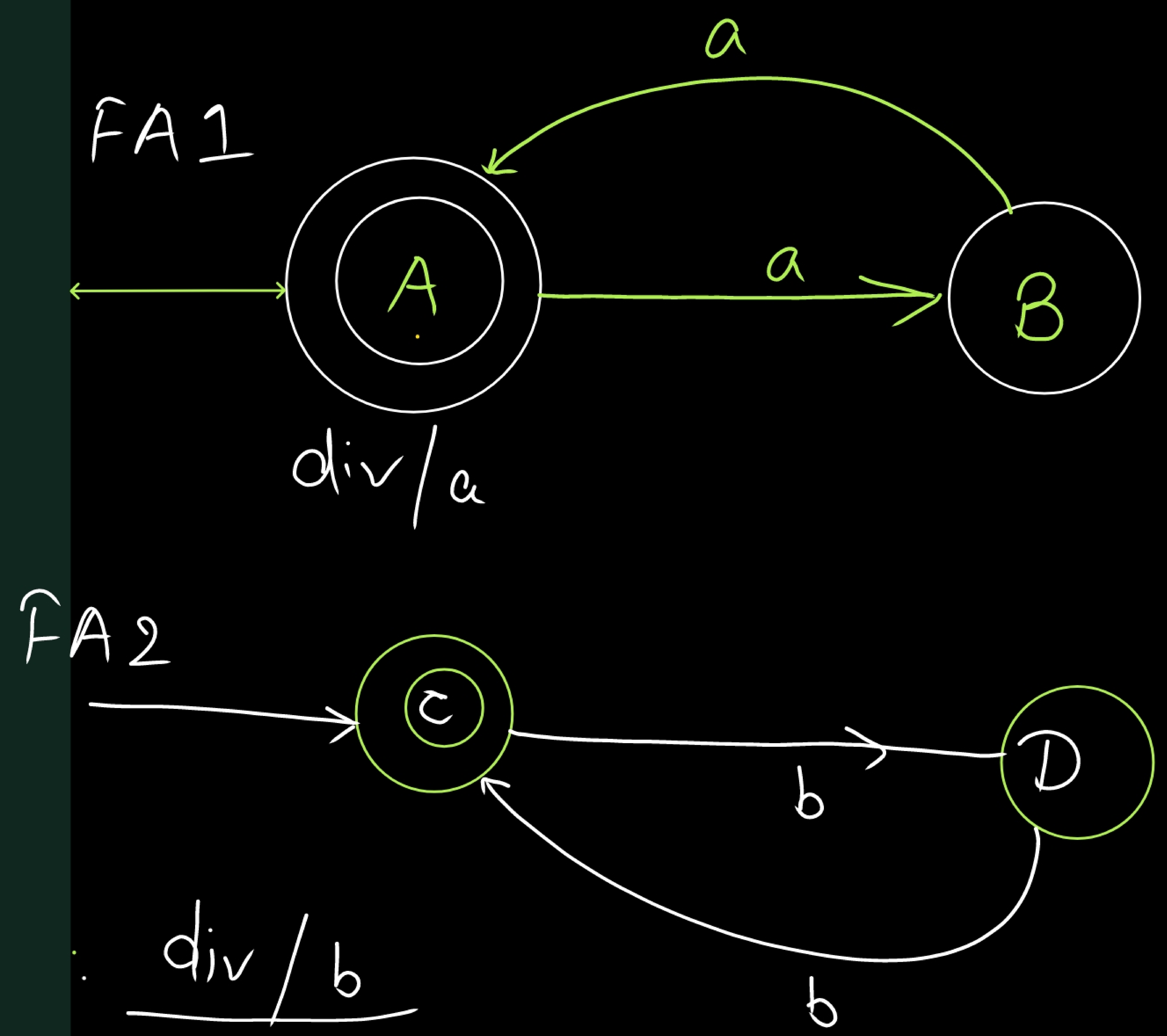
1. Construct minimal Finite Automata that accepts all strings of a's and b's, where the length of the no of a's and no of b's are divisible by 2.

