

20/8/25

CS310

Alphabet, Words, Lang
 Σ w $L \subseteq \Sigma^*$

Grammars $\langle \Sigma, V, S, P \rangle$

Machines

Regular	CFG	Type 0
FSA	PDA	TM

Language Acceptors

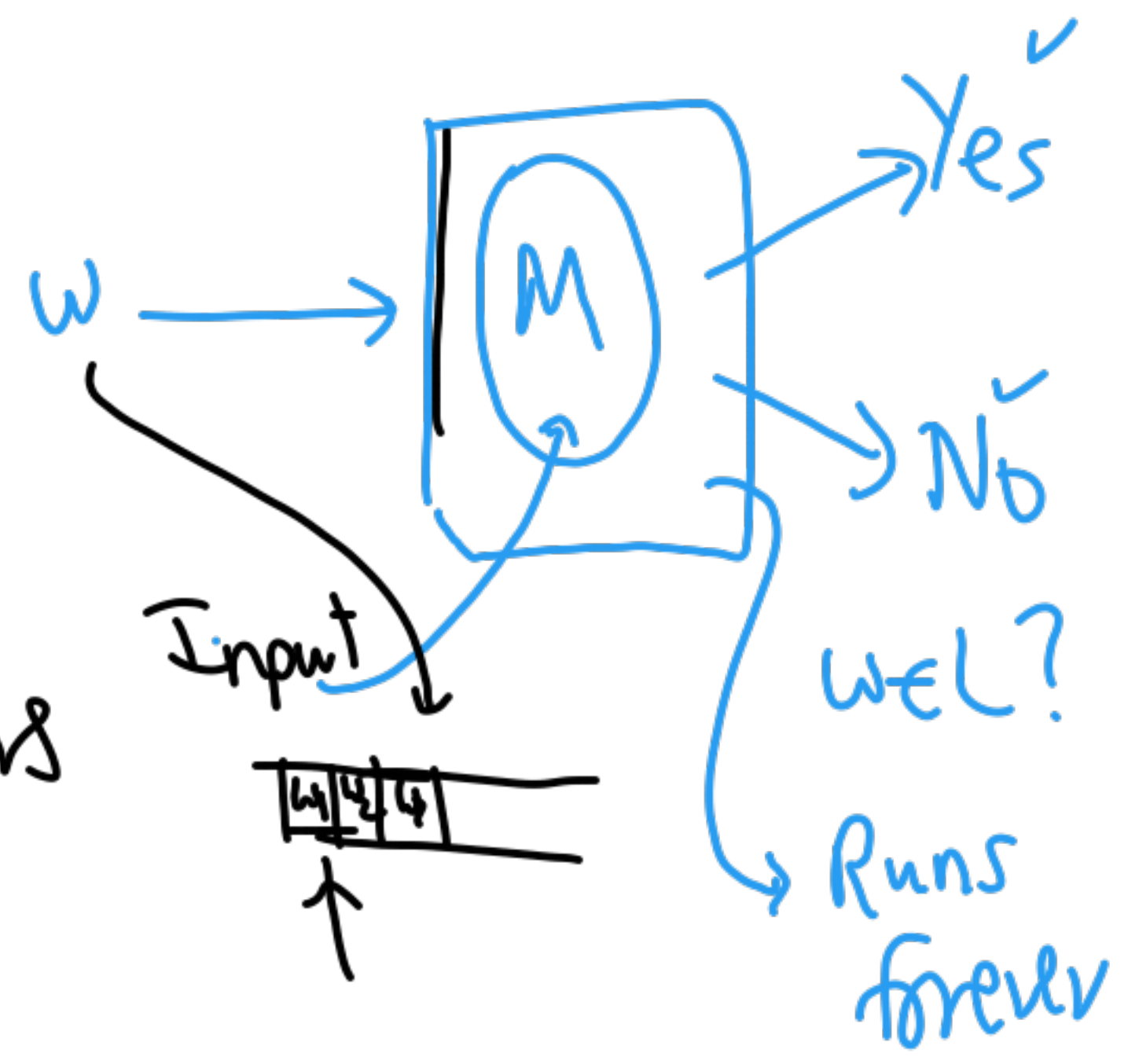
