PES UNIVERSITY ONLINE

Automata Formal Languages & Logic

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Automata Formal Languages & Logic

Unit 3 - Pushdown Automata

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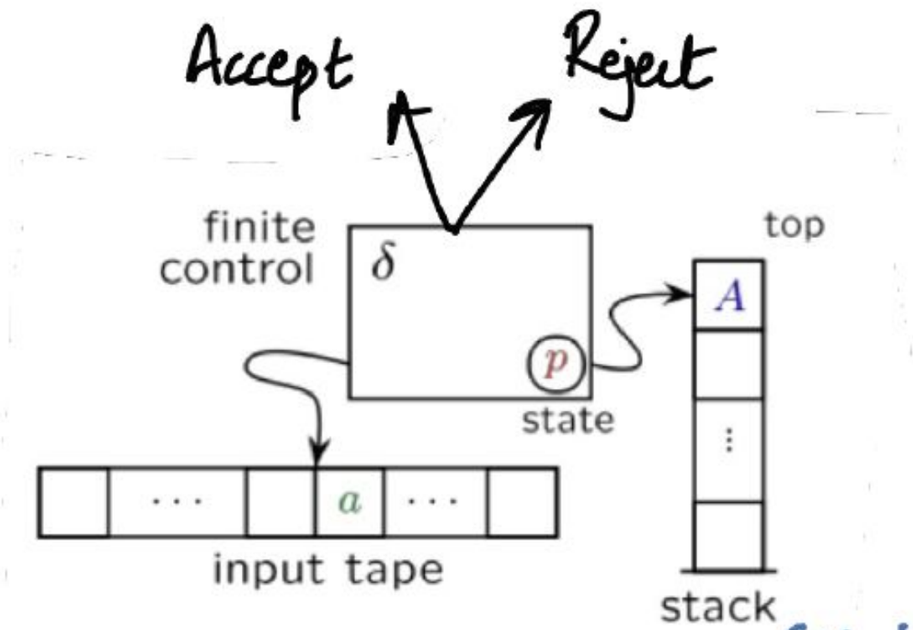
Outline :

- Model of a PDA
- Definition of a PDA
- Transition in a PDA (Push and Pop operations)
- Instantaneous Description of a PDA
- Acceptance in a PDA (by Final State or Empty Stack)

Model of a Pushdown Automata



(Unlimited memory)

PDA = FA + Stack

Definition of a Pushdown Automata

A PDA P := (Q,∑,Γ, δ,q_0,Z_0,F):

- Q: states of the ε-NFA
- ∑: input alphabet
- Γ : stack symbols
- δ: transition function
- q_0: start state
- Z_0: Initial stack top symbol
- F: Final/accepting states

PDA = λ-NFA + Stack

DPDA - Deterministic PDA

$\delta: Q \times (\Sigma \cup \lambda) \times \Gamma \rightarrow Q \times \Gamma^*$

NPDA - Non-Deterministic PDA

$\delta: Q \times (\Sigma \cup \lambda) \times \Gamma \rightarrow 2^{Q \times \Gamma^*}$

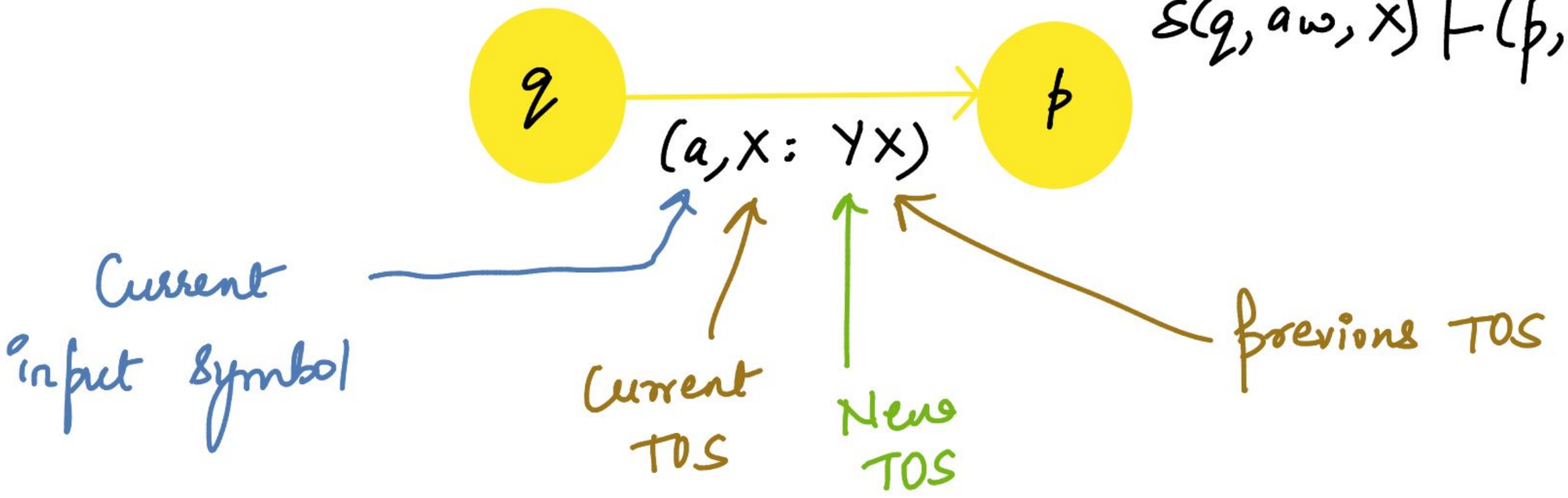
Transition in a Pushdown Automata

Push Operation

$\delta(q, a, X) = (p, Y)$

or

$\delta(q, aw, X) \vdash (p, w, YX)$



Note : More than one symbol can be pushed on to the stack at a time.