OR

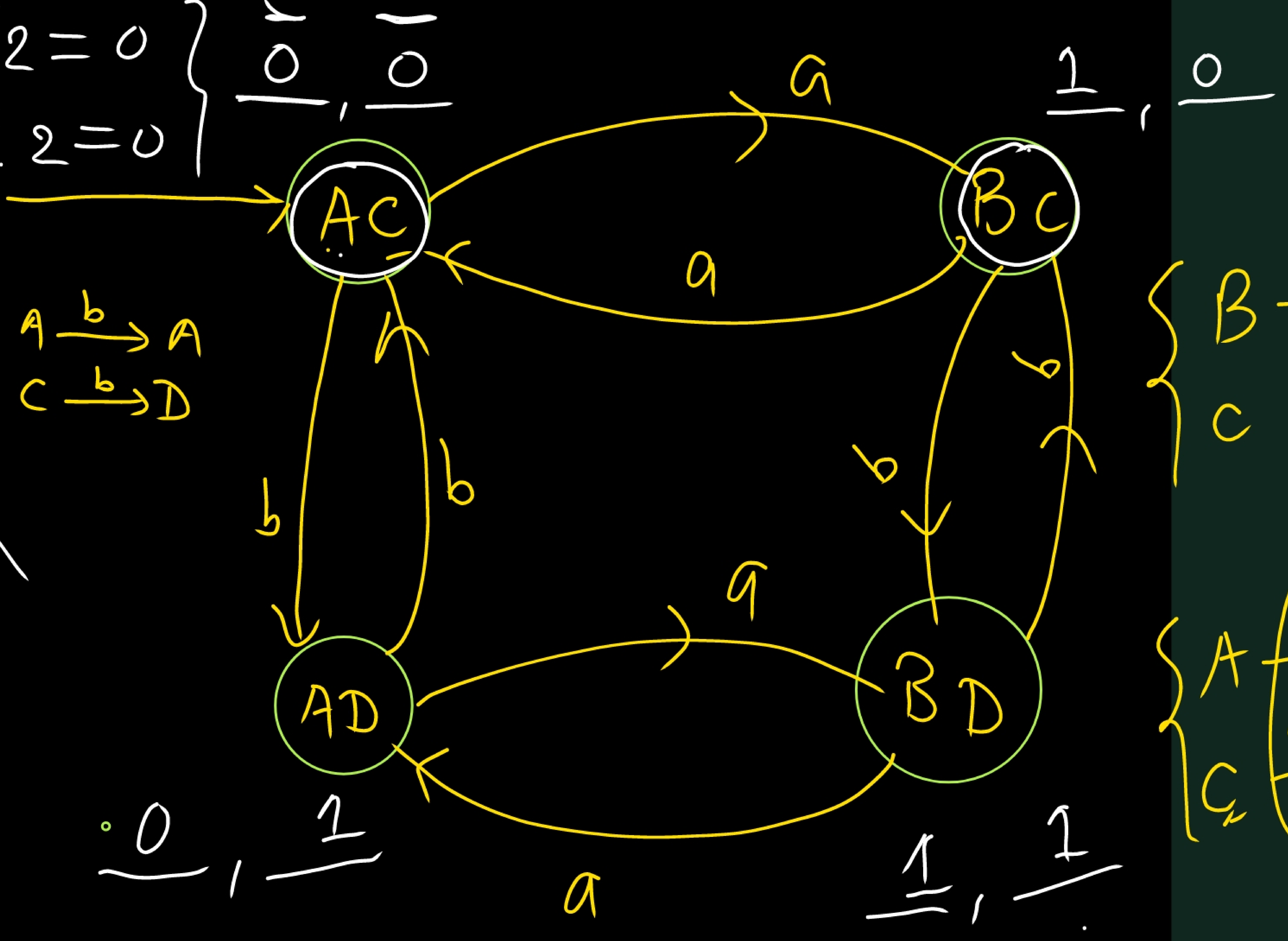


$\{A, B\} \times \{C, D\} = \{AC, AD, BC, BD\}$

$\left\{\begin{array}{l} n_a \% 2 = 0 \\ n_b \% 2 = 0 \end{array}\right.$

$A \xrightarrow{b} A$

$C \xrightarrow{b} D$



$\left\{\begin{array}{l} B \xrightarrow{a} \\ C \rightarrow \end{array}\right\}$

$\left\{\begin{array}{l} A \xrightarrow{a} \\ C \xrightarrow{a} \end{array}\right. B$