State

Transitions

RUN on an input

(1) Non-Determinism

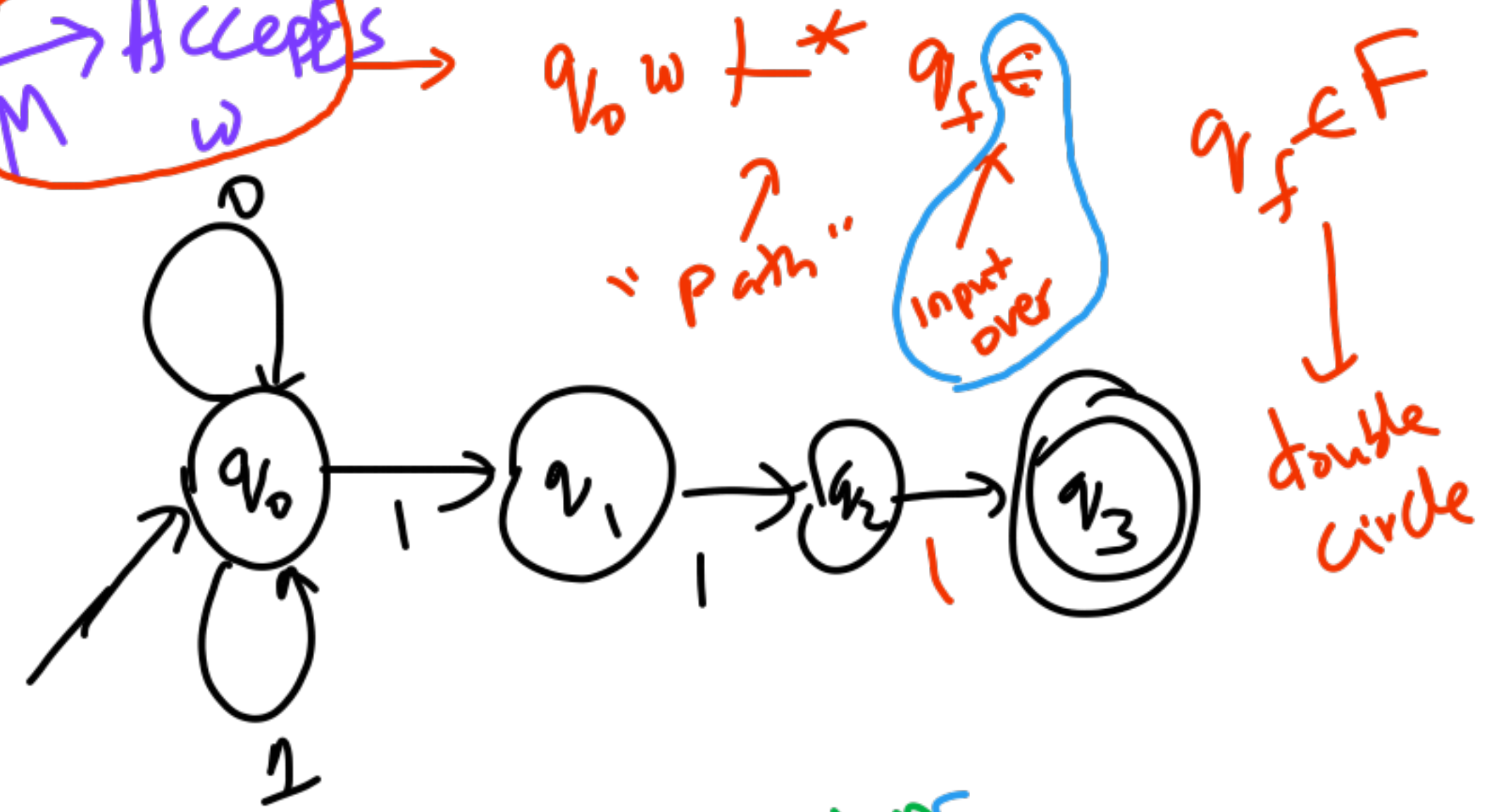
(2) ϵ -moves



Don't know non-det
try all choices

FSA \rightarrow Accepts $M \xrightarrow{w}$

