DETERMINISTIC PDA

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AP/CSE

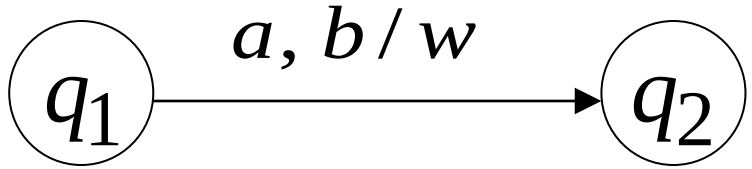
LEARNING OBJECTIVE

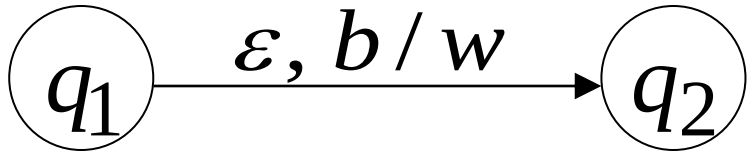
- To Design pushdown automata for any CFL (K3)
  - To Understand the concept of Deterministic PDA

DETERMINISTIC PDA'S

- A PDA M = (Q, Σ, Γ, δ, q_0, z_0, F) is said to be deterministic if
  - δ(p, a, β) = (q, γ)
    - ie. To be deterministic, **there must be at most one choice** of move for any state p, input symbol *a*, and stack symbol β.
  - δ(p, ε, β) is not empty then δ(p, a, β) must be empty for every a∈ Σ, p ∈Q, β ∈ Γ.
    - ie. **there must not be a choice between using input ε or real input**.
    - Formally, δ(p, ε, β) and δ(p, a, β) cannot both be nonempty.

