Undecidability - VI

Complete Course on Theory of Computation

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Decidable problems of CFL

1. Emptiness
2. Finiteness
3. membership

CFG ⟹ Reduced Grammar

(1) E. not reachable productions from Start S.

(2) If any production not generating atleast 1 string then delete that production

CYK – Algo

CFG, x ⟹ yes / No

O(n3) , DP

1 Rules

$S \rightarrow AB$

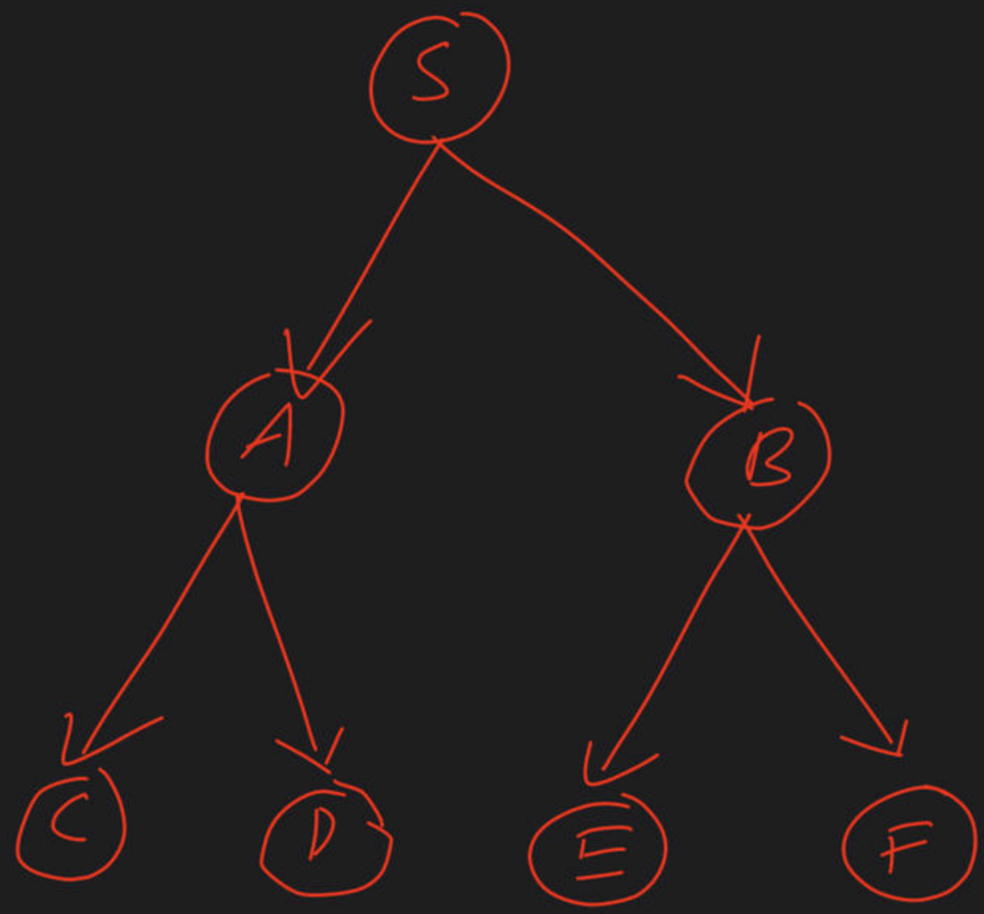
$A \rightarrow CD \mid a$

$B \rightarrow EF \mid b$

$C \rightarrow a \quad D \rightarrow b$

$E \rightarrow e \quad F \rightarrow f$

2 Dep



3 no-cycle $\Rightarrow$ finite lang

(1)