$$L = \{ w \in (0+1)^* \mid w \text{ ends with } 3 \text{ 1s} \}$$



Instantaneous Descriptions

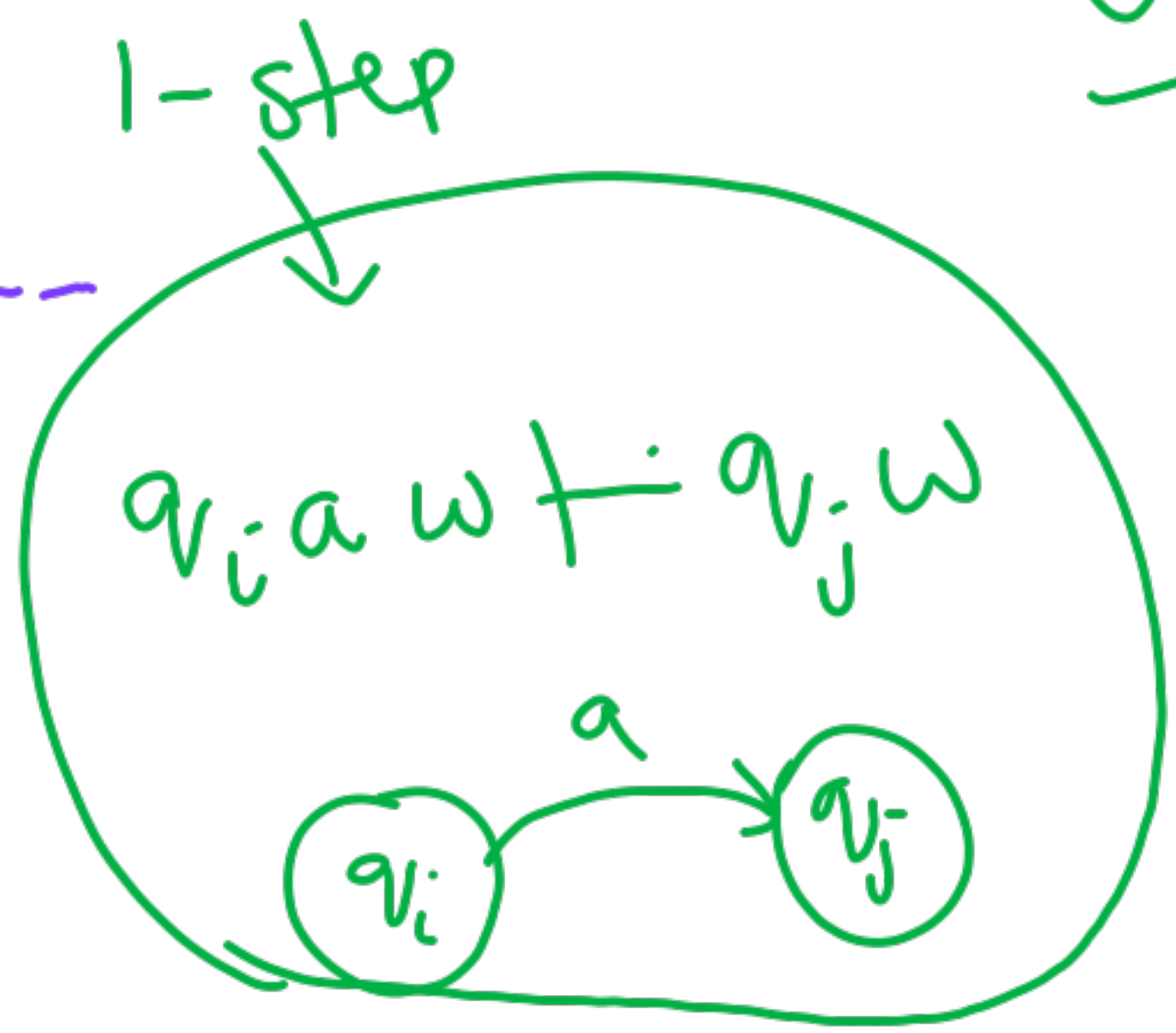


current state q
remaining input w_{rest}

One of the runs

$q_0 1 0 1 1 1$
 \downarrow
accepting run?

