TUTORIAL 9

ii) Design PDM for context free language
$L = \{a^n b^n \mid n \geq 1\}$.

Def: A pushdown automata M is defined
$M = (Q, \Sigma, \Gamma, \delta, q_0, z_0, F)$
Q = set of states
Σ = input alphabets
Γ = stack symbols
q_0 = $q_0 \in Q$ is initial state
δ = transition function is a transition form
F = $F \subseteq Q$ is a set of final states
z_0 = initial state symbol

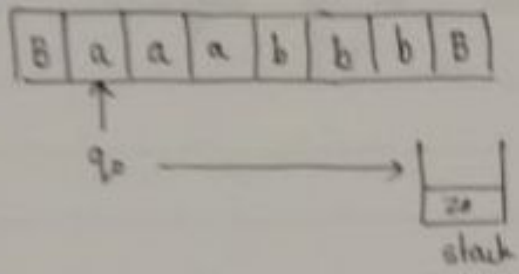
Features:
i) Has readable pointer
ii) Has stack memory
2.1) Push operation
2.2) Pop operation
2.3) Check empty condition of stack through an initial stack symbol.
2.4) No operation reads top symbol of stack
iii) Makes state changes

For language : $\{a^n b^n\}$

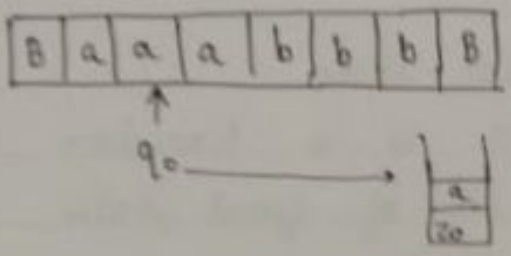
Words : { aabb, aaabbb,

Sample string: aaabbb

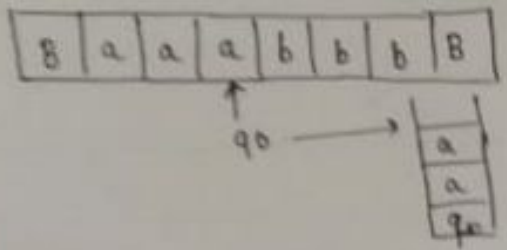
Transition:

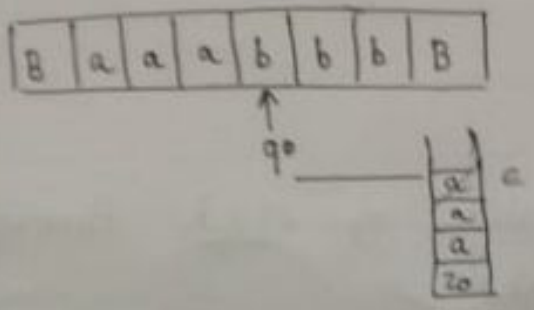


$\delta(q_0, a, z_0) \rightarrow (q_0, a z_0)$

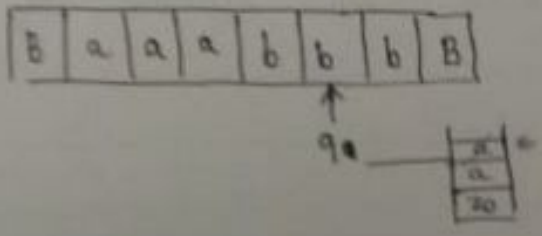


$\delta(q_0, a, a) \rightarrow (q_0, aa)$

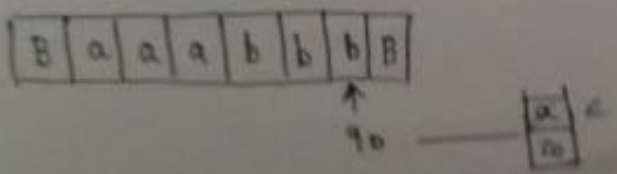




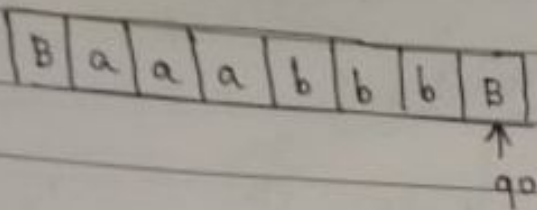
$\delta(q_0, b, a) \rightarrow (q_1, \epsilon)$



