

1. Design PDA for $\{a^n b^{n+m} c^m \mid n, m \geq 1\}$ and give 6-tuple specification for PDA.
2. Find a pushdown automata that recognize the following languages and give 6-tuple specification for PDA.
 $L = \{a^i b^k c^{i+2k} \mid i, k \geq 0\}$
3. Find the language
 $S \rightarrow aABB \mid aAA,$
 $A \rightarrow aBB \mid a,$
 $B \rightarrow bBB \mid A$
4. Find the language
 $S \rightarrow aAa$
 $A \rightarrow Sb \mid bCC \mid DaA$
 $C \rightarrow abb \mid DD$
 $E \rightarrow ac$
 $D \rightarrow aDA$
5. Find a pushdown automata with two states that accepts the languages
A. $L = \{a^n b^{2n} \mid n \geq 1\}$
B. $L = \{a^{2n} b^{2m} c^m d^{3n} \mid n \geq 0, m > 0\}.$
6. Consider a pushdown automata $M = (\{q_1, q_2\}, \{0, 1, c\}, \{R, B, G\}, \delta, q_1, R, \emptyset)$
 δ :

(1) $\delta(q_1, 0, R) = \{(q_1, BR)\}$	(9) $\delta(q_1, 1, R) = \{(q_1, GR)\}$
(2) $\delta(q_1, 0, B) = \{(q_1, BB)\}$	(10) $\delta(q_1, 1, B) = \{(q_1, GB)\}$
(3) $\delta(q_1, 0, G) = \{(q_1, BG)\}$	(11) $\delta(q_1, 1, G) = \{(q_1, GG)\}$
(4) $\delta(q_1, c, R) = \{(q_2, R)\}$	
(5) $\delta(q_1, c, B) = \{(q_2, B)\}$	
(6) $\delta(q_1, c, G) = \{(q_2, G)\}$	
(7) $\delta(q_2, 0, B) = \{(q_2, \varepsilon)\}$	(12) $\delta(q_2, 1, G) = \{(q_2, \varepsilon)\}$
(8) $\delta(q_2, \varepsilon, R) = \{(q_2, \varepsilon)\}$	

Give an execution trace of the PDA M showing that input string 001cc100 is in $N(M)$.
7. Design PDA for palindrome with middle symbol c and trace the string *abcba*.
8. Design PDA for $L = \{a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i = j \text{ or } j = k\}$

9. Construct a PDA that accepts $L = \{ ww^R \mid w = (a+b)^* \}$