$q_0 w \vdash^* \dots$



$\vdash q_0 1 0 1 1$
 $\vdash q_1 0 1 1$

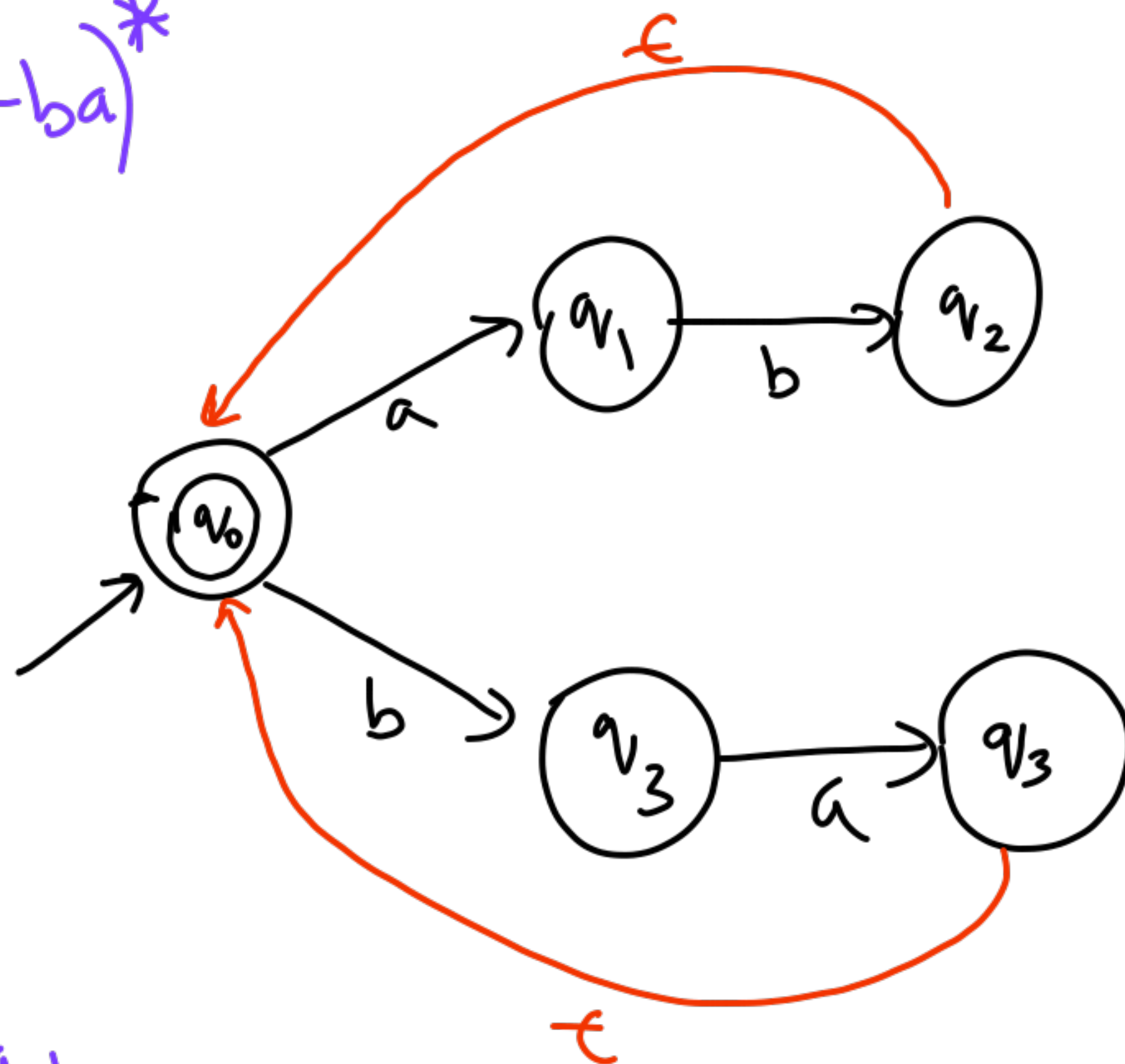
0 or more steps

ϵ -transitions

$$L = (ab+ba)^*$$

DFA

NFA -- ϵ



$$M = \langle \Sigma, Q, \delta, F \rangle$$

States

$q_0 \dots q_n$

final
 $F \subseteq Q$

transitions
"arrows"