$S \rightarrow AB \mid a \mid as$

$A \rightarrow BS \mid b$

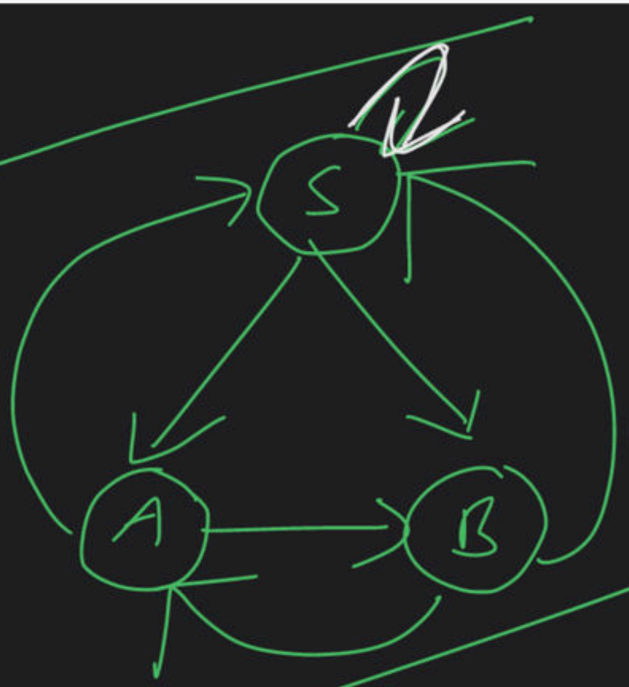
$B \rightarrow AS \mid d$

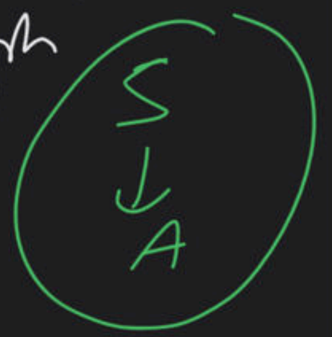
~~$E \rightarrow FG$~~

~~$F \rightarrow f \quad G \rightarrow g$~~

RG

(2) Dependency graph

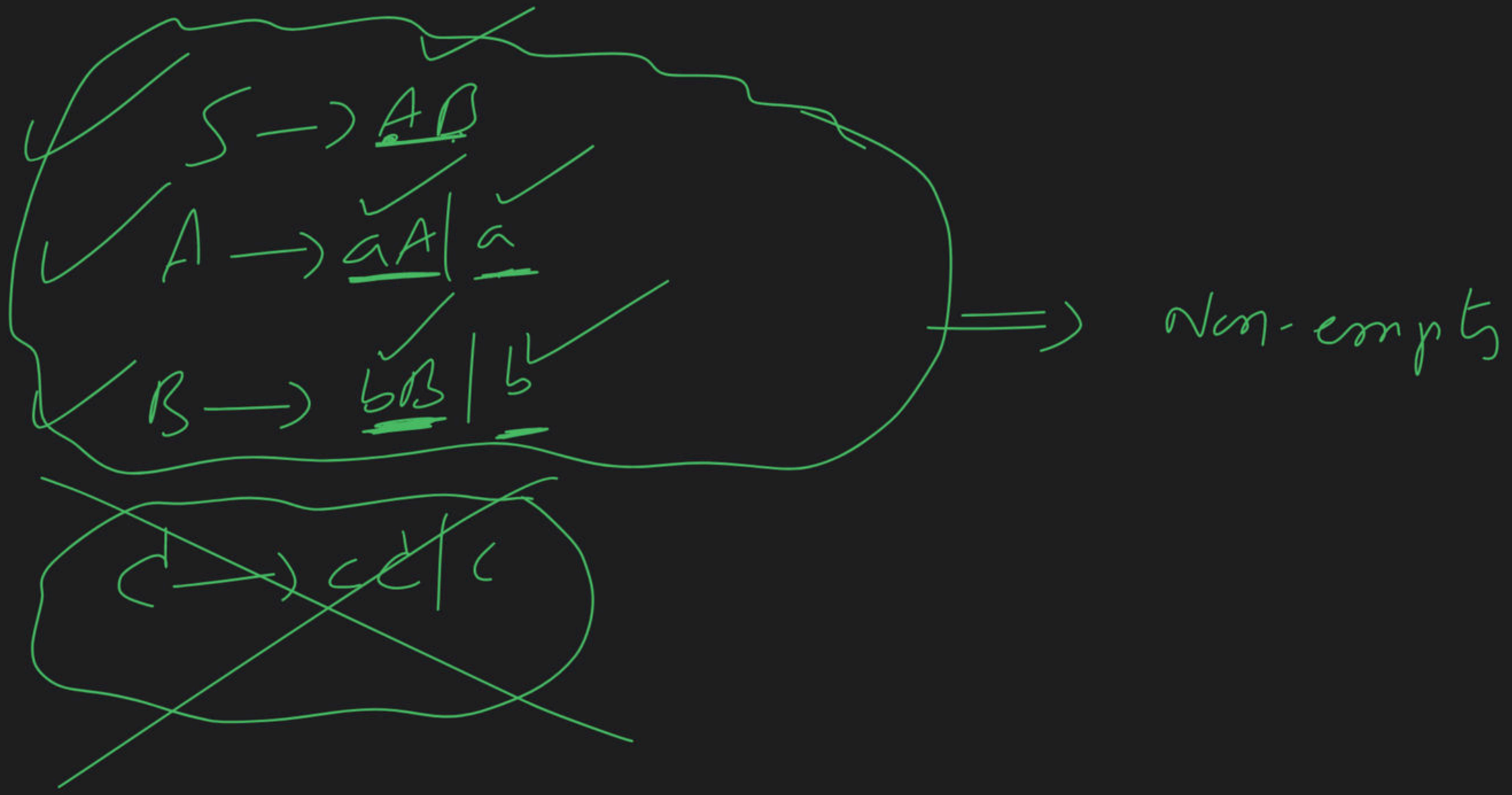




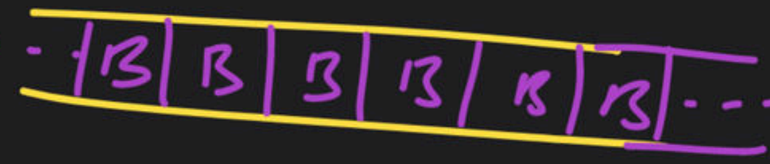
$S \longrightarrow A$

