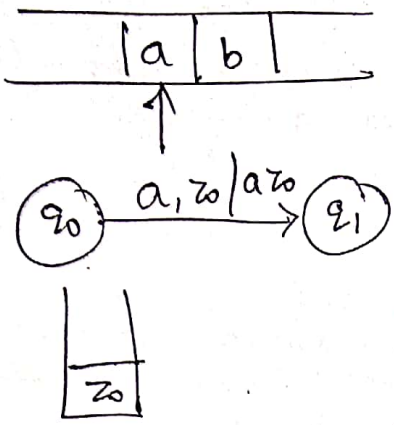
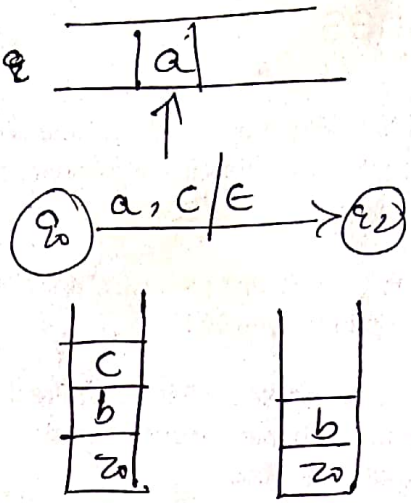
① Push



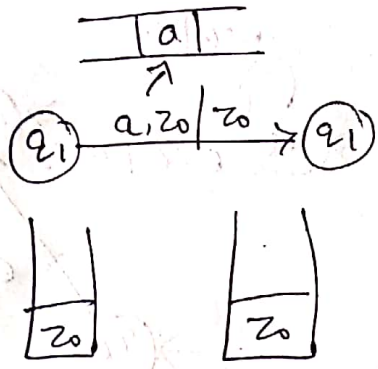
$\delta(q_0, a, z_0) = (q_1, a z_0)$

② Pop



$\delta(q_0, a, c) = (q_1, \epsilon)$

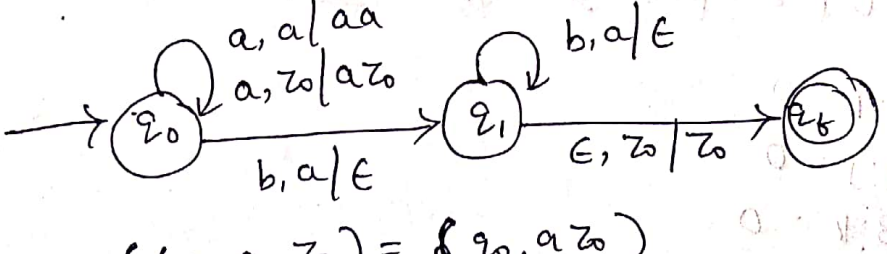
③ Skip



$\delta(q_0, a, z_0) = (q_1, z_0)$

① $\{a^n b^n \mid n \geq 1\}$

aabb ∈



$\delta(q_0, a, z_0) = (q_0, a z_0)$

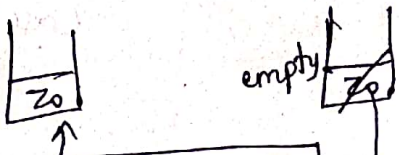
$\delta(q_0, a, a) = (q_0, aa)$

$\delta(q_0, b, a) = (q_1, \epsilon)$

$\delta(q_1, b, a) = (q_1, \epsilon)$

$\delta(q_1, \epsilon, z_0) = (q_f, z_0)$ → acceptance by final stack.

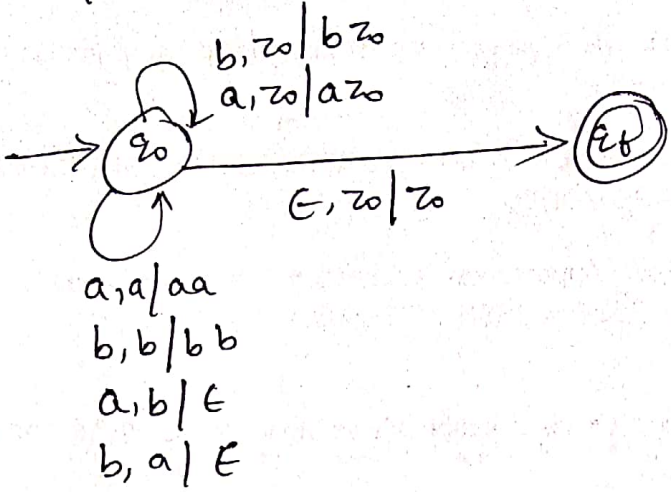
$\delta(q_1, \epsilon, z_0) = (q_f, \epsilon)$ → acceptance by empty stack.