labels

$$\Sigma \cup \{\epsilon\}$$

from q_i to q_j
 ϵ

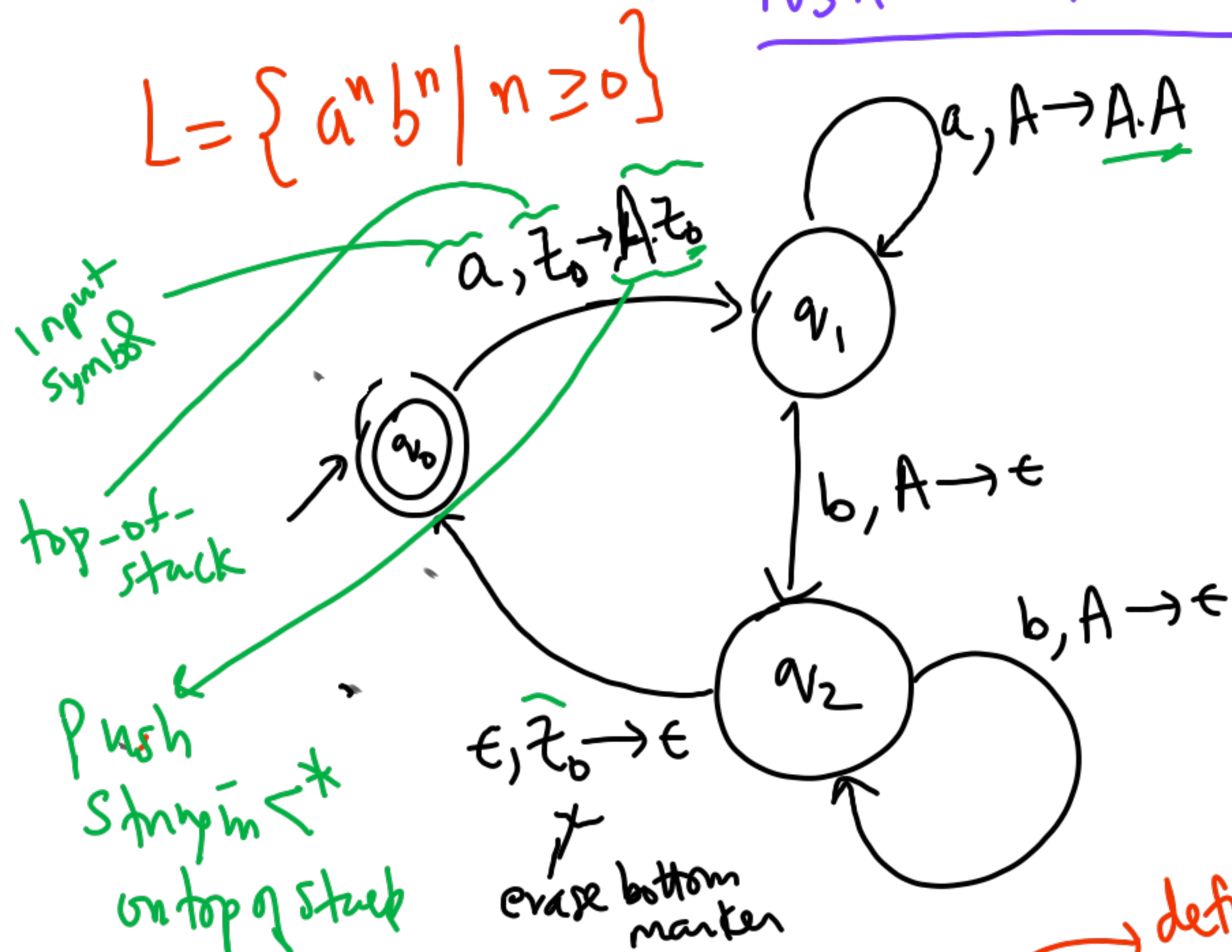
Accepting Run

$q_0 \xrightarrow{a} q_1 \xrightarrow{b} q_2 \xrightarrow{\epsilon} q_0 \xrightarrow{b} q_3 \xrightarrow{a} q_4 \xrightarrow{\epsilon} q_0 \xrightarrow{\epsilon} q_0$
stop

