Name: Sanket Chandrashekhar Harvande
Roll : 19
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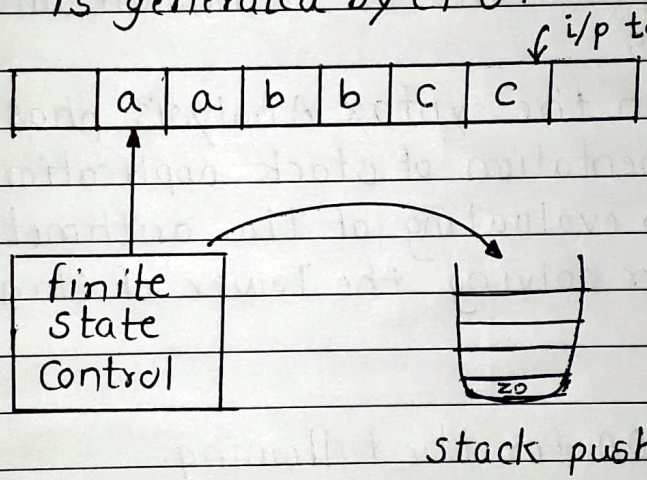
# TCS - Assignment No. 04

Q.1 Define PDA :-

→ Definition :- PDA is used for recognizing CFL which is generated by CFG.




Components of PDA

PDA consists of finite set of states, input tape and read head and stack.

Working :-

PDA can be represented using 7 tuple representation and it is defined as follows

$$M = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$$

Where,

$Q$ = finite set of states
$\Sigma$ = i/p alphabet
$\Gamma$ = Stack alphabet
$\delta$ = Transition Function

$\delta = Q \times \Sigma \cup \{\epsilon\} \times \Gamma \rightarrow$ subsets of $Q \times \Gamma^*$
$q_0$ = start state $q_0 \in Q$
$Z_0$ = Initial stack top symbol $Z_0 \in \Gamma$
F = Finite set of final states $F \subseteq Q$

Q.2 Write a short note on Applications of PDA.

→ The applications of Pushdown automata are as follows

- Used in the syntax Analysis phase.
- Implementation of stack applications
- Used in evaluating of the arithmetic expressions
- Used for solving the Tower of Hanoi Problem.

Q.3 Design PDA for the following.

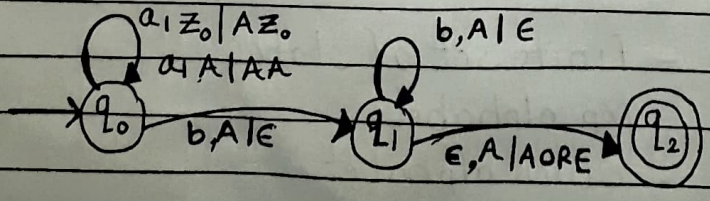
i) $L = \{a^m \; b^n \mid n < m\}$

ii) $L = \{a^n \; b^n \; c^m \; d^m \mid n, m >= 1\}$

iii) $L = \{a^n \; b^m \; a^n \mid n, m >= 1\}$

→

$L = \{a^m b^n \mid n < m\}$

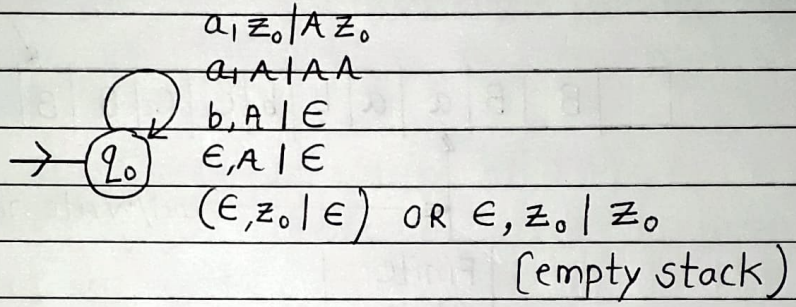


$\delta(q_0, a, Z_0) = (q_0, A Z_0)$ $\quad$ $\delta(q_0, b, A) = (q_1, \epsilon)$

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

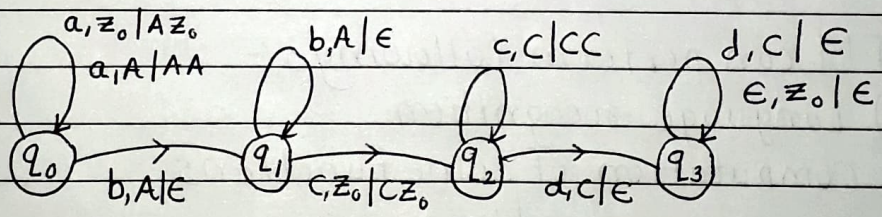
$\delta(q_1, \epsilon, A) = (q_2, A)$ OR $(q_2, \epsilon)$

$M = (\{q_0, q_1, q_2\}, \{a, b\}, \{A, B, Z_0\}, \delta, q_0, Z_0, \{q_2\})$



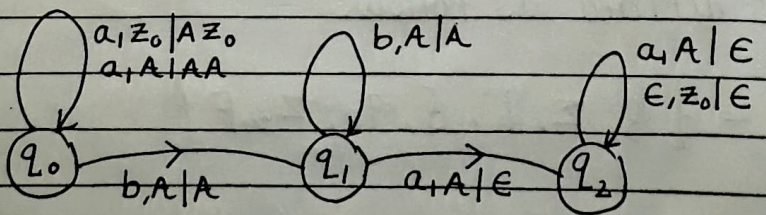

ii)

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




$M = (\{q_0, q_1, q_2, q_3\}, \{a, b, c, d\}, \{A, B, C, D\}, \delta, q_0, Z_0, \phi)$

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




$\therefore M = (\{q_0, q_1, q_2\}, \{a, b\}, \{A, Z_0\}, \delta, q_0, Z_0, \phi)$