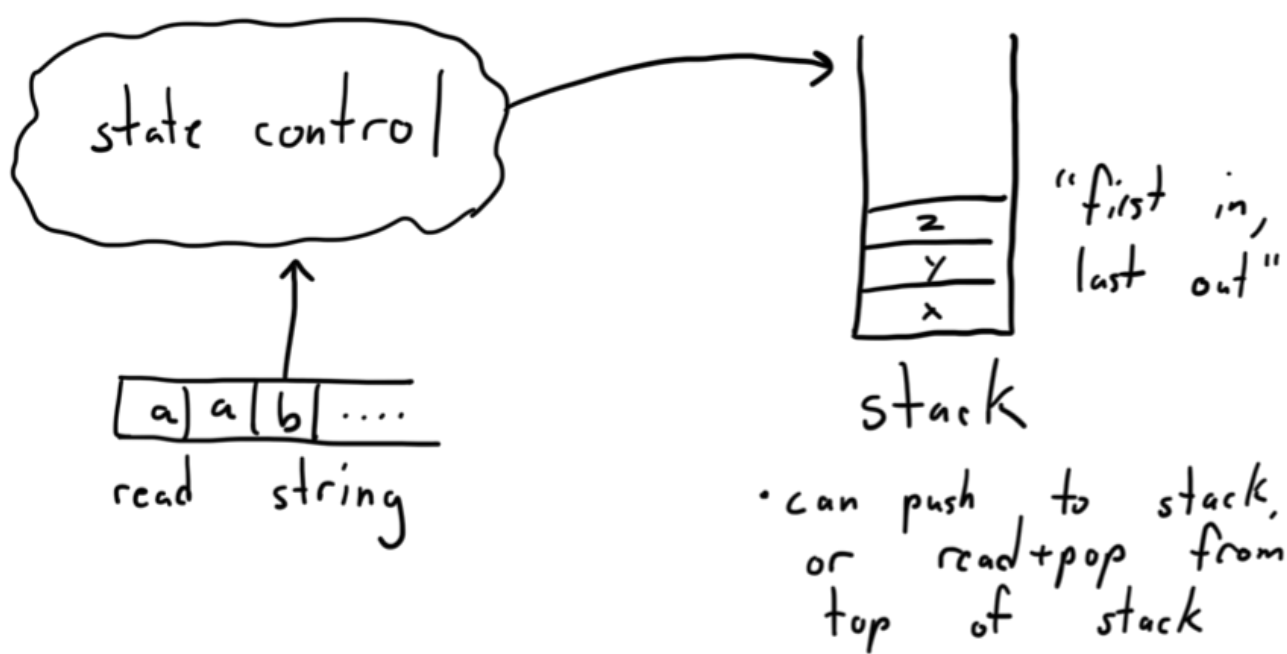


Pushdown Automata (PDA)