$q_2 \xrightarrow{\epsilon} q_0$ ϵ -tran

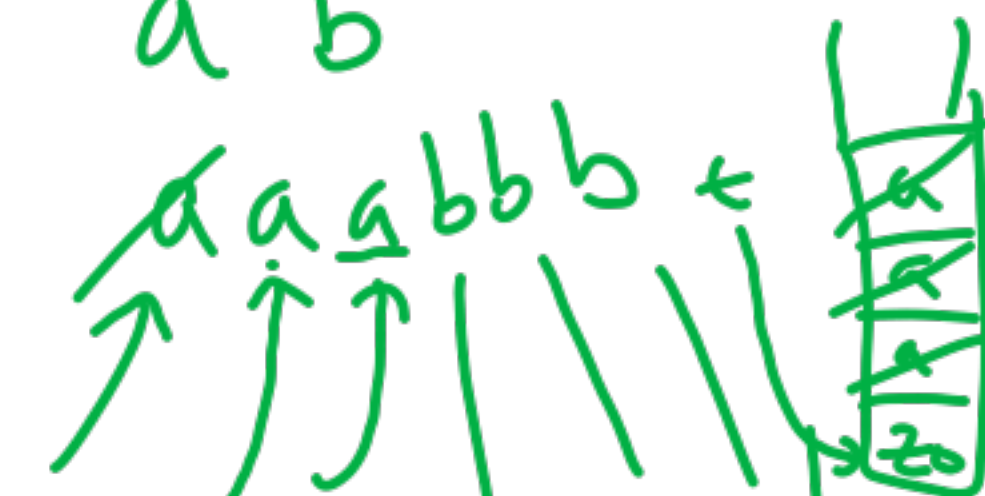
Push Down Automaton

$$L = \{a^n b^n \mid n \geq 0\}$$



$$\{A, B, \epsilon\} \subseteq \Sigma - \{z_0\}$$

Sample $a^3 b^3$



accept



