Q1) Convert the following CFG to PDA

$S \to asb$

$S \to a/b/\epsilon$

and check string acceptance for aaab

Soln:

$$PDA = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$$

$Q = q$

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

$q_0 = q_0$.

Rule 1 : $\delta(q, \epsilon, A) = (q, x)$

where $A \to x$

Rule 2: $\delta(q, a, a) = (q, \epsilon)$

Apply the Rule 1 for NonTerminal.

Given NonTerminals $= V = \{S\}$

Apply the Rule 2 for Terminals.

T = Terminals $= \{a, b\}$

Given

$S \to asb$

$S \to a$

$S \to b$

$S \to \epsilon$

Rule 1 : $\delta(q, \in, A) = (q, \alpha)$

$R_1 : \delta(q, \in, S) = (q, aSb)$

$R_2 : \delta(q, \in, S) = \{(q, a), (q, b), (q, \in)\}$

Rule 2 : $\delta(q, a, a) = (q, \in)$

Apply for $\{a, b\} \in$

$R_3 : \delta(q, a, a) = (q, \in)$

$R_4 : \delta(q, b, b) = (q, \in)$

$R_5 : \delta(q, \in, Z_0) = (q, \in)$

String acceptance for aaabb.

$\delta(q, aaabb, S) \vdash (q, aaabb, aSb)$ (R_1)

$\vdash (q, aaabb, aSb)$ (R_3)

$\vdash (q, aabb, Sb)$ (R_1)

$\vdash (q, aabb, aSbb)$ Apply R_3

$\vdash (q, aaSbb, aSbb)$

$\vdash (q, aSbb, Sbb)$ (R_2)

$\vdash (q, aSbb, abb)$ (R_3)

$\vdash (q, bb, bb)$ (R_4)

$\vdash (q, b, b)$ (R_4)

$\vdash (q, \in, Z_0)$ (R_5)

$\vdash (q, \in)$

Stack is empty & String accepted

PDA = M = (Q, Σ, Γ, δ, q0, Z0, F)

Q = q, Σ = {a, b, ∈}

Γ = {S, a, b, Z0}, q0 = q

Z0 = Z0, F = q

M = (q; {a, b, ∈}, {S, a, b, Z0}, δ, q, Z0, q)

Q2. Construct PDA for the given CFG and test 010000 accepted by PDA or not

S → OBB

B → OS/1S/0/∈

Soln: Given S → OBB

B → OS

B → 1S

B → 0

B → ∈

V = Non terminals = {S, B}

T = Terminals = {0, 1, ∈}

Apply Rule 1 for Non terminals & Rule 2 for Terminals

Rule 1 : $\delta(q, \in, A) = (q, \alpha)$ where $A \to \alpha$

$R1 : \delta(q, \in, S) = (q, OBB)$

$R2 : \delta(q, \in, B) = \{(q, OS), (q, 1S), (q, 0), (q, \in)\}$

Rule 2 : $\delta(q, a, a) = (q, \in)$

$R3 : \delta(q, 0, 0) = (q, \in)$

$R4 : \delta(q, 1, 1) = (q, \in)$

$R5 : \delta(q, \in, Z_0) = (q, \in)$

String acceptance of 010000 or 0104

$\delta(q, 010000, S) \vdash (q, 010000, OBB)$ (R1)

$\vdash (q, 010000, OBB)$ (R3)

$\vdash (q, 10000, BB)$ (R2 apply)

$\vdash (q, 10000, 1SB)$ Apply R4

$\vdash (q, 0000, SB)$ (R1)

$\vdash (q, 0000, OBBB)$ (R3)

$\vdash (q, 000, BBB)$ (R2)

$\vdash (q, 000, OBB)$ (R3)

$\vdash (q, 00, BB)$ (R2)

$\vdash (q, 00, BB)$ (R2)

$\vdash (q, 00, 0B)$ (R3)

$\vdash (q, 0, B)$ (R2)

$\vdash (q, 0, 0)$ (R3)

$\vdash (q, \epsilon, Z_0)$ (R5)

$\vdash (q, \epsilon)$

Stack is empty and String is accepted

PDA = $M = (Q, \Sigma, \Gamma, \delta, q_0, Z_0, F)$

$M = (q, \{0, 1, \epsilon\}, \{S, B, 0, 1\}, \delta, q, Z_0, q)$.