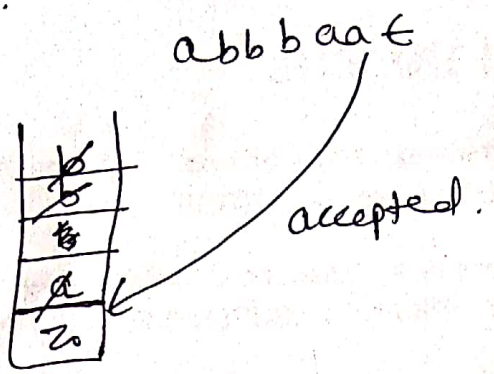


② $L = \{ w \mid n_a(w) = n_b(w) \}$

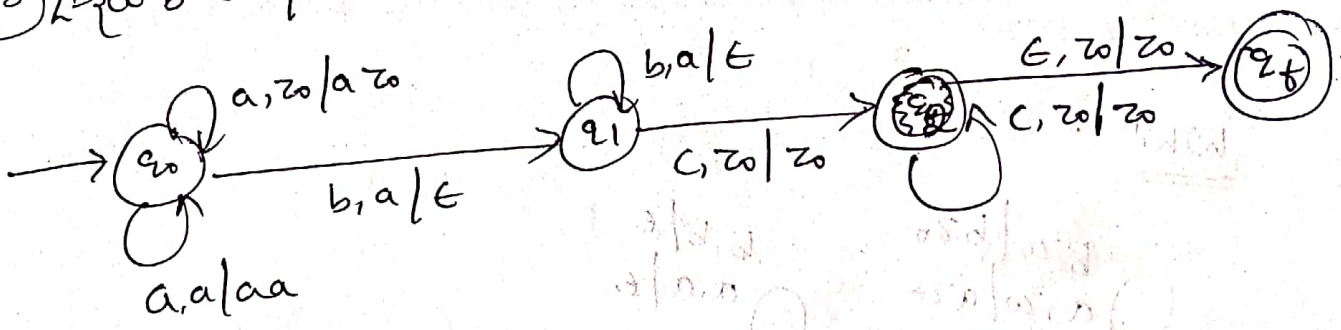
a and b come in any order.