$$(q_i, aw, B\gamma) \vdash (q_j, w, \alpha\gamma)$$

$$\vdash (q_0, w, z_0)$$

Tuple State input stack

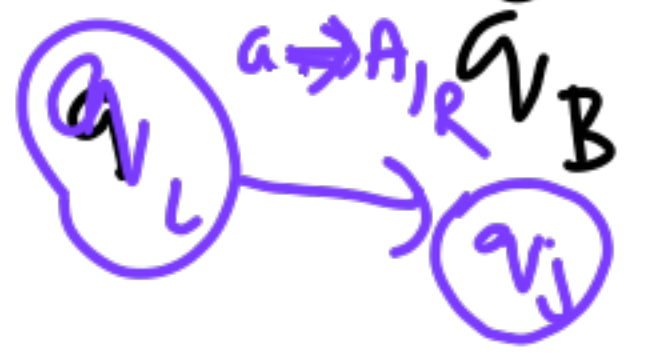
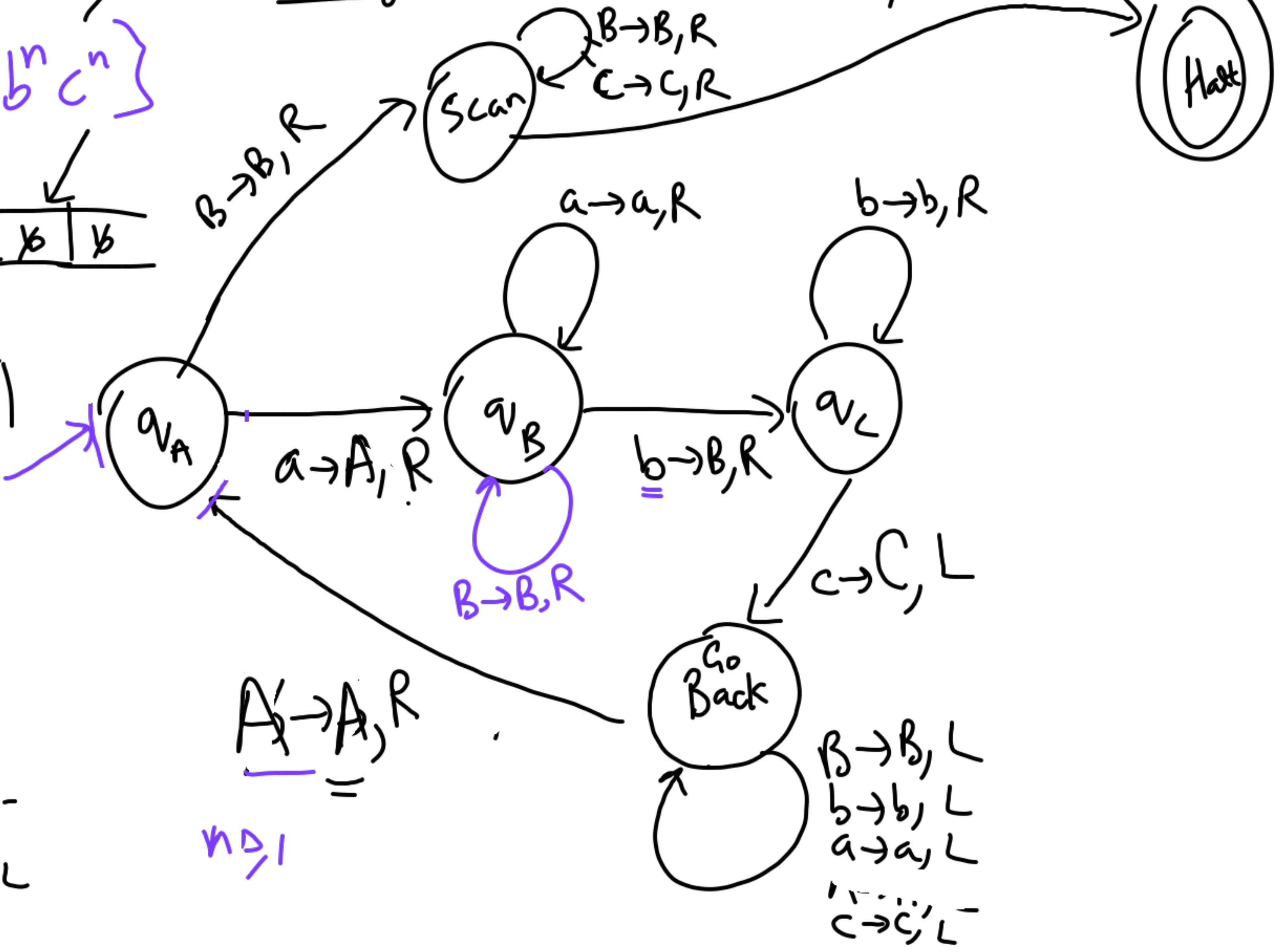
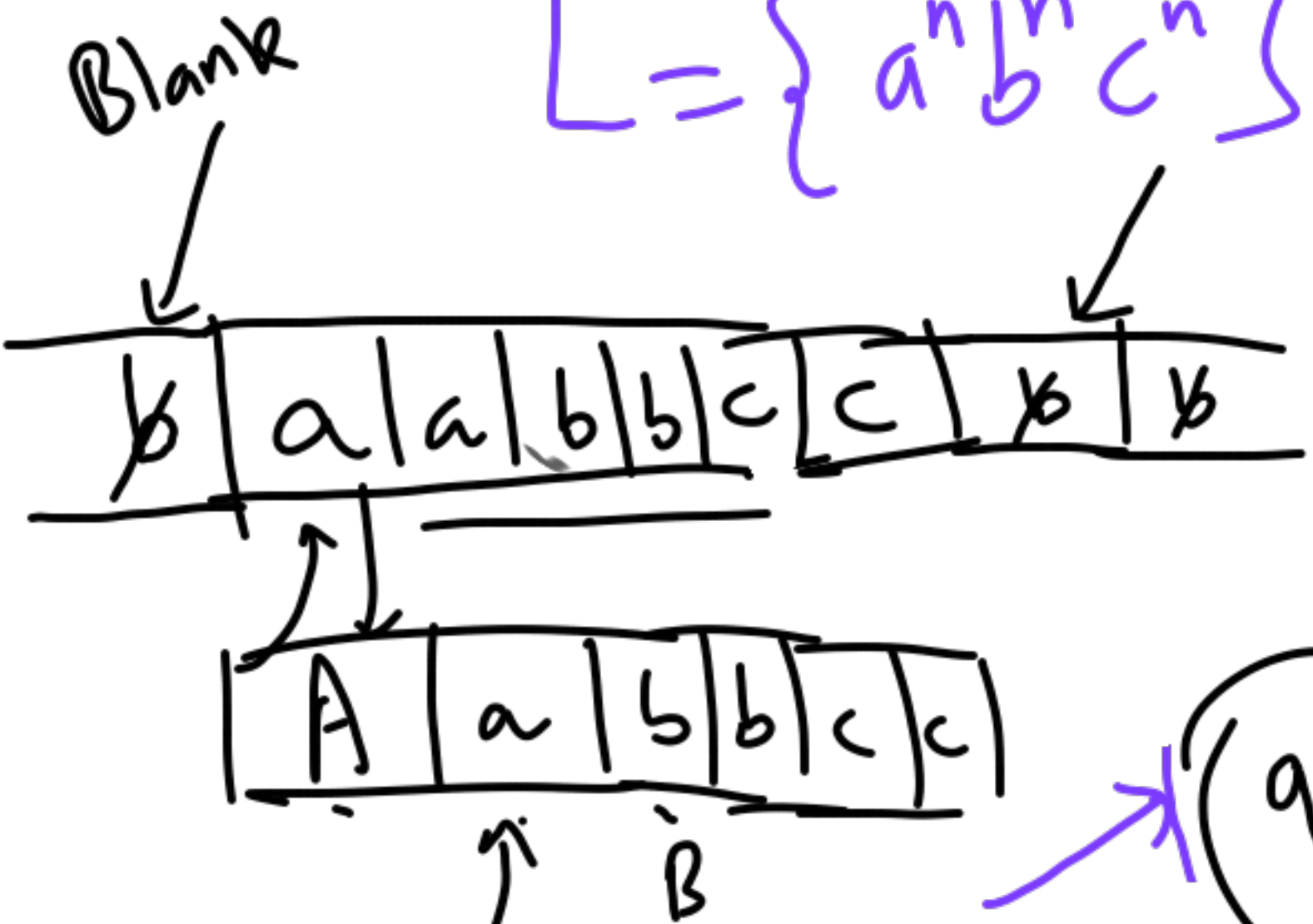
Accept by final state

after all input is consumed

turingmachine.io

n ≥ 1 Turing-Machines

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



$$\underline{w_L} q_i a \underline{w_L}$$

$$\underline{w_L} A q_i \underline{w_L}$$

$$\underline{A'} \rightarrow A, R$$

$n \geq 1$