$n_a \% 3 = 2$

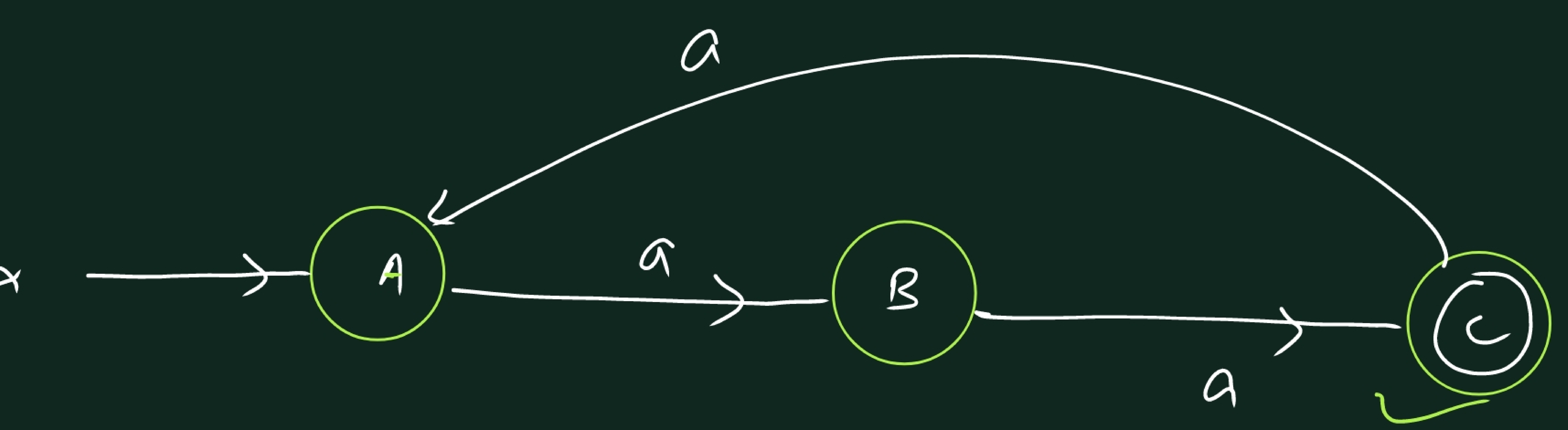
$n_b \% 3 = 1$

$n_a \% 3 = 0$

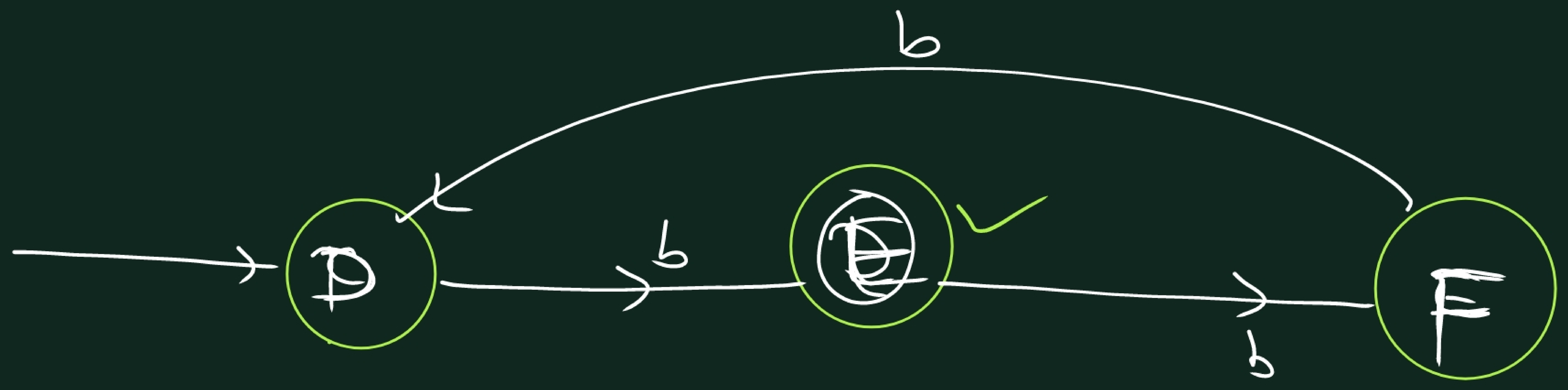
FA1

$n_b \% 3 = 0$

FA2

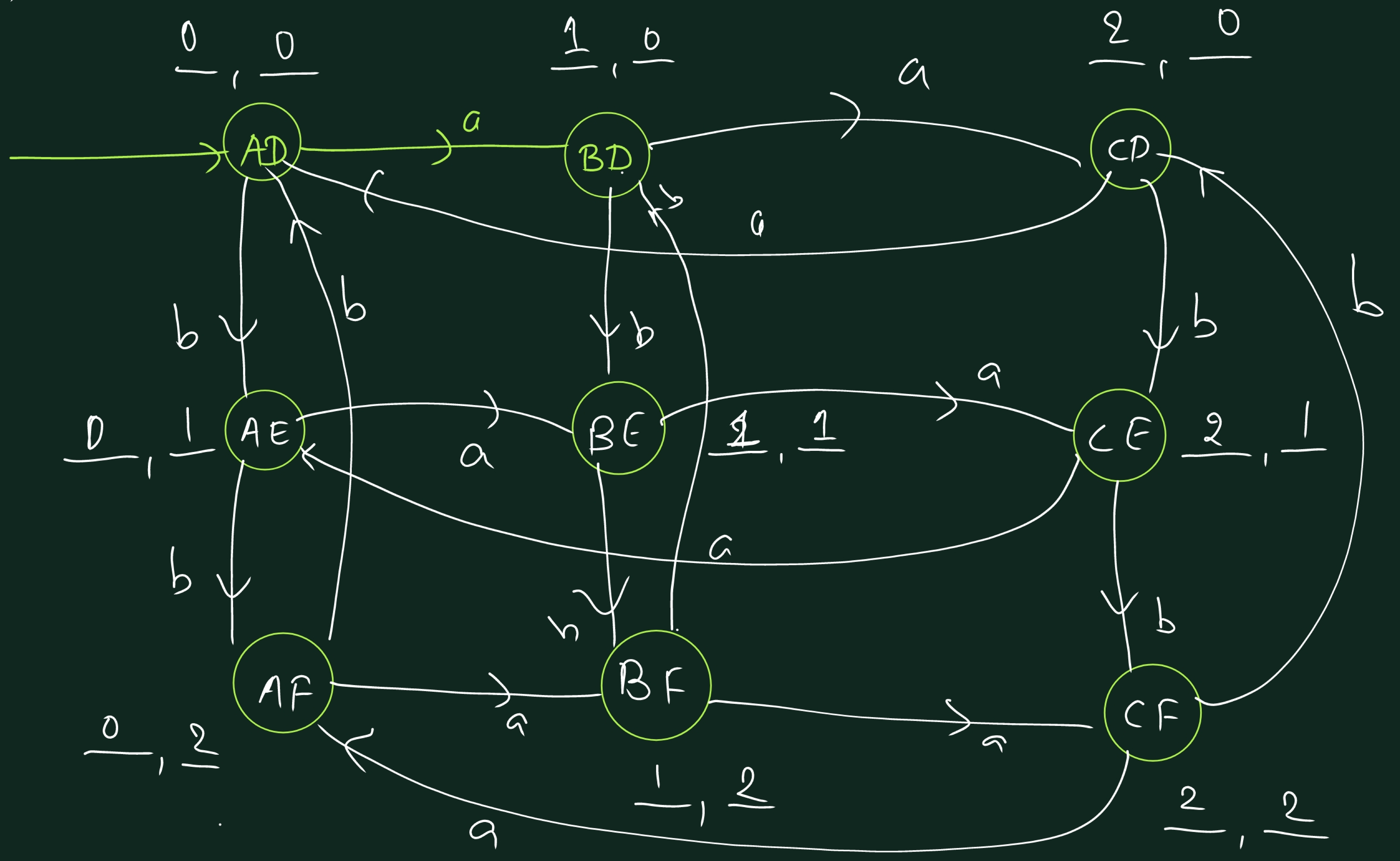


