



PES UNIVERSITY, Bangalore
(Established under Karnataka Act No. 16 of 2013)
Department of Computer Science & Engineering

Automata Formal Languages & Logic

1) Convert the following grammar to Chomsky Normal Form

$S \rightarrow a \mid aA \mid B \mid C, A \rightarrow aB \mid \lambda, B \rightarrow Aa, C \rightarrow cCD, D \rightarrow add$

Solution:

LHS		RHS
S	\rightarrow	a
S	\rightarrow	CA
S	\rightarrow	AC
A	\rightarrow	CB
B	\rightarrow	AC
C	\rightarrow	a
B	\rightarrow	a

2) Convert the following grammar to Greibach Normal Form

$S \rightarrow AB, A \rightarrow aA \mid bB \mid b, B \rightarrow b$

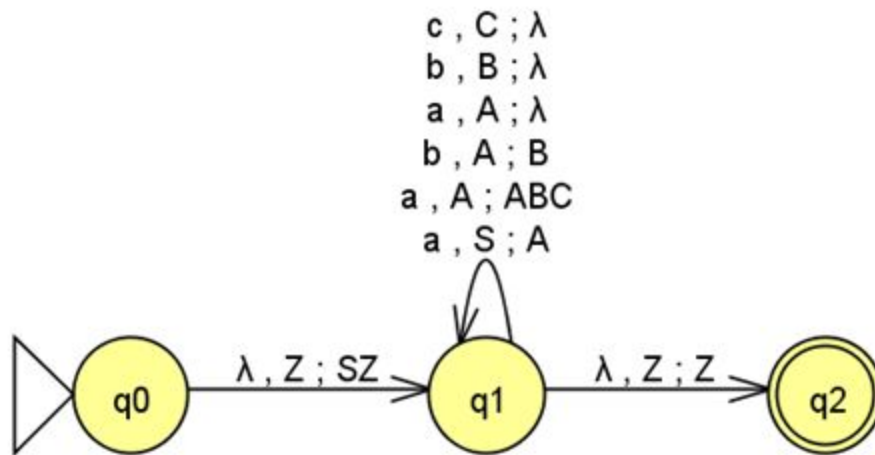
Solution: Only the S production is not in GNF. Substituting for A, we get:

$S \rightarrow aAB \mid bBB \mid bB, A \rightarrow aA \mid bB \mid b, B \rightarrow b$

3) Convert the following CFG to PDA

$S \rightarrow aA, A \rightarrow aABC \mid bB \mid a, B \rightarrow b, C \rightarrow c$. Show how aaabc is accepted.

Solution:



The string *aaabc* is accepted via:

$(q_0, aaabc, Z), (q_1, aaabc, SZ), (q_1, aabc, AZ), (q_1, abc, ABCZ), (q_1, bc, BCZ), (q_1, c, CZ),$
 $(q_1, \lambda, Z), (q_2, \lambda, Z)$

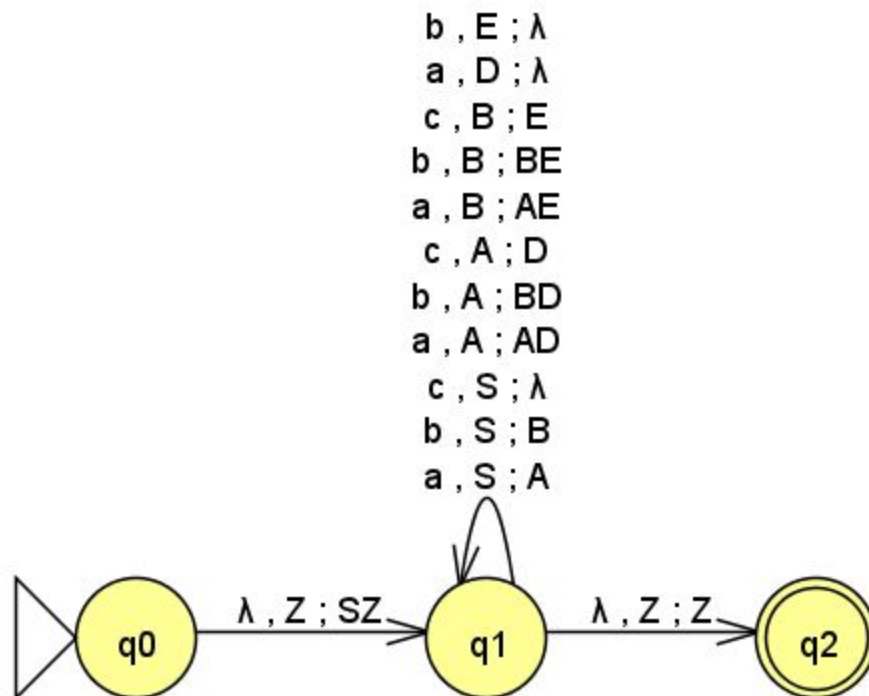
4) Convert the following CFG to PDA

$S \rightarrow aA \mid bB \mid cC, A \rightarrow Sa, B \rightarrow Sb, C \rightarrow \lambda$

Solution:

First we need to convert the given grammar to GNF:

$S \rightarrow aA \mid bB \mid c, A \rightarrow aAD \mid bBD \mid cD, B \rightarrow aAE \mid bBE \mid cE, D \rightarrow a, E \rightarrow b$



5) Apply CYK - algorithm to verify the given string (s) can be derived from the below grammar

$S \rightarrow AB \mid BC, A \rightarrow BA \mid a, B \rightarrow CC \mid b, C \rightarrow AB \mid a$, w is baaba

5	s,A				
4	\emptyset	S,A,C			
3	\emptyset	B	B		
2	S,A	B	S,C	S,A	
1	B	A,C	A,C	B	A,C
	b	a	a	b	a

Baaba belongs to the grammar
We can see the table
the cell $X_{15} = (S, A, C)$ then
if $S \in X_{15}$ then $baaba \in L(G)$