DPDA

Deterministic PDA

Deterministic PDA's

- A PDA $M = (Q, \Sigma, \Gamma, \delta, q_0, z_0, F)$ is said to be deterministic if
  - $\delta(p, a, \beta) = (q, \gamma)$
    - ie. To be deterministic, there must be at most one choice of move for any state p, input symbol *a*, and stack symbol β.
  - $\delta(p, \epsilon, \beta)$ is not empty then $\delta(p, a, \beta)$ must be empty for every $a \in \Sigma$, $p \in Q$, $\beta \in \Gamma$.
    - ie. there must not be a choice between using input ϵ or real input.
    - Formally, $\delta(p, \epsilon, \beta)$ and $\delta(p, a, \beta)$ cannot both be nonempty.

Deterministic PDA: DPDA

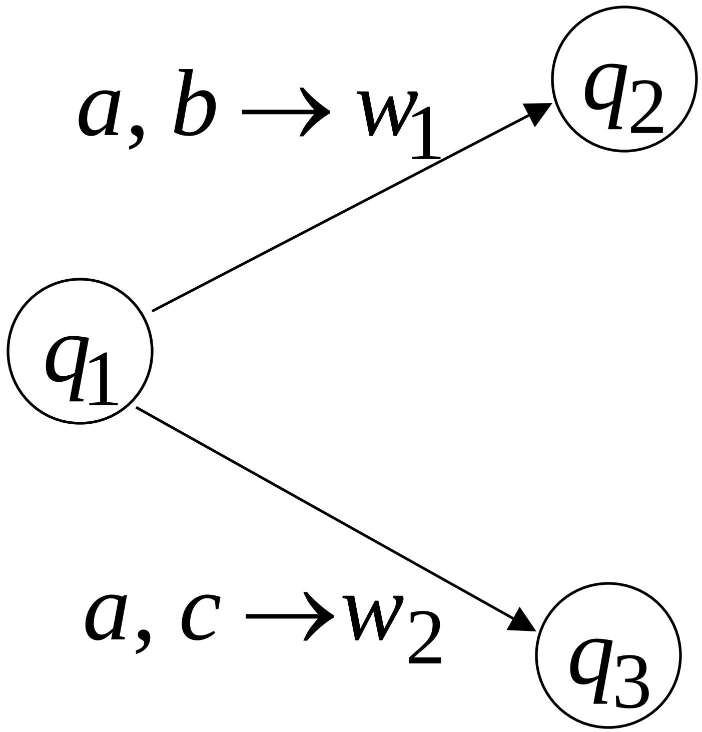
Allowed transitions:

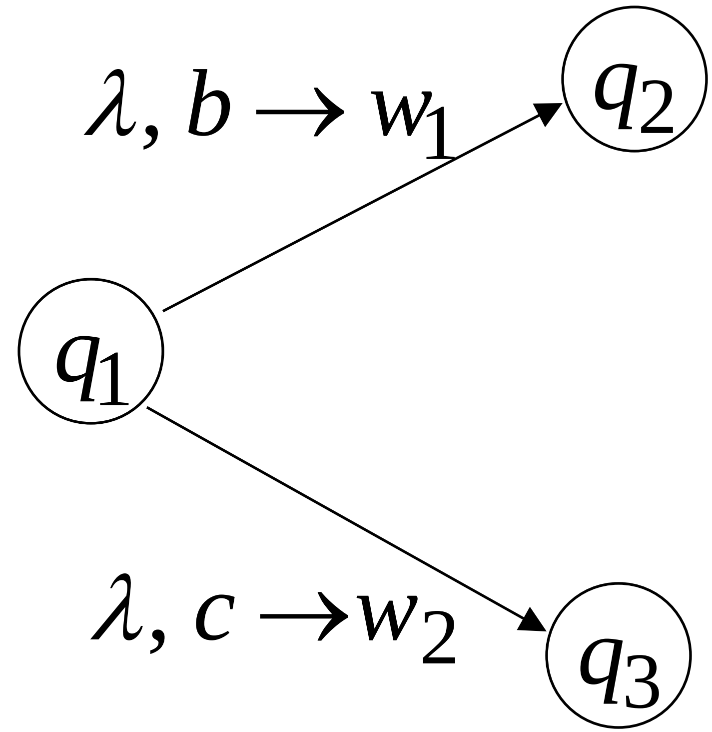
$$q_1 \xrightarrow{a,\ b \to w} q_2$$

$$q_1 \xrightarrow{\lambda,\ b \to w} q_2$$

(deterministic choices)