$AD \xrightarrow{a} BD$



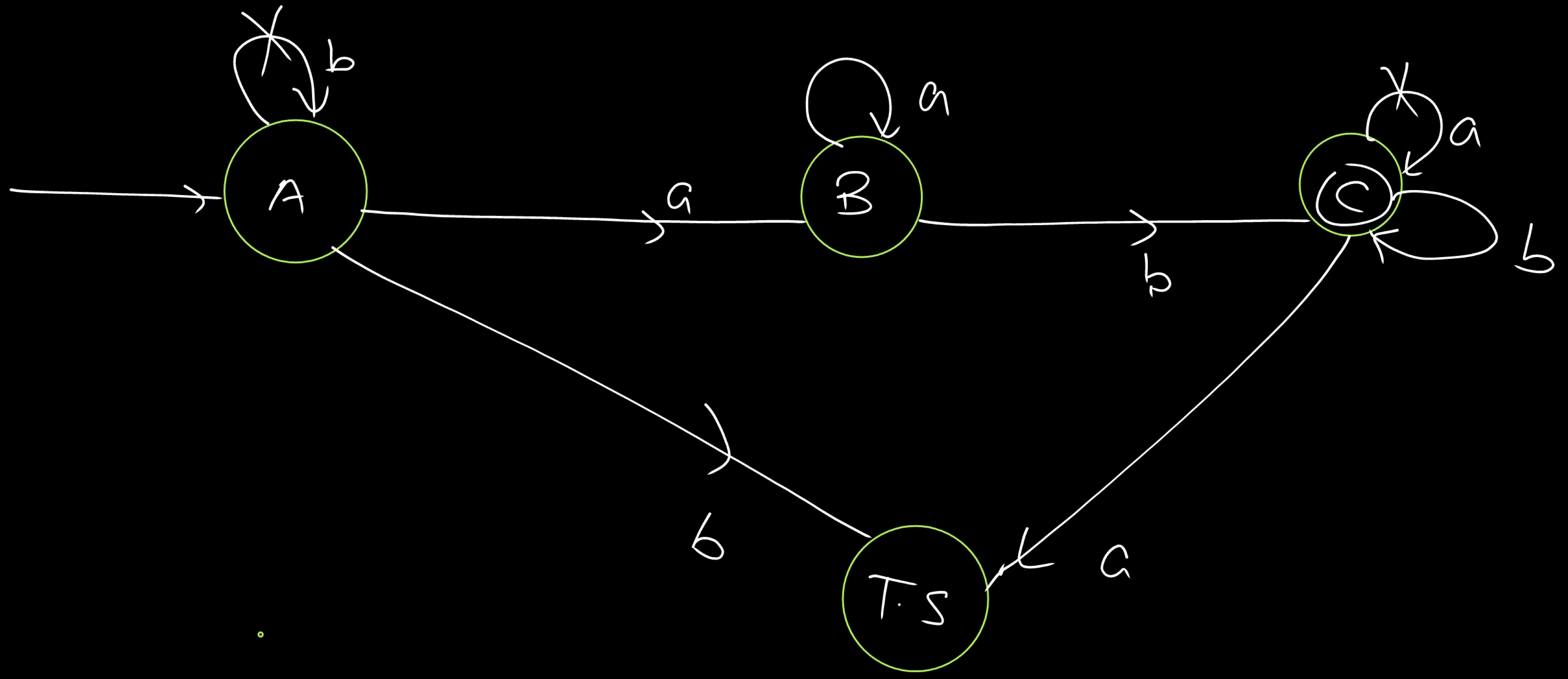
$\{A, B, C\} \times \{D, E, F\} = \{AD, AE, AF, BD, BE, BF, CD, CE, CF\}$

$n_a \% 3 =$



2. Construct minimal Finite Automata for the language L = { $a^m b^n$ | m, n >= 1}.

{ab, aab, aaab, abbbbb ...}



$L = \{a^n b^n : n >= 1\}$ min DFA

Yes	NO
	✓

Q : no. of States

Σ : $\{0, 1\}$

L : divisible by 3.