• PDA's and CFG's recognize CFLs



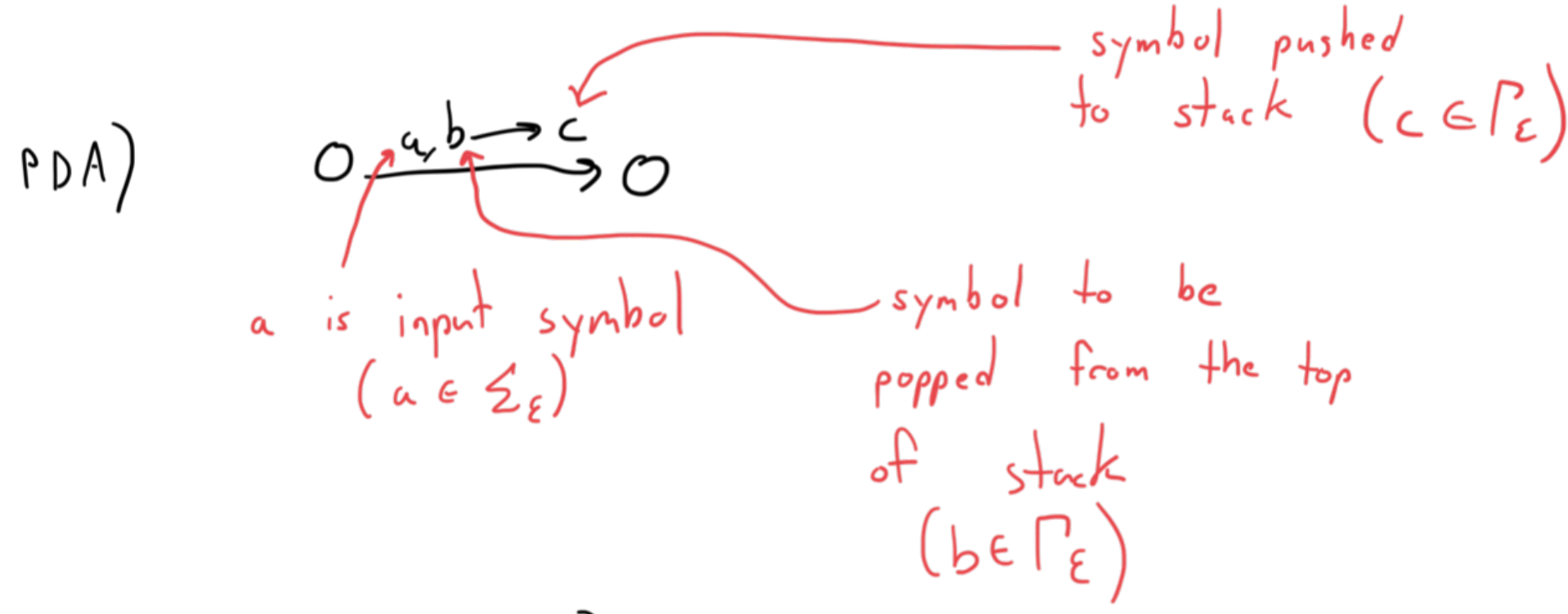
• A PDA is a 6-tuple $(Q, \Sigma, \Gamma, \delta, q_0, F)$

where:

1. Q is the set of states
2. Σ is the input alphabet
3. Γ is the stack alphabet
4. $\delta: Q \times \Sigma \times \Gamma \rightarrow P(Q \times \Gamma)$ is the transition function
5. $q_0 \in Q$ is the start state
6. $F \subseteq Q$ is the set of accepting states

• we assume PDA's are nondeterministic
NPDA's are strictly more powerful than DPDA's.

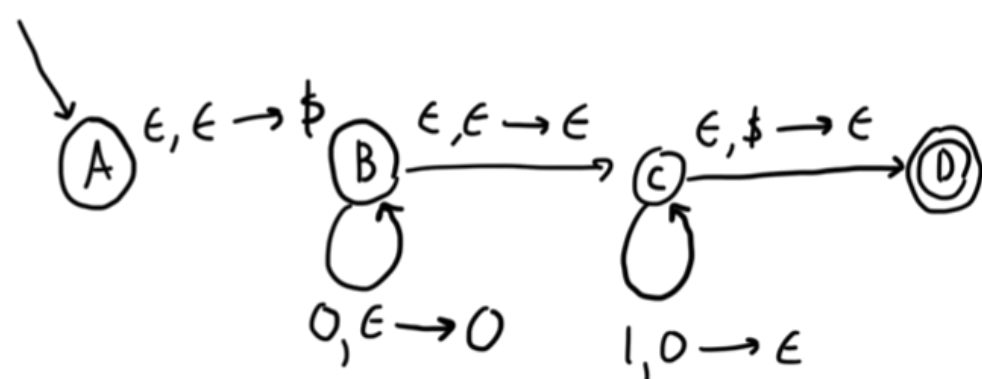
FSM) $\bigcirc \xrightarrow{a} \bigcirc$



