* Theory of Computation (TOC) - Assignment Number - 4.

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★ Construct a PDA for language $L = \{0^n 1^m \mid n>=1, m>=1, m>n+2\}$

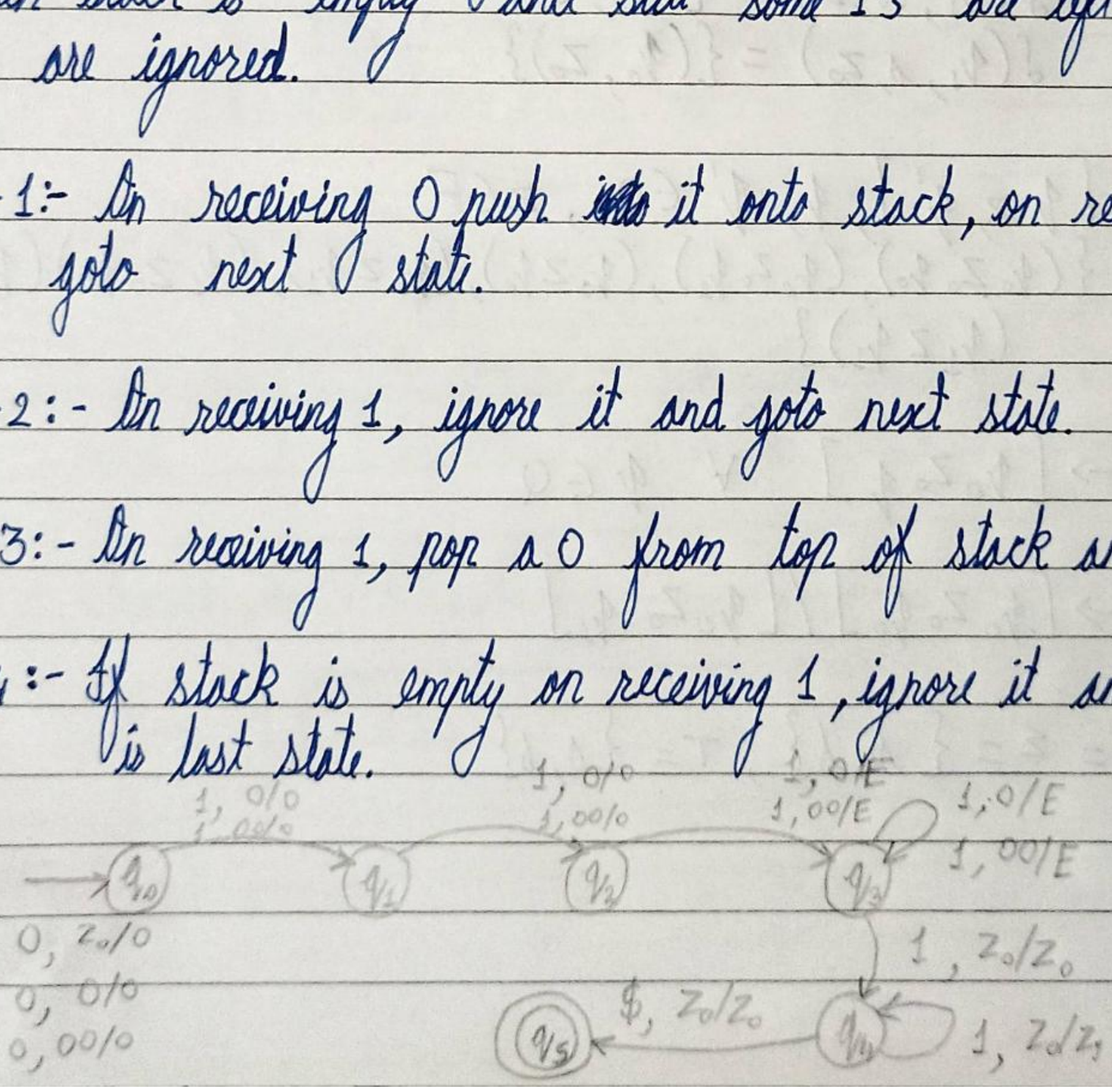
→ First 0's are pushed into stack. When 0's are finished, two 1's are ignored. Thereafter for every 1 as input a 0 is popped out of stack. When stack is empty and still some 1's are left then all of them are ignored.

Step-1 :- On receiving 0 push it onto stack, on receiving 1, ignore it and goto next state.