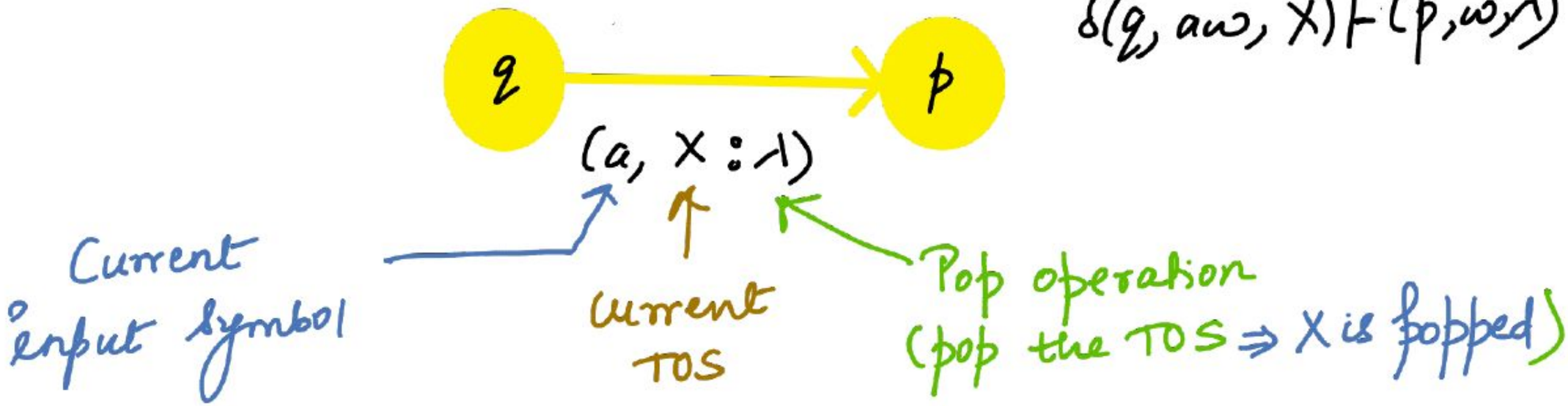
Transition in a Pushdown Automata

Pop operation

$\delta(q, a, X) = (p, \lambda)$

or

$\delta(q, aw, X) \vdash (p, w, \lambda)$



Note : Only one symbol can be popped from the stack at a time.

Instantaneous Description (ID) of a PDA(M)

- Current State of PDA
- Defined by a Triplet (q, w, u)

$q \in Q$ — Current State

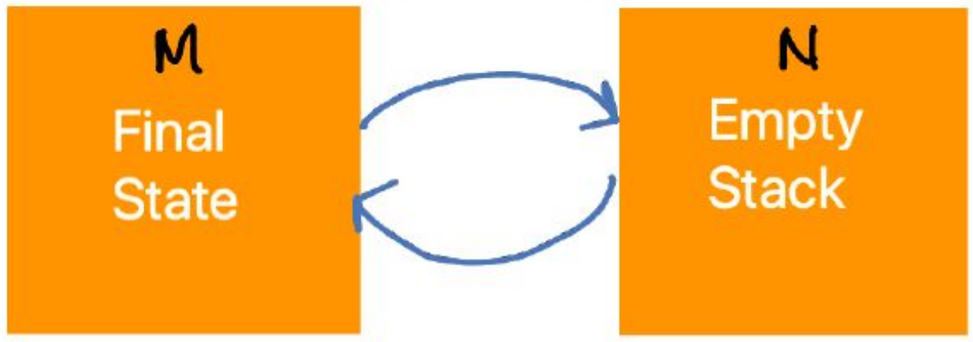
$w \in \Sigma^*$ — Set of input symbols (Input) remaining on the input tape

$u \in \Gamma^*$ — current Stack Content

Acceptance in Pushdown Automata

$M = (Q, \Sigma, q_0, F, \delta, z_0, \Gamma)$ $N = (Q, \Sigma, q_0, \phi, \delta, z_0, \Gamma)$

L(M) = L(N)



$\delta(q_0, \omega, z_0) \vdash^* (q_f, \lambda, X)$

$q_f \in F$

$\delta(q_0, \omega, z_0) \vdash^* (\phi, \lambda, \lambda)$

$\phi \in Q$ (No final state in the PDA)

THANK YOU

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