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

$\Sigma = \{0, 1\}$ input

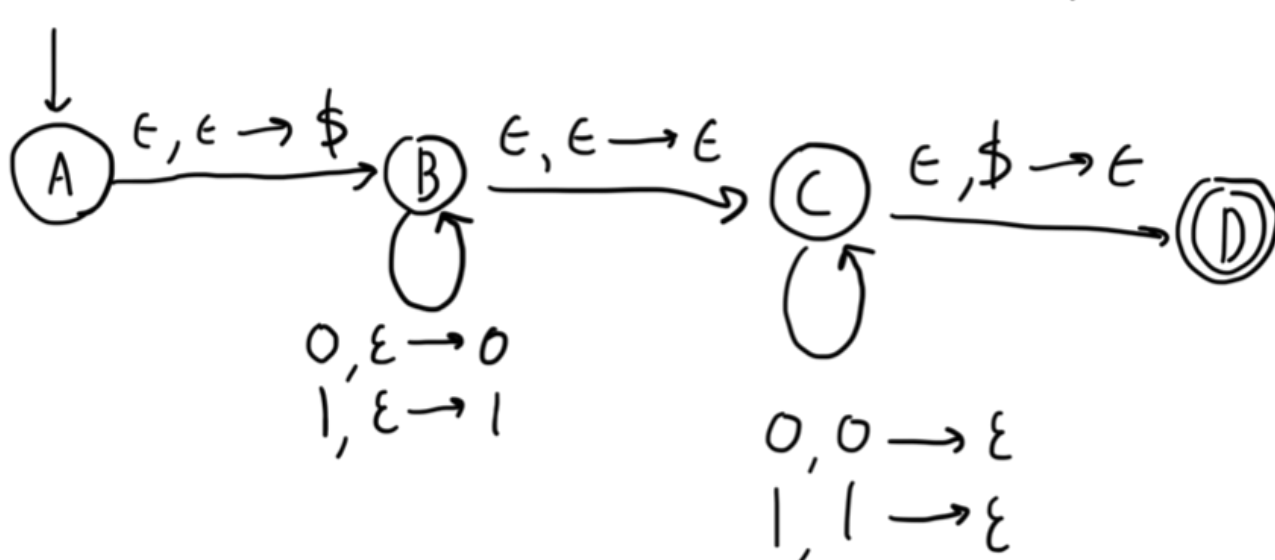
$\Gamma = \{\$, 0\}$ stack



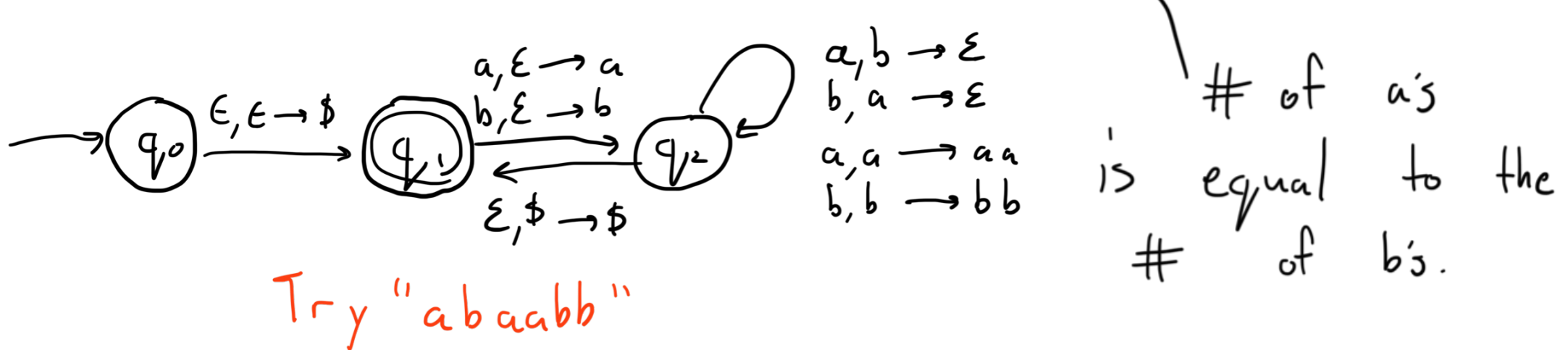
• PDA's can end with symbols on the stack (but this machine does not)

