Context free grammar to Pushdown Automata

Let $G = (V, T, P, S)$ be a CFG. We construct a PDA P that accepts $L(G)$ by empty stack as follows :-

$P = (\{q\}, T, V \cup T, \delta, q, S)$

where transition function δ is defined by:

1. For each variable A,
   $\delta(q, \epsilon, A) = \{(q, \beta) \mid A \to \beta \text{ is a production of } G\}$.
2. For each terminal a,
   $\delta(q, a, a) = \{(q, \epsilon)\}$.

Qn-1 : Construct a PDA equivalent to the grammar

$S \to aAA$

$A \to aS \mid bS \mid a$

Sol :-

Set of terminals = $\{a, b\}$

Set of variables = $\{S, A\}$

$\delta(q, \epsilon, S) = \{(q, aAA)\}$

$\delta(q, \epsilon, A) = \{(q, aS), (q, bS), (q, a)\}$

$\delta(q, a, a) = \{(q, \epsilon)\}$

$\delta(q, b, b) = \{(q, \epsilon)\}$.

Qn-2: Construct a PDA for the following CFG and test whether "abbabb" is in N(P).

$G = (\{S, A\}, \{a, b\}, R, S) = (V, T, P, S)$

$R = \{ S \to AA \mid a,\ A \to SA \mid b \}$

Soln- set of variables = $\{S, A\}$

set of terminals = $\{a, b\}$

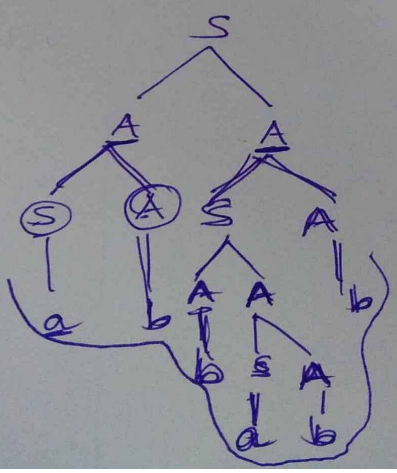
$\delta(q, \epsilon, S) = \{(q, AA), (q, a)\}$

$\delta(q, \epsilon, A) = \{(q, SA), (q, b)\}$

$\delta(q, a, a) = \{(q, \epsilon)\}$

$\delta(q, b, b) = \{(q, \epsilon)\}$

abbabb



$\vdash \delta(q, bb, AA)$

$\vdash \delta(q, bb, bAA)$

$\vdash \delta(q, b, A)$

$\vdash \delta(q, b, b)$

accepted.

$\delta(q, abbabb, S)$

$\vdash \delta(q, abbabb, AA)$

$\vdash \delta(q, abbabb, SAA)$

$\vdash \delta(q, abbabb, aAA)$

$\vdash \delta(q, bbabb, AA)$

$\vdash \delta(q, bbabb, bAA)$

$\vdash \delta(q, babb, A)$

$\vdash \delta(q, babb, SA)$

$\vdash \delta(q, babb, AAA)$

$\vdash \delta(q, babb, bAA)$

$\vdash \delta(q, abb, AA)$

$\vdash \delta(q, abb, SAA)$

$\vdash \delta(q, abb, aAA) \vdash \delta(q, bb, AA)$