Step-2 :- On receiving 1, ignore it and goto next state.

Step-3 :- On receiving 1, pop a 0 from top of stack and go to next state.

Step-4 :- If stack is empty on receiving 1, ignore it and goto next state that is last state.



Examples :-

① Input as → 000 111 111

Result : Accepted.

② Input as → 0000 11 11

Result : Not Accepted.

★ Convert PDA to CFG

$\delta(q_0, b, Z_0) = \{(q_0, ZZ_0)\}$
$\delta(q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$
$\delta(q_0, b, Z) = \{(q_0, ZZ)\}$
$\delta(q_0, a, Z) = \{(q_1, Z)\}$
$\delta(q_1, b, Z) = \{(q_1, \epsilon)\}$
$\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$

→ $V = [q\ Z\ q']$, $q, q' \in Q$, $Z \in F$

$V = \{(q_0 Z_0 q_0), (q_0 Z_0 q_1), (q_0 Z q_0), (q_0 Z q_1), (q_1 Z_0 q_0)(q_1 Z_0 q_1)(q_1 Z q_0).$
$(q_1 Z q_1)\}$

$S \rightarrow [q_0 Z_0 q]$ $\forall$ $q \in Q$.

$S \rightarrow [q_0 Z_0 q_0] / [q_0 Z_0 q_1]$

$T = \Sigma = \{a, b\}$, $T = \{a, b\}$

1) $\delta(q_0, b, Z_0) = (q_0, ZZ_0)$

→ Push = $[q_0, Z_0 q_0] \rightarrow \delta[q_0 Z q_0][q_0 Z_0 q_0]$
$[q_0 Z_0 q_0] \rightarrow \delta[q_0 Z q_1][q_1 Z_0 q_0]$
$[q_0 Z_0 q_1] \rightarrow \delta[q_0 Z q_0][q_0 Z_0 q_1]$
$[q_0 Z_0 q_1] \rightarrow \delta[q_0 Z q_1][q_1 Z_0 q_1]$

2) $\delta(q_0, \epsilon, Z_0) = (q_0, \epsilon)$

→ POP : $[q_0 Z_0 q_0] \rightarrow \epsilon$

3) $\delta(q_0, b, Z) = (q_0, Z, Z)$

→ Push : $[q_0 Z q_0] \rightarrow \delta[q_0 Z q_0][q_0 Z q_0]$
$[q_0 Z q_0] \rightarrow \delta[q_0 Z q_1][q_1 Z q_0]$
$[q_0 Z q_1] \rightarrow \delta[q_0 Z q_0][q_0 Z q_1]$
$[q_0 Z q_1] \rightarrow \delta[q_0 Z q_1][q_1 Z q_1]$

4) $\delta(q_0, a, Z) = (q, Z)$

[No-operation read] : $[q_0 Z q_0] \rightarrow a[q_1 Z q_0]$
$[q_0 Z q_1] \rightarrow a[q_1 Z q_1]$

5) $\delta(q_1, b, Z) = (q_1, \epsilon)$

Pop : $[q_1 Z q_1] \rightarrow b$.

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

[No-operation / Read] $[q_1 z_0 q_0] \longrightarrow a[q_0 z_0 q_0]$
$[q_1 z_0 q_1] \longrightarrow a[q_0 z_0 q_1]$.

$G = (V, T, P, S)$
$V = \{(q_0 z_0 q_0), (q_0 z_0 q_1), (q_0 z q_0), (q_0 z q_1), (q_1 z_0 q_0), (q_1 z_0 q_1), (q_1 z q_0)$
$(q_1 z q_1)\}$.

$T = \{a, b\}$
$S \rightarrow [q_0 z_0 q_0] / [q_0 z_0 q_1]$.

$[q_0 z_0 q_0] \longrightarrow b[q_0 z q_0][q_0 z_0 q_0]$
$[q_0 z_0 q_0] \longrightarrow b[q_0 z q_0][q_1 z_0 q_0]$
$[q_0 z_0 q_1] \longrightarrow b[q_0 z q_0][q_0 z_0 q_1]$
$[q_0 z_0 q_1] \longrightarrow b[q_0 z q_1][q_1 z_0 q_1]$
$[q_0 z q_0] \longrightarrow \epsilon$
$[q_0 z q_0] \longrightarrow a[q_1 z q_0]$
$[q_0 z q_1] \longrightarrow a[q_1 z q_1]$
$[q_0 z q_1] \longrightarrow b$.