Ea:

Convert the grammar CFG to a PDA

$$E \rightarrow E+E$$
$$E \rightarrow id$$

Sol:
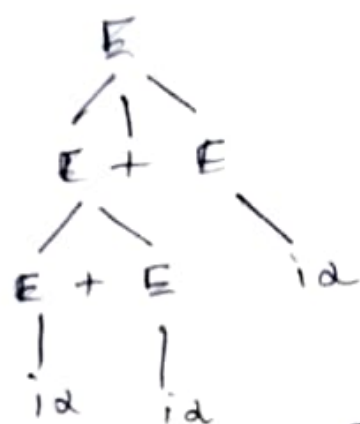
$$[id + id + id]$$

E
/ | \
E + E
/ \
E + E   id
|
id   id

The equivalent PDA is given by

$$P = \left(\{q\}, \{+, id\}, \{E + id\}, \delta, q, E \right)$$

where δ is defined by

$$\delta(q, \varepsilon, E) = \{ (q, E+E), (q, id) \}$$
$$\delta(q, id, id) = \{ (q, \varepsilon) \}$$
$$\delta(q, +, +) = \{ (q, \varepsilon) \}$$

Test whether the i/p $id + id + id$ is in $N(P)$

$$(q, id+id+id, E) \vdash (q, id+id+id, E+E)$$
$$\vdash (q, id+id+id, id+E)$$
$$\vdash (q, +id+id, +E)$$
$$\vdash (q, id+id, E)$$

$$\vdash (q, ia+id, E+E)$$
$$\vdash (q, ia+id, id+E)$$
$$\vdash (q, +id, +E)$$
$$\vdash (q, id, E)$$
$$\vdash (q, id, id)$$
$$\vdash (q, \varepsilon, \varepsilon)$$

$$\therefore id+id+id \ \varepsilon \ N(P)$$

$$S \rightarrow 0S1 | A$$
$$A \rightarrow 1A0 | S | \varepsilon$$

Sol :

$$P = \{ \{q\}, \{0,1\}, \{S,A,0,1\}, \delta, q, S)$$

δ is defined as

$$\delta(q, \varepsilon, S) = \{(q, 0S1)(q, A)\}$$
$$\delta(q, \varepsilon, A) = \{(q, 1A0), (q, S)(q, 4e)$$
$$\delta(q, 0, 0) = \{(q, 4e)\}$$
$$\delta(q, 1, 1) = \{(q, \varepsilon e)\}$$

<u>sting</u>

0101

$(q, 0$

$(q, 0101, S) \vdash (q, 0101, OS1)$

$\vdash (q, 101, S1)$

$\vdash (q, 101, 1AO1)$

$\vdash (q, 01, AO1)$

$\vdash (q, 01, O1)$

$\vdash (q, 1, 1)$

$\vdash (q, \epsilon, \epsilon)$

The given i/p string is belong to N(D

<u>Ea!3</u>

CFG to PDA

$S \rightarrow OBB$

$B \rightarrow OS|1S|O$

<u>sol</u>

$P = \{ \{q\}, \{0,1\}, \{S, B, 0, 1\}, \delta, q, S \}$

where δ is defined as

$\delta(q, \epsilon, S) = \{ (q, OBB)$

$\delta(q, \epsilon, B) = \{ (q, OS) (q, 1S), (q, 0)\}$

$\delta(q, 0, 0) = \{(q, \epsilon, \epsilon)\}$

$\delta(q, 1, 1) = \{q, \epsilon \epsilon)\}$

<u>Let</u>

CFG Construction from PDA

<u>Ex:</u>

Let $M = (\{q_0, q_1\}, \{0,1\}, \{x, z_0\}, \delta, q_0, z_0, \emptyset)$
is given by

$$\delta(q_0, 0, z_0) = \{(q_0, x\, z_0)\}$$
$$\delta(q_1, 1, x) = \{(q_1, \varepsilon)\}$$
$$\delta(q_0, 0, x) = \{(q_0, x\, x)\}$$
$$\delta(q_1, \varepsilon, x) = \{(q_1, \varepsilon)\}$$
$$\delta(q_0, 1, x) = \{(q_1, \varepsilon)\}$$
$$\delta(q_1, \varepsilon, z_0) = \{(q_1, \varepsilon)\}$$

Construct a CFG for the PDA. M.

<u>Sol:</u>

$$T = \{0, 1\}$$
$$V = \{\, s, (q_0, x, q_0)\, (q_0, x, q_1)$$
$$(q_1, x, q_0)\, (q_1, x, q_1)$$
$$(q_0, z_0, q_0)\, (q_0, z_0, q_1)$$
$$(q_1, z_0, q_0)\, (q_1, z_0, q_1)\,\}$$

(i) $\delta(q_0, 0, z_0) = \{(q_0, x z_0)\}$

$$[q_0 \ z_0 \ z_0] \rightarrow 0[q_0,x,q_0][q_0,z_0,q_0]$$
$$\rightarrow 0[q_0,x,q][q,z_0,q_0]$$

$$[q_0, z_0, q_1] \rightarrow 0[q_0,x,q_0][q_0,z_0,q_1]$$
$$\rightarrow 0[q_0,x,q_1][q_1,z_0,q_1]$$

(ii) $\delta(q_0, 0, x) = \{(q_0, xx)\}$

$$[q_0,x,q_0] \rightarrow 0[q_0,x,q_0][q_0,x,q_0]$$
$$\rightarrow 0[q_0,x,q_1][q_1,x,q_0]$$

$$[q_0,x,q_1] \rightarrow 0[q_0,x,q_0][q_0,x,q_1]$$
$$\rightarrow 0[q_0,x,q_1][q_1,x,q_1]$$

(iii) $\delta(q_0, 1, x) = \{(q_1, \varepsilon)\}$
$$(q_0, x, q_1) \rightarrow 1$$

(iv) $\delta(q_1, 1, x) = \{(q_1, \varepsilon)\}$
$$(q_1, x, q_1) \rightarrow 1$$

(v) $\delta(q_1, \varepsilon, x) = \{(q_1, \varepsilon_e)\}$

$$(q_1, x, q_1) \rightarrow \varepsilon_e$$

(vi) $\delta(q_1, \varepsilon, z_0) = \{(q_1, \varepsilon_e)\}$

$$(q_1, z_0, \dot{q}_1) \rightarrow \varepsilon_e$$

Production for S

$$S \rightarrow [q_0, z_0, q_0]$$
$$[q_0, z_0, q_1]$$

Resultant Production are an follow

$$S \rightarrow [q_0, z_0, q_1]$$

$$[q_0, z_0, q_1] \rightarrow o[z_0, x, q_1][q, z_0, q_0]$$

$$[q_0, x, q_1] \rightarrow o[q_0, x, q_1][q, x, q_1]$$

$$[q_1, z_0, q_1] \rightarrow \varepsilon_e$$

$$[q_1, x, q_1] \rightarrow \{\varepsilon_e, 1\}$$