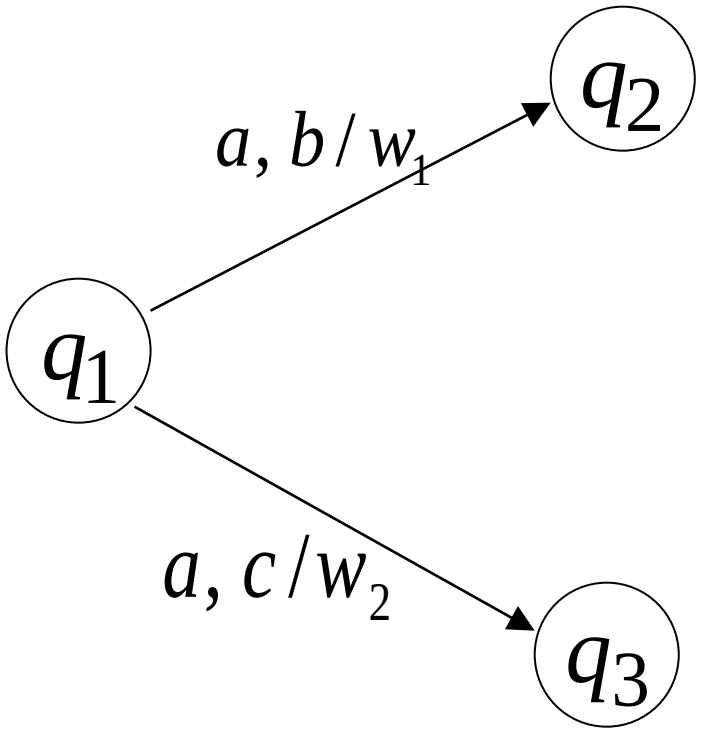
ALLOWED TRANSITIONS

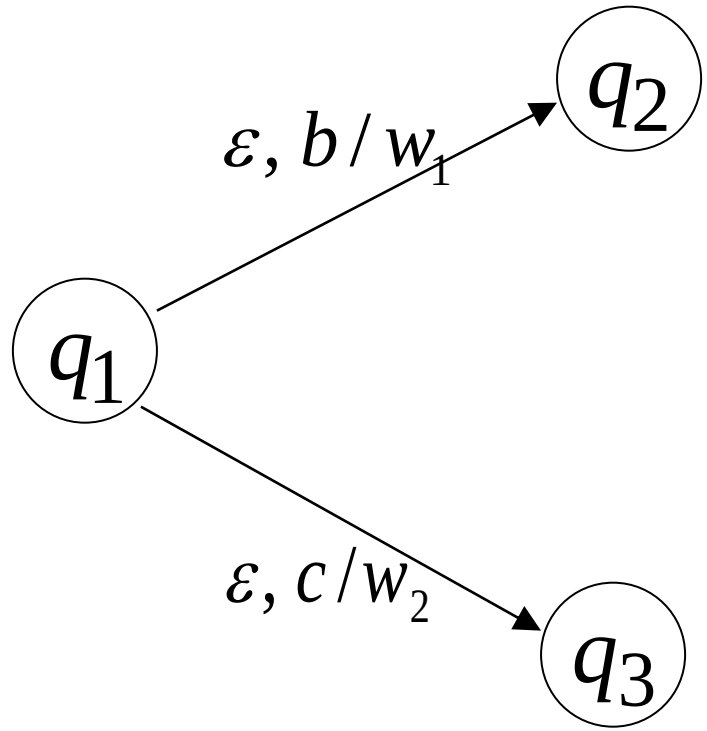




(deterministic choices)

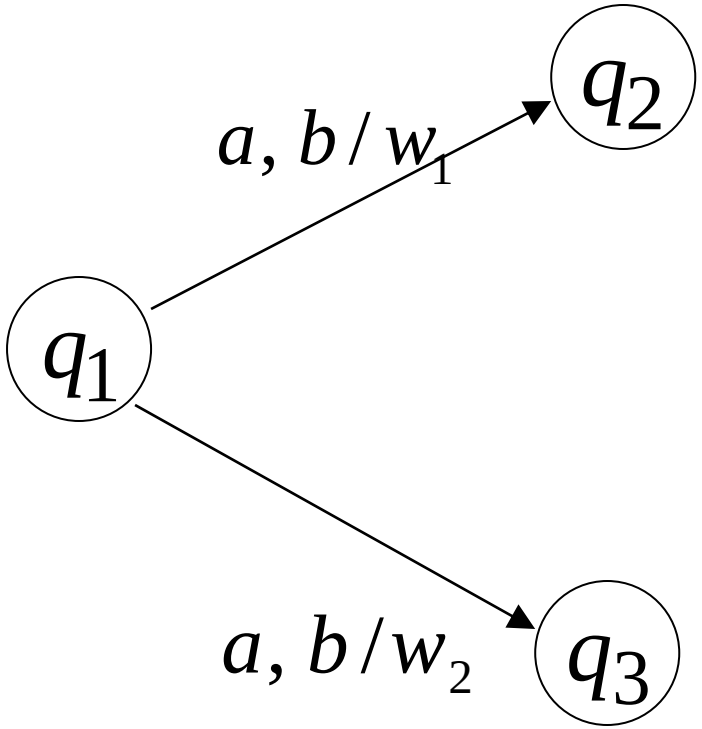
ALLOWED TRANSITIONS

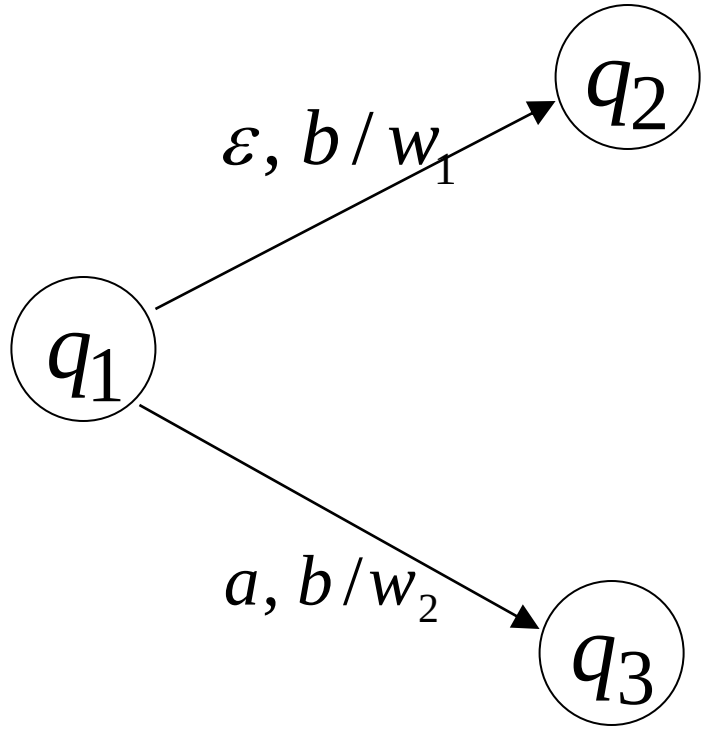




(deterministic choices)