(3) Loop $\Longrightarrow$ infinite length.

~~Loop~~ $\Longrightarrow$ finite length


S → AD
A → aA | a
B → bB | b
C → cC | c
⟹ Non-empty

Turing Machine



160
60
30
10

FA + 1- stack $\Longrightarrow$ PDA

FA + 2- stack $\Longrightarrow$ TM
(or)
PDA + 1- stack $\Longrightarrow$ TM

$\Sigma \subseteq T$

$B \subseteq T$

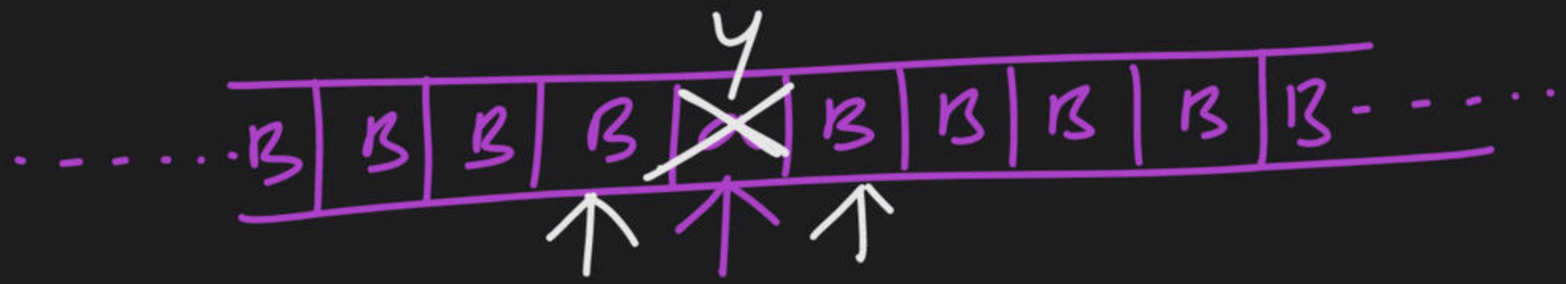
TM $M = (Q, \Sigma, \delta, s, F, T, B)$