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



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



$\delta(q_1, B, z_0) \rightarrow \delta(q_2, z_0)$

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

Σ : $\{a, b\}$

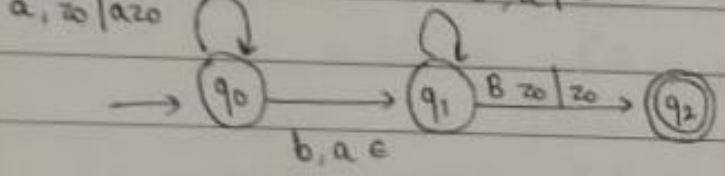
Q : $\{q_0, q_1, q_2\}$

Γ : $\{a, b, z_0\}$

δ : Transition states

q_0 : initial state

F : Final state $\{q_2\}$

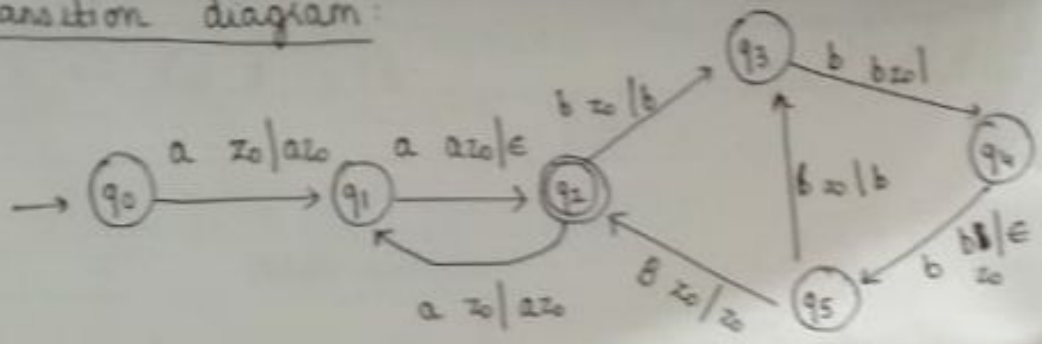


2) Design PDA for $L = \{a^{2n} b^{3m} \mid n \geq 1\}$

words = { aa, aaaa, aaaabbb ... }

→ Logic:
① For 1st 'a' push to the stack
② For 2nd 'a' pop from stack
③ For 1st 'b' push on to the stack
④ For 2nd 'b' no-operation
⑤ For 3rd 'b' pop from stack

Transition diagram:



Transition states:

$\delta(q_0, a, z_0) \longrightarrow \delta(q_1, az_0)$

$\delta(q_1, a, az_0) \longrightarrow (q_2, \epsilon)$

$\delta(q_2, a, z_0) \longrightarrow (q_1, az_0)$

$\delta(q_2, b, z_0) \longrightarrow (q_3, b)$

$\delta(q_3, b, bz_0) \longrightarrow (q_3$) NOP

$\delta(q_4, b, bz_0) \longrightarrow (q_5, \epsilon)$

$\delta(q_5, b, z_0) \longrightarrow (q_3, b)$

$\delta(q_5, B, z_0) \longrightarrow (q_2, z_0)$

$M = \{Q, \Sigma, \Gamma, \delta, q_0, z_0, F\}$

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$

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

$\Gamma = \{a, b, z_0\}$

δ : Transition

q_0 : initial state

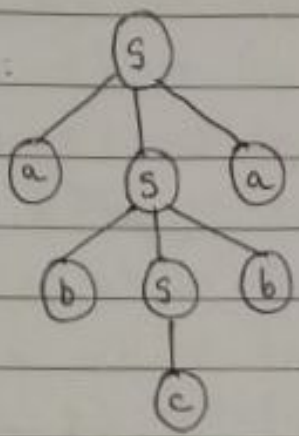
z_0 : initial stack symbol

$F = \{q_2\}$

3). Find PDM of CFG

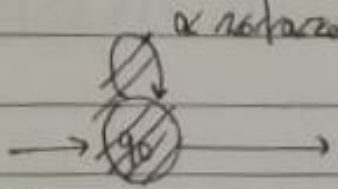
$S \rightarrow aSa \mid bSb \mid c$

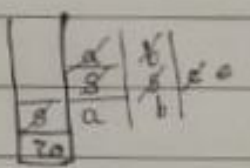
Parse tree:



B	a	b	c	b	a	B

↑





$\delta(q_0, B, z_0) \rightarrow (q_0, Sz_0)$

$\delta(q_0, a, S) \rightarrow (q_0, aSa)$

$\delta(q_0, a, a) \rightarrow (q_0, \epsilon)$

$\delta(q_0, b, S) \rightarrow (q_0, bSb)$

$\delta(q_0, b, b) \rightarrow (q_0, \epsilon)$

$\delta(q_0, c, S) \rightarrow (q_0, c)$

$\delta(q_0, c, c) \rightarrow (q_0, \epsilon)$

$\delta(q_0, b, b) \rightarrow (q_0, \epsilon)$

$\delta(q_0, a, a) \rightarrow (q_0, \epsilon)$

$\delta(q_0, B, z_0) \rightarrow (q_0, z_0)$

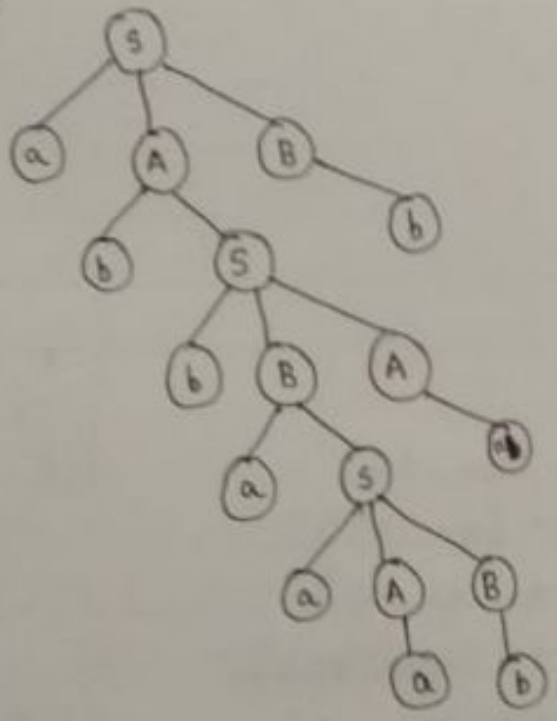
4) PDM for CFG

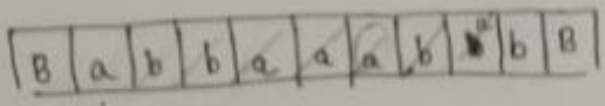
$S \rightarrow aAB \mid bBA$

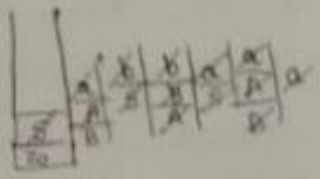
$A \rightarrow bS \mid a$

$B \rightarrow aS \mid b$.

Parse string







$\delta(q_0, B, z_0) \rightarrow (q_1, S)$

$\delta(q_1, a, S) \rightarrow (q_1, aAB)$

$\delta(q_1, a, a) \rightarrow (q_1, \epsilon)$

$\delta(q_1, b, A) \rightarrow (q_1, bS)$

$\delta(q_1, b, b) \rightarrow (q_1, E)$

$\delta(q_1, b, S) \rightarrow (q_1, bBA)$

$\delta(q_1, b, b) \rightarrow (q_1, \epsilon)$

$\delta(q_1, a, B) \rightarrow (q_1, aS)$

$\delta(q_1, a, a) \rightarrow (q_1, \epsilon)$

$\delta(q_1, a, S) \rightarrow (q_1, a, aAB)$

$\delta(q_1, a, a) \rightarrow (q_1, \epsilon)$

$\delta(q_1, a, A) \rightarrow (q_1, a)$

$\delta(q_1, a, a) \rightarrow (q_1, \epsilon)$

$\delta(q_1, b, B) \rightarrow (q_1, b)$

$\delta(q_1, b, b) \rightarrow (q_1, \epsilon)$

$\delta(q_1, b, a, A) \rightarrow (q_1, a)$

$\delta(q_1, a, a) \rightarrow (q_1, \epsilon)$

$\delta(q_1, b, B) \rightarrow (q_1, b)$

$\delta(q_1, b, b) \rightarrow (q_1, \epsilon)$