NOT ALLOWED TRANSITIONS

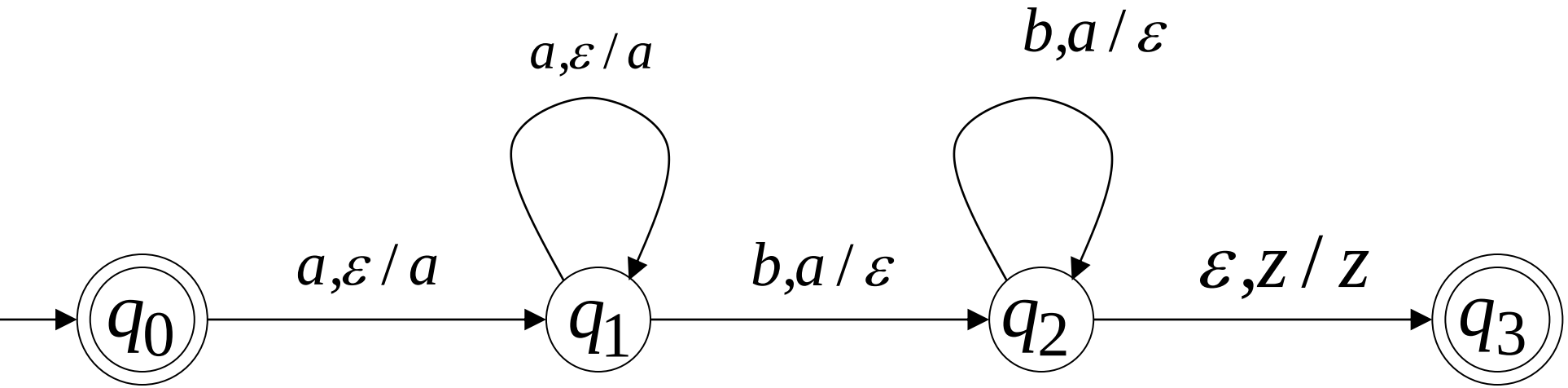




(non deterministic choices)

EXAMPLE

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



DETERMINISTIC CF

- A language L is Deterministic CF if there exists some DPDA that accepts it.

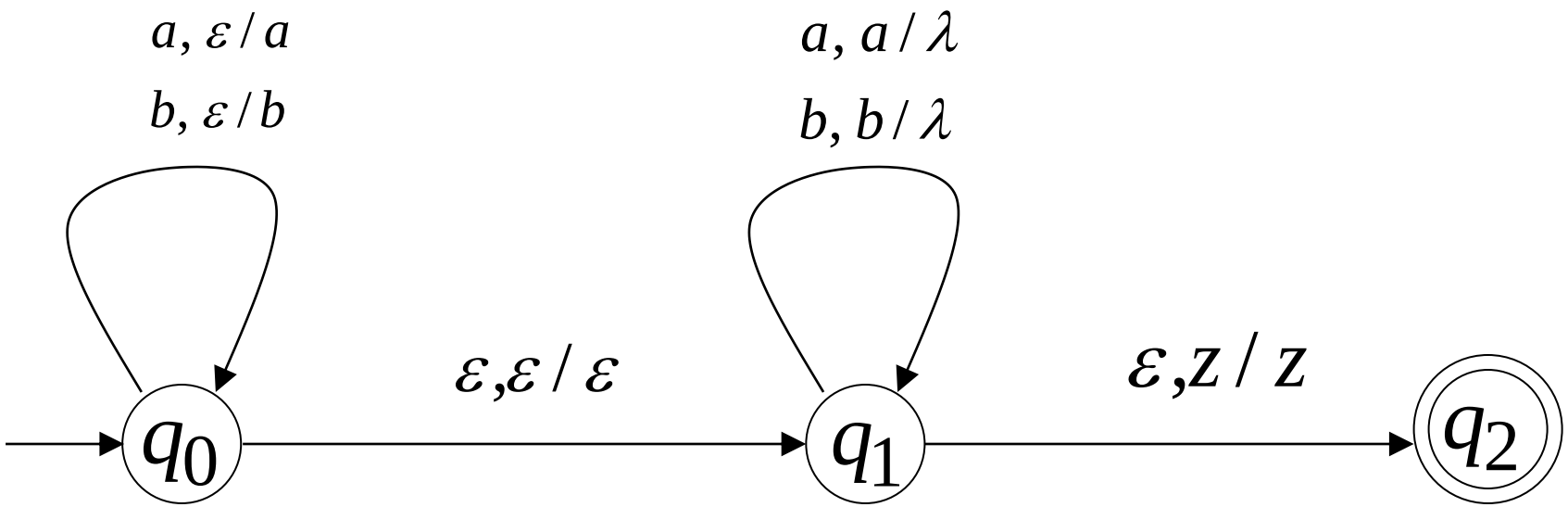
Example:

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

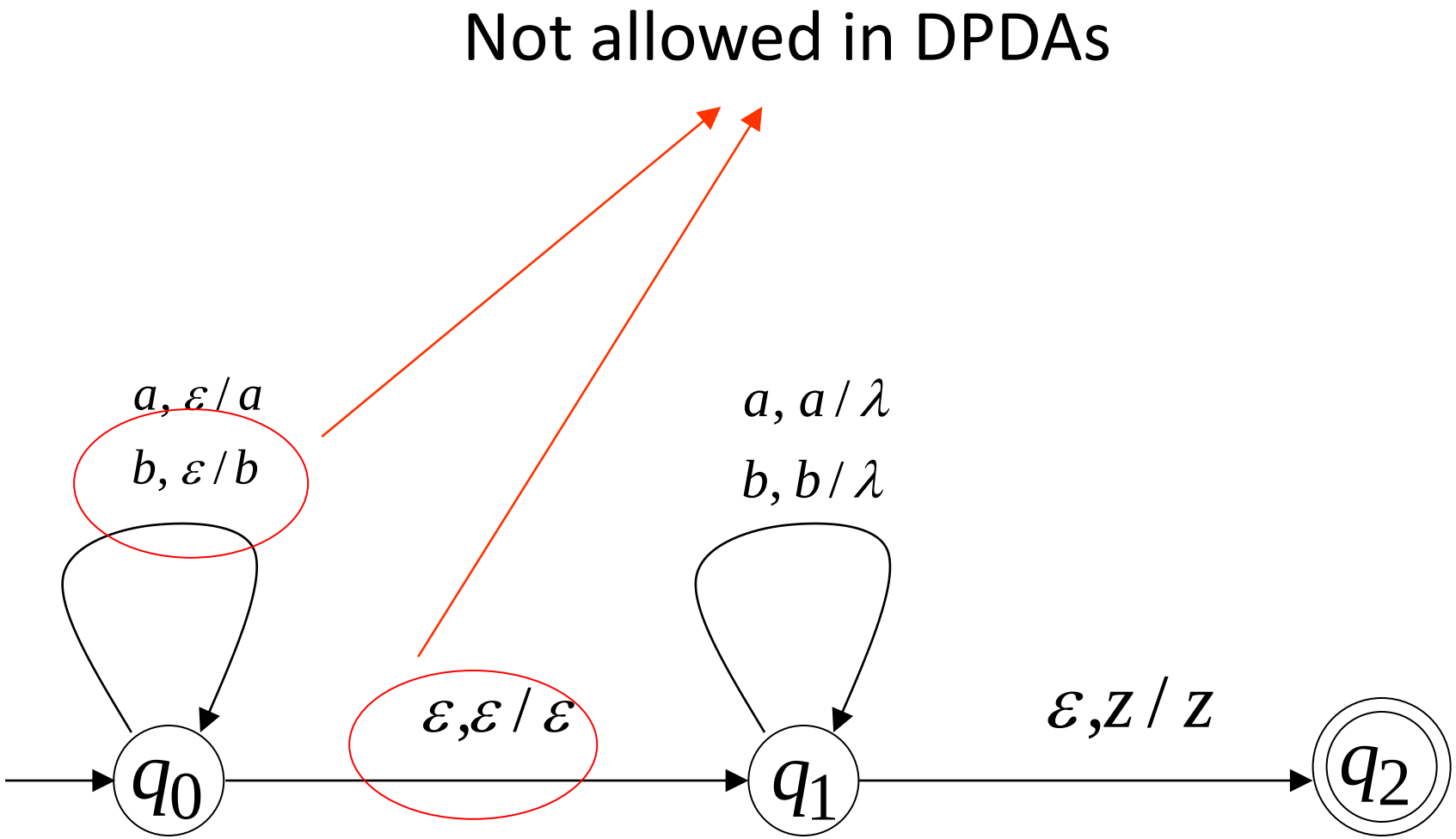
is **deterministic context-free**

EXAMPLE OF NON-DPDA (PDA)

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



EXAMPLE OF NON-DPDA (PDA)



SUMMARY

- Definition of Deterministic PDA

TEST YOUR KNOWLEDGE

- With reference of a DPDA, which among the following do we perform from the start state with an empty stack?
  a) process the whole string
  b) end in final state
  c) end with an empty stack
  d) all of the mentioned

REFERENCE

- Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008