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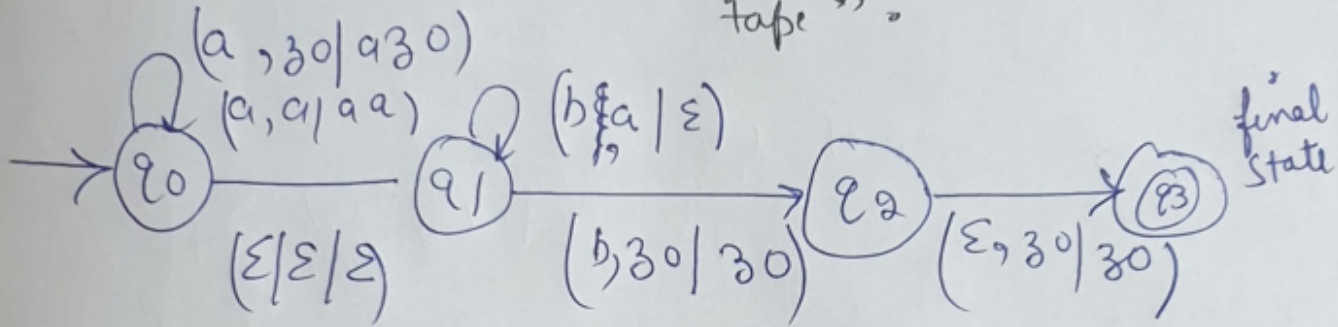
(Section → B)

Pda

→ $L\{G\} = \{a^n b^{n+1} \mid n >= 1\}$

* According to the grammer, then will always be exacting one extra in "tape".



Production used :-

$\delta(q_0, a, Z_0) = (q_0, aZ_0)$

$\delta(q_0, a, a) = (q_0, aa)$

$\delta(q_0, \varepsilon, \varepsilon) = (q_1, \varepsilon)$

$\delta(q_1, b, a) = (q_1, \varepsilon)$

$\delta(q_1, b, Z_0) = (q_2, Z_0)$

$\delta(q_1, b, Z0) = (q_2, Z0)$

$\delta(q_2, \varepsilon, Z0) = (q_3, Z0)$

Now Acceptibility for string ie aabbb **

$\delta(q_0, aabbb, Z0) = \delta(q_0, abbb, aZ0)$

$= \delta(q_0, bbb, aaZ0)$

$= \delta(q_1, bb, aZ0)$

$= \delta(q_1, b, Z0)$

$= \delta(q_2, \varepsilon, Z0)$

$= (q_3, Z0) \in F$

↓ final state

String is accepted for this Pda.

∴ Pda is correct.

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(2)

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(Section → A)

Ques→1) Perform specification of the given CFG.

$$S \to aAB \mid aBb \mid A \mid B$$
$$A \to aA \mid \varepsilon$$
$$B \to Bb \mid \varepsilon$$
$$C \to AaA \mid B$$

Ans → Steps for the ~~Sfe~~ simplification of the given CFG.

1. Remove the useless production.
2. Remove the unit production.
3. Remove the null production.

Step→1) Remove the useless production.

$S \to aAB \mid aBb \mid A \mid B$
$A \to aA \mid \varepsilon$
$B \to Bb \mid \varepsilon$
$\boxed{C \to AaA \mid A}$ – This one is the useless production

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Step-2) Remove the null production
ie Null Removal

$S \to aAB \mid aBb \mid A \mid B$
$A \to aA \mid \varepsilon$
$B \to Bb \mid \varepsilon$ } "Here the null is"

Step-3) Production without "null":

$$\left\{ \begin{array}{l} S \to aAB \mid aBb \mid A \mid B \\ A \to aA \\ B \to Bb \end{array} \right\} \quad -(1.)$$

Step-4) Find the effect of a nullable Variables. ie Put (ε) at the place of nullable variable.
ie nullable variables are (S, A, B).

$$\left\{ \begin{array}{l} S \to aB \mid aA \mid a \mid ab \mid \\ A \to a \\ B \to b \end{array} \right\} \quad -(2.)$$

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Now Adding (1) & (2),

$$S \to aAB \mid aBb \mid A \mid B \mid aB \mid aA \mid a \mid ab$$
$$A \to aA \mid a$$
$$B \to Bb \mid b$$

Step-3) Remove the unit production,
Here, There is a unit production

Result :- $S \to aAB \mid aBb \mid A \mid B \mid aB \mid aA \mid a \mid ab$
$A \to aA \mid a$
$B \to Bb \mid b$.

Remove the unit production. ↓

$S \to aAB \mid aBb \mid aB \mid aA \mid a \mid ab$
$A \to aA \mid a$
$B \to Bb \mid b$

(2.) Find out the sequence of derivable variables :-

(6.)

i'e derived from specific unit production

S derivables = { A, B }

A " = { ϕ }

B " = { ϕ }.

i'e (S, A) = (S → a)

(S, B) = (S → b)

i'e (A, B) = (A → b).

i'e (B) = { ϕ }

Final Result →

S → aAB | aBb | aB | aA | ab | a | b

A → aA | a

B → Bb | b

Ans.

removing unit, null & useless production

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⇒ "(Section-C)"

Ques→4) Perform & Construct Turing Machine for the given grammer.

$$L(G) = \{ a^n b^m \mid n \neq m \}$$

Ans→ Turing Machine is a mathematical model which have infinite input tape with read and write heads, and Header always points left & Right.