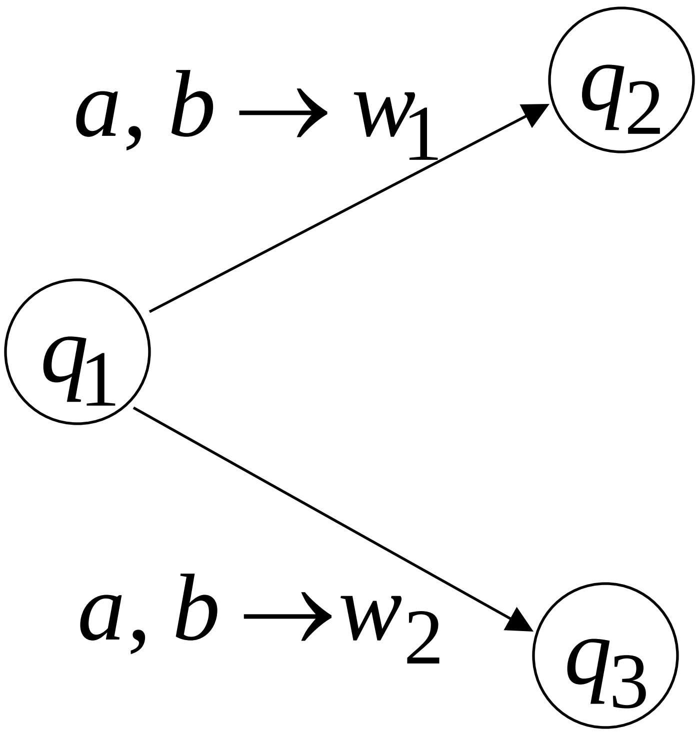
Allowed transitions:

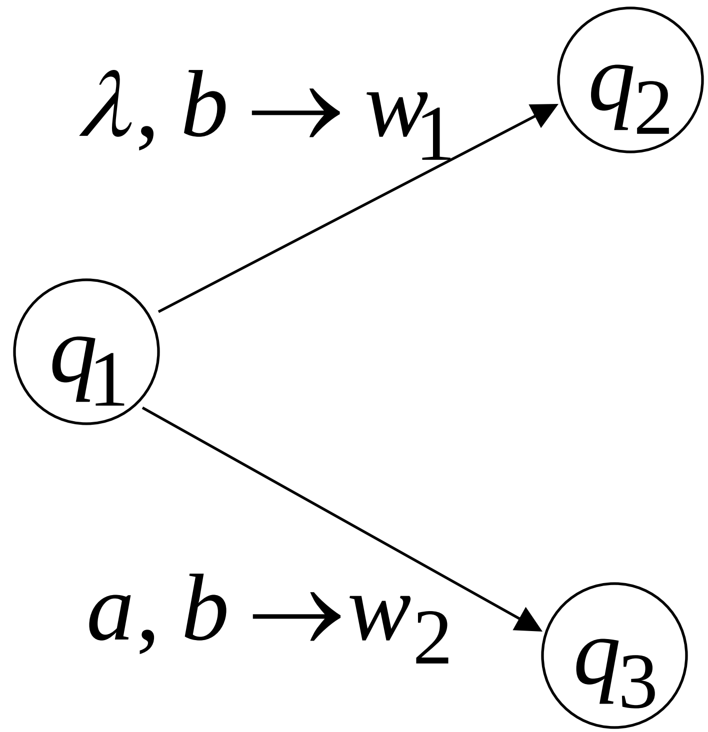




(deterministic choices)

Not allowed:

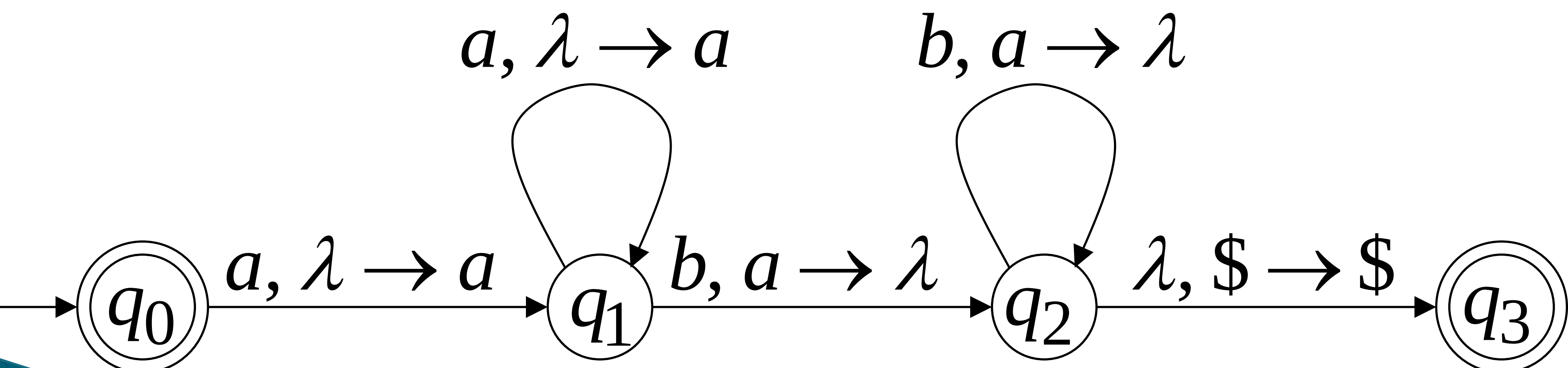




(non deterministic choices)

DPDA example

$$L(M) = \{a^n b^n : n \geq 0\}$$



Definition:

A language L is **deterministic context-free** if there exists some DPDA that accepts it

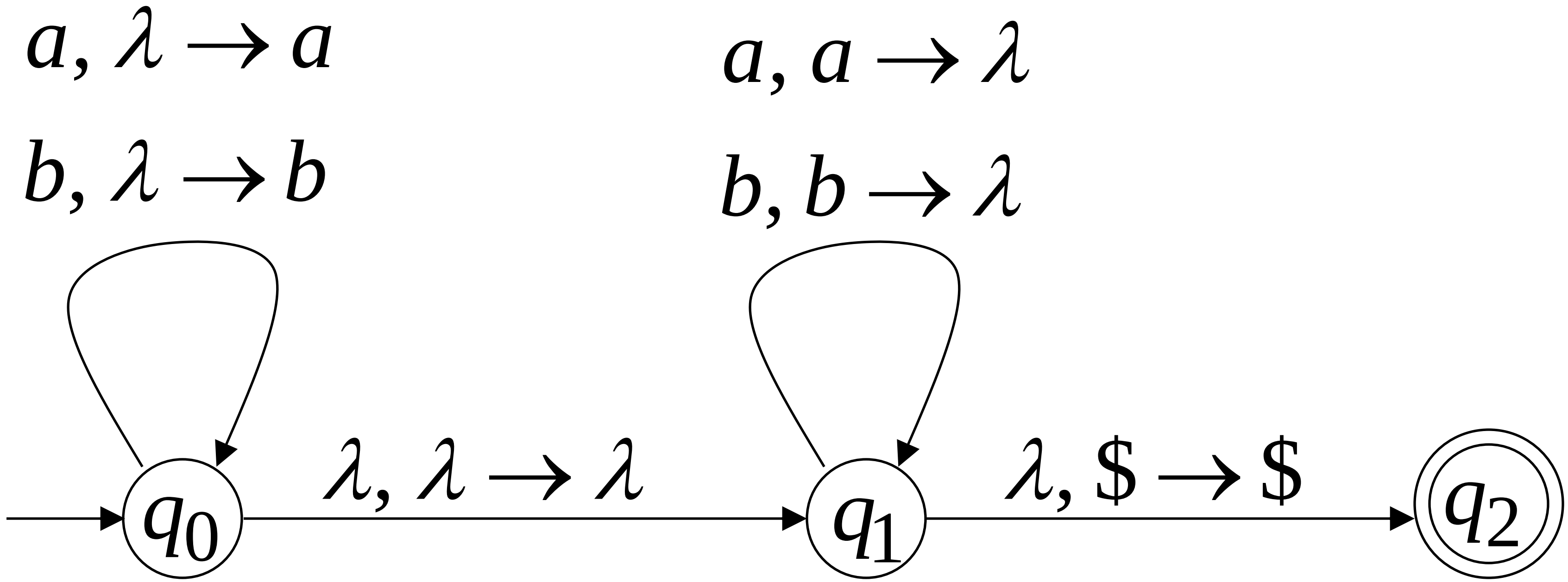
Example:

The language $L(M)=\{a^n b^n : n \geq 0\}$

is **deterministic context-free**

Example of Non-DPDA (PDA)

$$L(M) = \{vv^R : \ v \in \{a,b\}^*\}$$



Not allowed in DPDAs