000	→ 0
001	→ 1
010	→ 2
011	→ 0
100	→ 1
101	→ 2
110	→ 0

$n \% 3 = 2$

$(2n+1) \% 3 = 2$

0 → $0 \% 3 = 0$

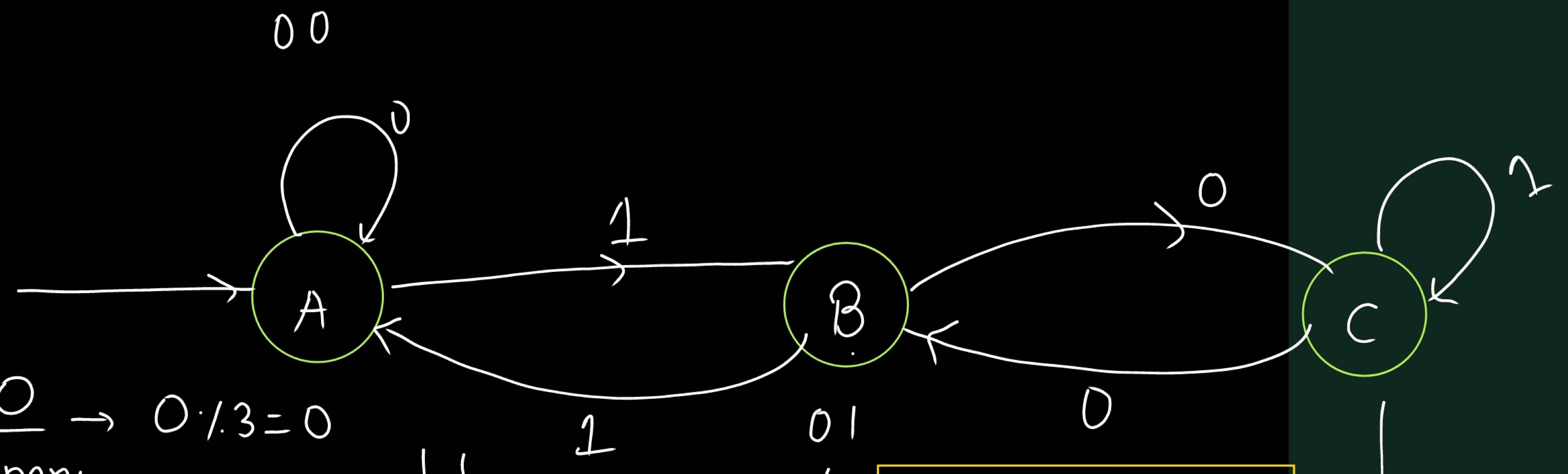
Binary

01 → $1 \% 3 = 1$

010 → $2 \% 3 = 2$

011 → $3 \% 3 = 0$

0100 → $4 \% 3 = 1$



0101 1

		0	1
0	A	A	B
1	B	C	A
2	C	B	C

2

2

1

$F.A : \{Q, \Sigma, \delta, q_0, F\}$

Q → no. of States $\{q_0, q_1, q_2, T.S\}$

Σ → Alphabets $\{a, b\} = \Sigma$

δ → Transition States

F → Set of final States

$F = \{q_2\}$

input tape

a	b	a	b	b

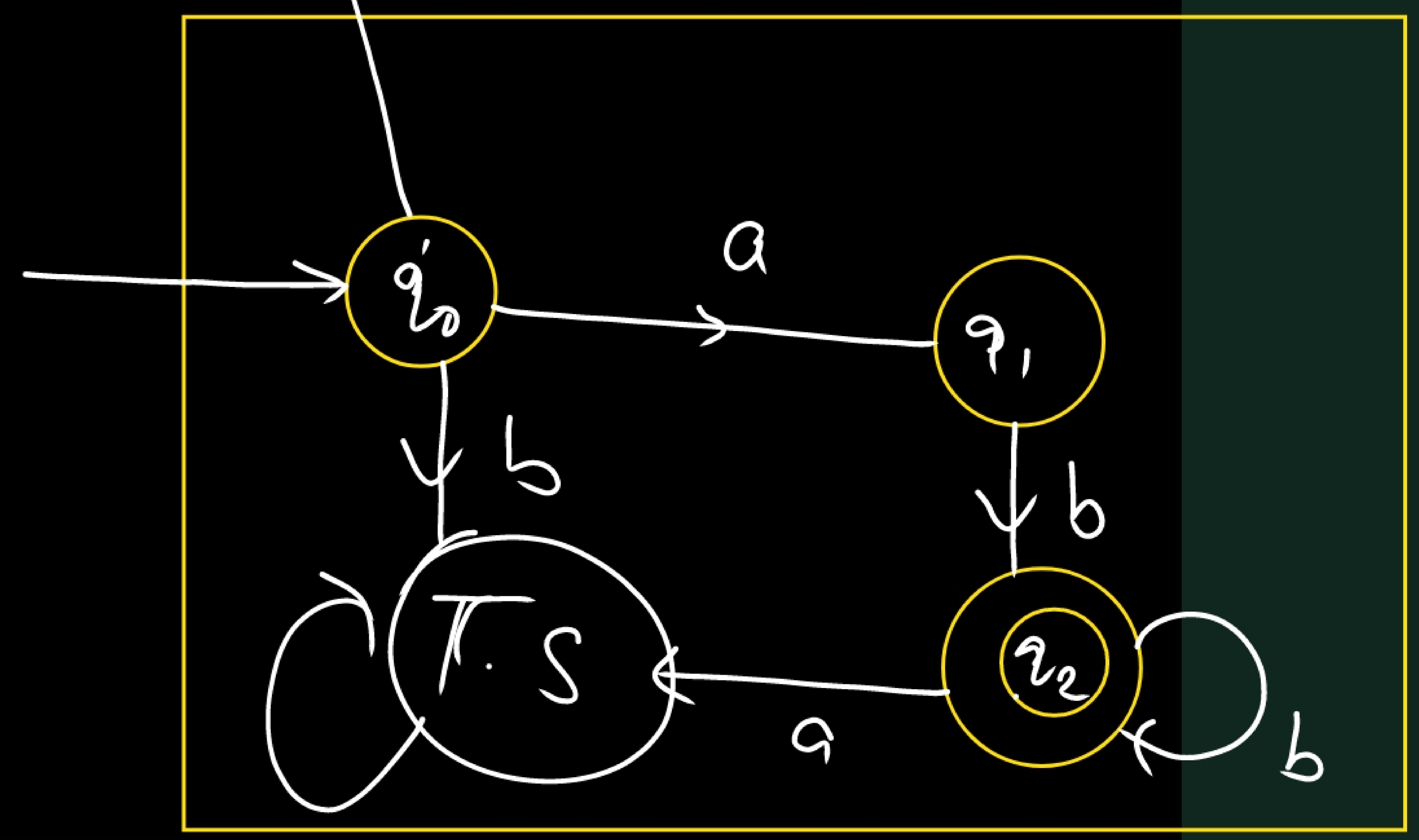
R/W head

Transition table

δ

	a	b
—		
—		
—		
—		

Transition diagram



DFA

NFA

F.A

F.A $\longrightarrow$ Reg lang $\longrightarrow$ Reg gra $\longrightarrow$ Type-3

PDA $\longrightarrow$ Contex free lang $\longrightarrow$ CFG $\longrightarrow$ Type-2

LBA $\longrightarrow$,, Sensitive ,, $\longrightarrow$ CSG $\longrightarrow$ Type-1

TM $\longrightarrow$ R.E $\longrightarrow$ Free $\longrightarrow$ Type-0

F.A

{ DFA | NFA | FSM } → Finite Acceptor

Recognizer

$w \in L$, Halts at Final State

$w \notin L$, " " Non-final "

It always halts.

Thank You