$L = \{w \in \{0, 1\}^* \mid w \text{ is a palindrome and has an even } \# \text{ of symbols}\}$

$S \rightarrow 0S0 \mid 1S1 \mid \epsilon$

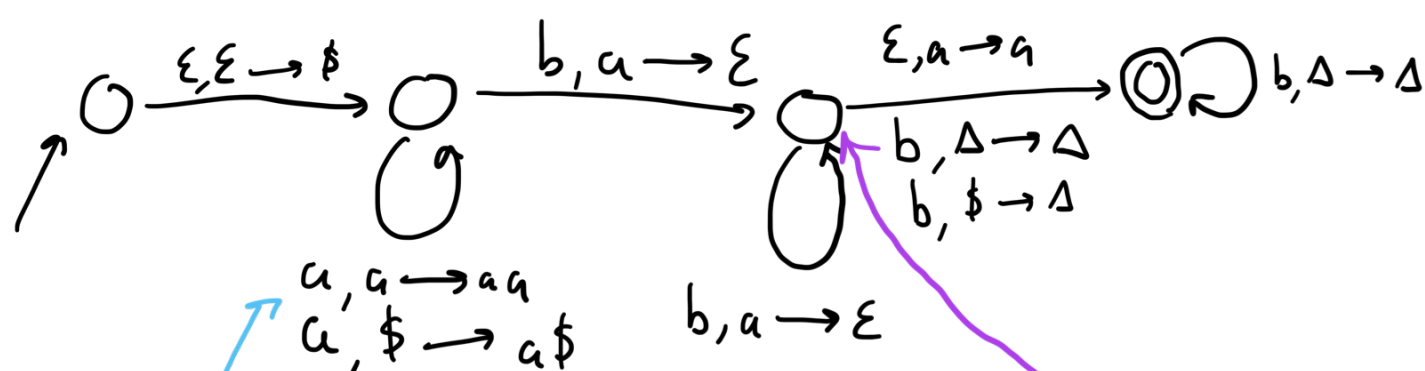


$L = \{w \in \{a, b\}^* \mid \#_a(w) = \#_b(w)\}$



of a 's is equal to the # of b 's.

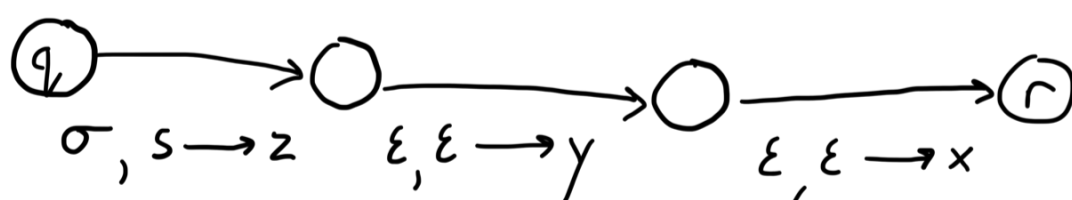
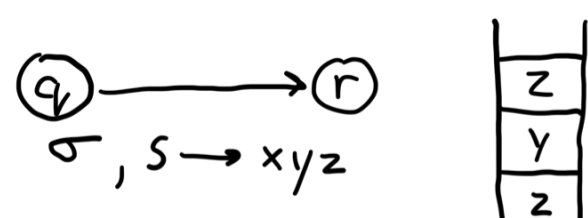
$C = \{a^m b^n \mid m \neq n \text{ and } n, m > 0\}$



Try "aabbb" and "aabb" and "aab"

this input will get stuck at the 3rd node!

Shorthand



$D = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i \in \{j, k\}\}$

$i=j \text{ or } i=k$