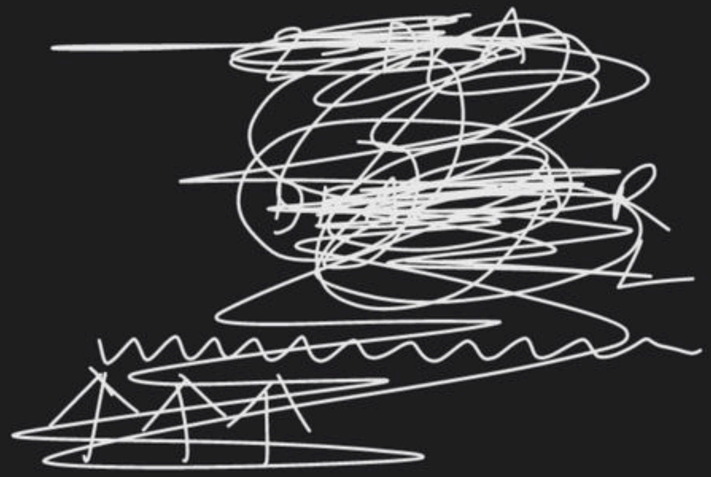
7-Tuple machine

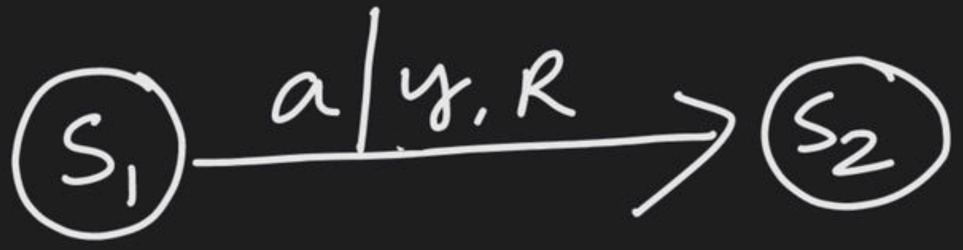
T — Tape Alphabet

B — Blank $\Longrightarrow$ Initial Tape Sym

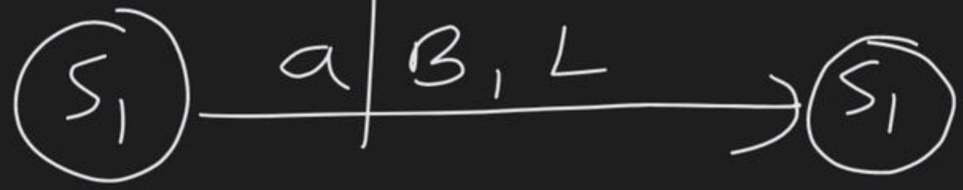
Tau



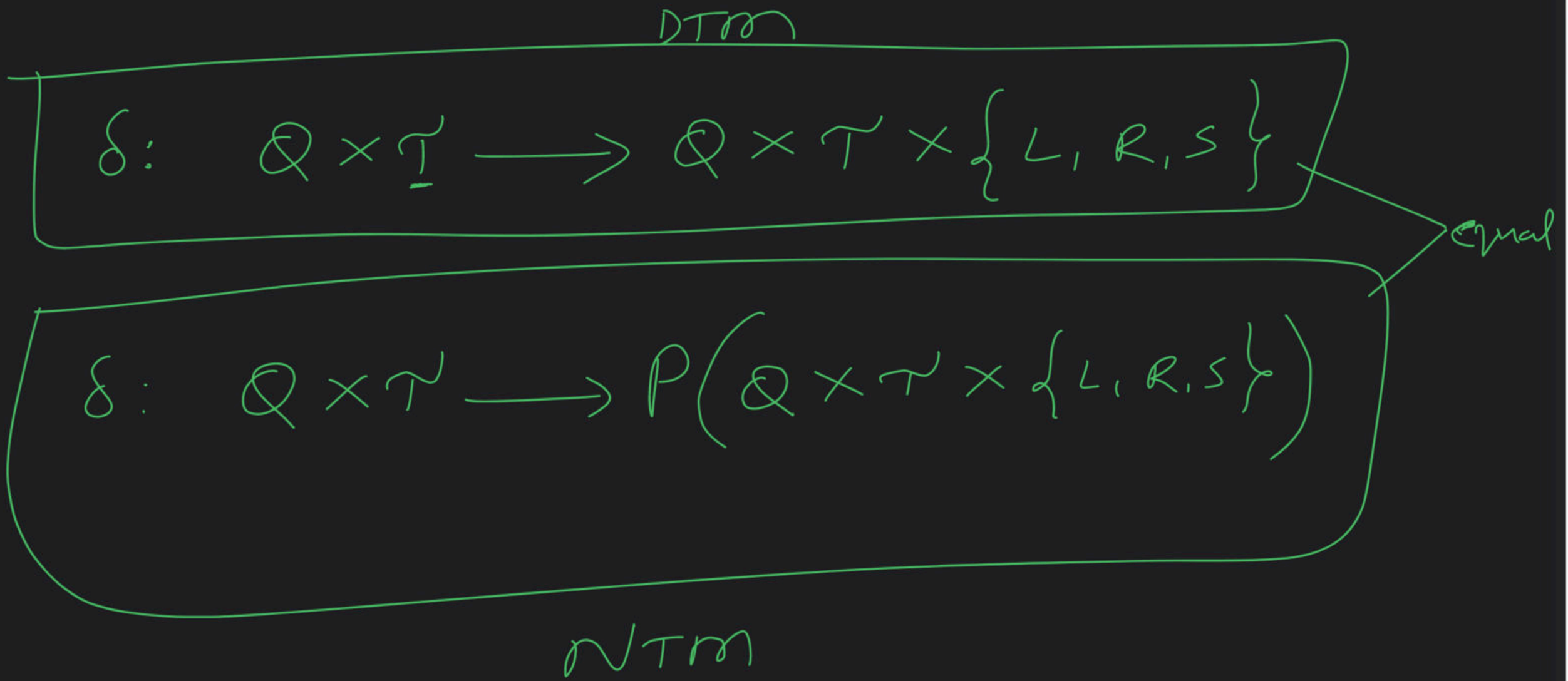