$L = \{ bbaa, baba, abab, \ldots \}$

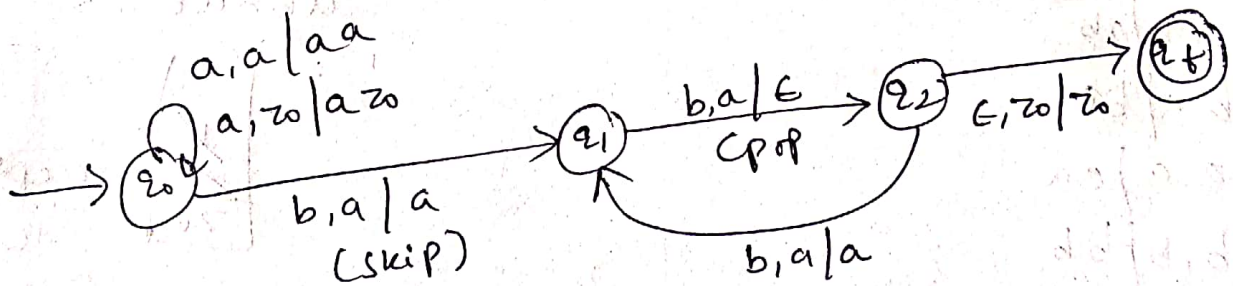


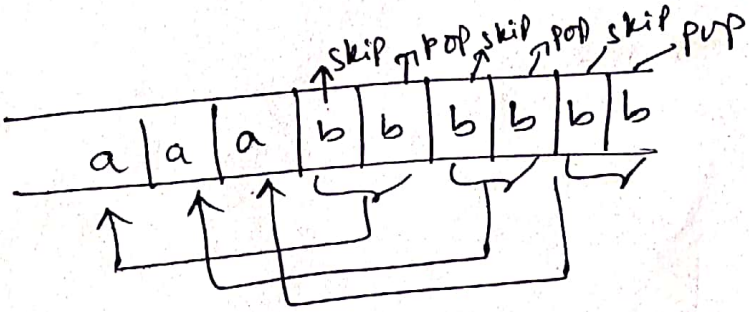


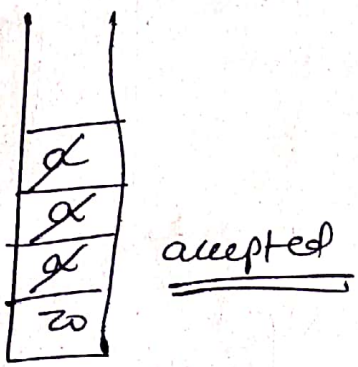
③ $L = \{ a^n b^n c^m \mid n, m \geq 1 \}$



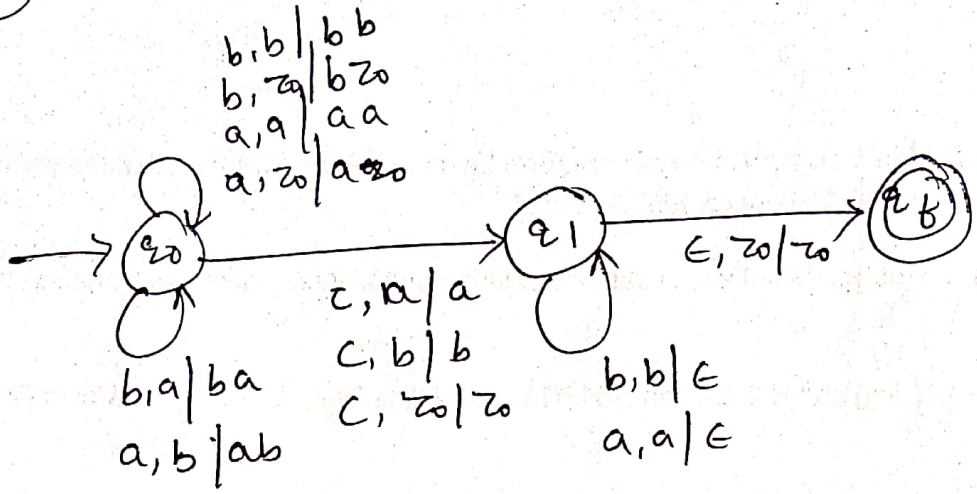
④ $L = \{ a^n b^{2n} \mid n \geq 1 \}$





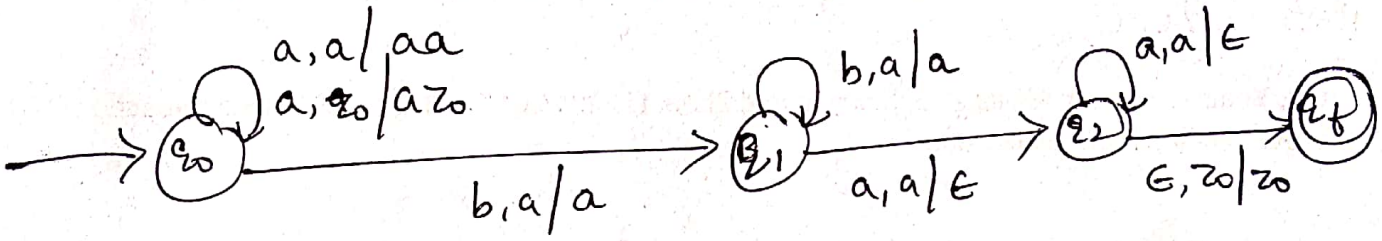


(5) $L = \{ wcw^R \mid w \in \{a,b\}^* \}$



(6) $L = \{ a^n b^m a^n \mid m, n \geq 1 \}$

$\{ aba, abba, abbba, \ldots \}$



Deterministic

→ centre symbol is known.

Ex: wcw^R

→ DPDA is less powerful

→ All context free languages not accepted by DPDA

→ only one possible move in every situation.