- 

(or) $\delta(S_1, a) = (S_2, Y, R)$

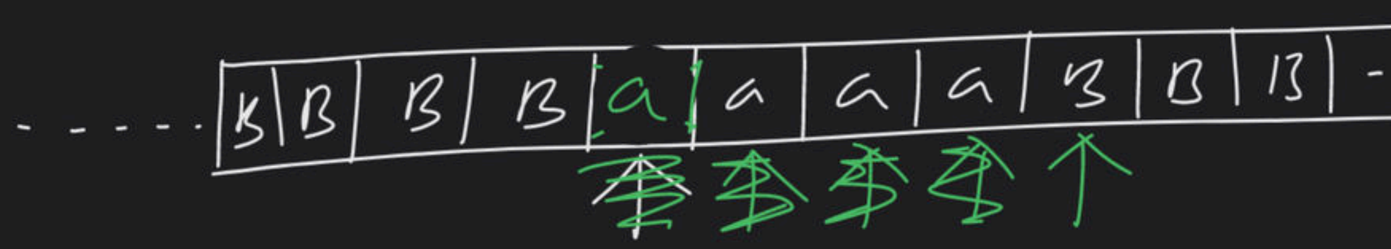
- 

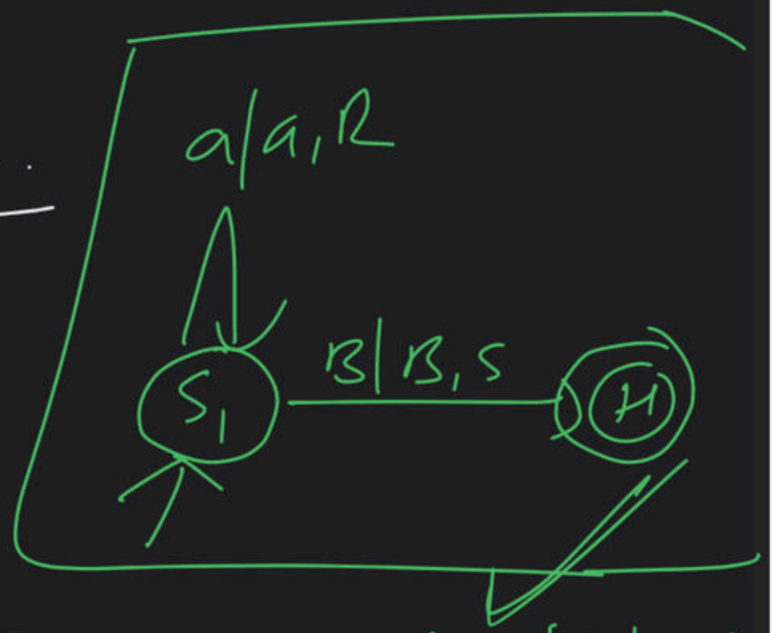
(or) $\delta(S_1, a) = (S_1, B, L)$

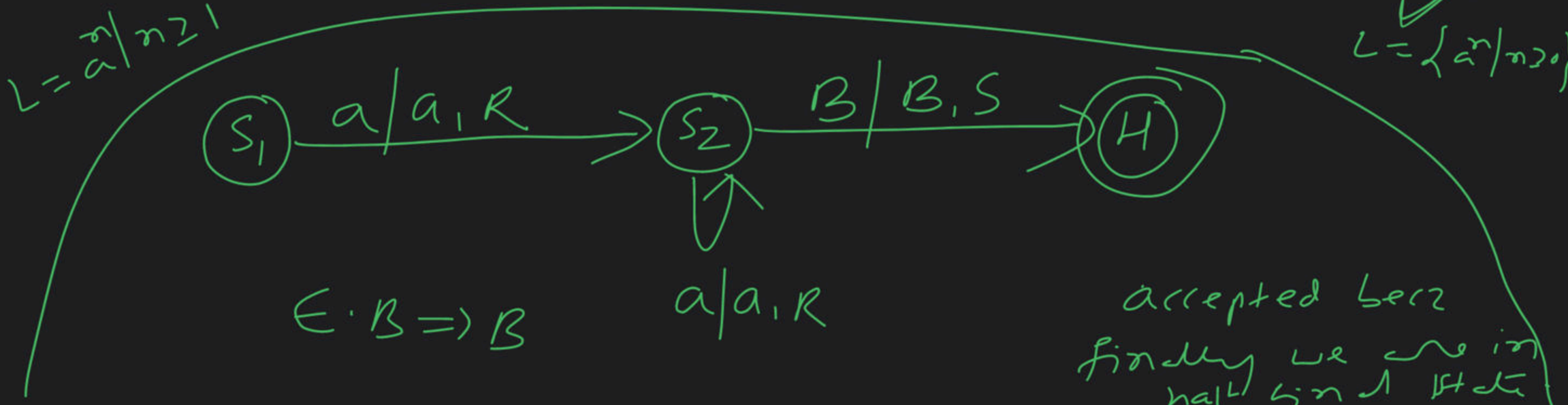

DTM
$\delta: Q \times \Gamma \longrightarrow Q \times \Gamma \times \{L, R, S\}$
Equal
$\delta: Q \times \Gamma \longrightarrow P(Q \times \Gamma \times \{L, R, S\})$
NTM

ex

Construct TM $L = \{ a^n \mid n \geq 1 \}$ ⟹ min 1-a







Thanks All