NonDeterministic

→ centre symbol is not known

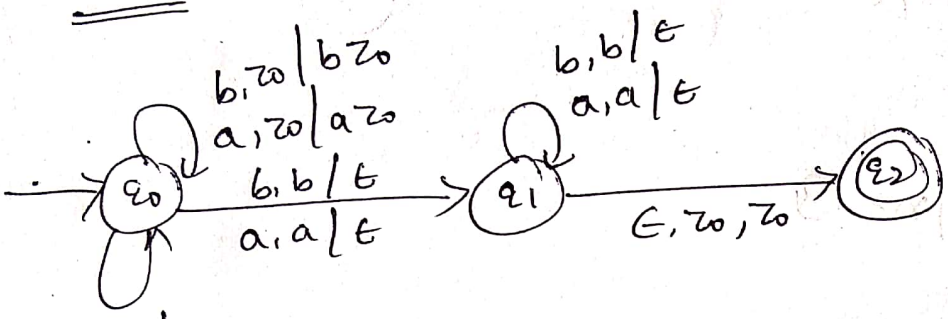
Ex: ww^R

→ more powerful.

→ All context free languages accepted by NPDA

→ multiple moves with multiple operations.

WW^R

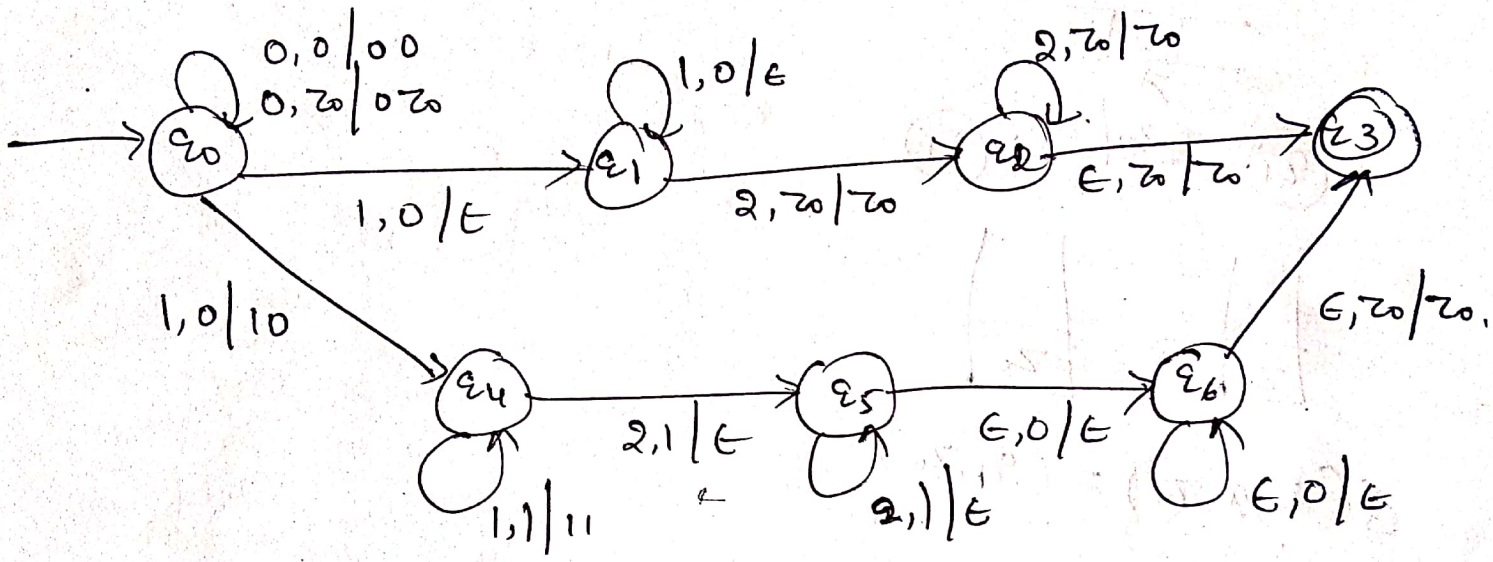


a, b | ab
b, a | ba
a, a | aa
b, b | bb

abbaϵ

accepted.

(2) NPDA for $L = \{0^i 1^j 2^k \mid i==j \text{ or } j==k ;\ i,j,k >= 1\}$



→ if $L = \{0^i 1^j 2^k \mid i,j,k >= 0\}$

Check
- Case1: i = 0
- Case2: j = 0
- Case3: k = 0
- Case4: i, j, k > 0