It have 7 tuples ie $(Q, \Sigma, \Gamma, q_0, \#, \delta, F)$

7 tuples

- Q → Set of states
- Σ → set of inputs
- Γ → stack symbol (tape)
- q_0 → initial state
- $\#$ → blank symbol
- δ → Transition's
- F → final state

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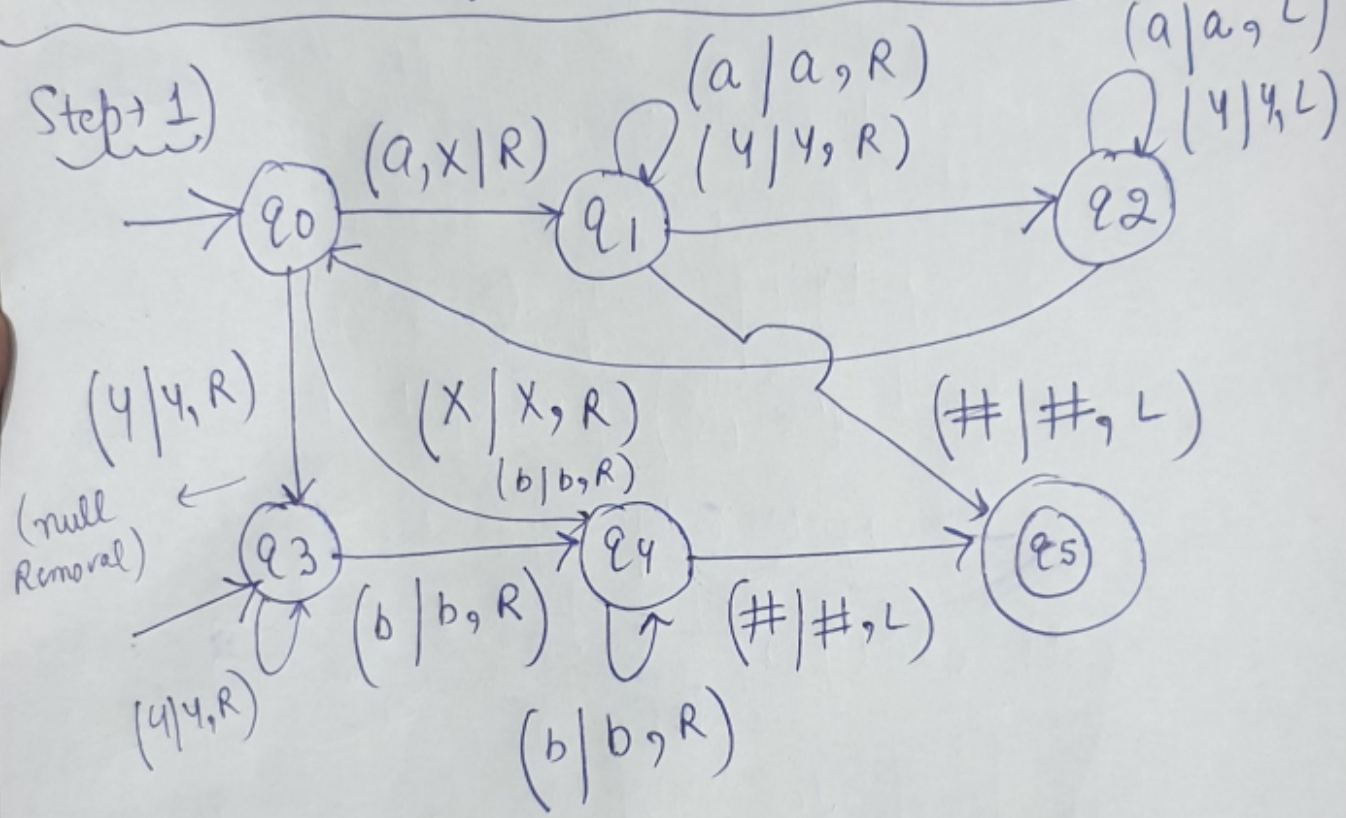
δ is also represented as -:

$$(Q \times \Gamma) = (Q \times \Gamma) \times (L \times R \times (\#))$$

- Q : set of states
- Γ : for reading
- Q : set of states
- $L \times R \times (\#)$: for writing

Step→1)



Step→2) Transition Moves -:

$$\delta(q_0, a) = (q_1, X, R)$$
$$\delta(q_1, a) = (q_1, a, R)$$

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$\delta(q_1, 4) = (q_1, 4, R)$

$\delta(q_1, b) = (q_2, a, L)$

$\delta(q_2, a) = (q_2, 4, L)$

$\delta(q_2, 4) = (q_0, X, R)$

$\delta(q_2, X) = (q_3, 4, R)$

$\delta(q_3, b) = (q_4, b, R)$

$\delta(q_4, b) = (q_4, b, R)$

$\delta(q_4, \#) = (q_5, \#, R)$ → Halt state

$\delta(q_1, \#) = (q_5, \# R)$

Step-3) Perform Acceptibility -:

For e.g Taking the string with Assumptions aaabb

no. of 'a's ≠ b

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$\delta(q_0, aaabb\#) = \delta(q_1, Xaabb\#)$

$= \delta(q_1, Xaabb\#)$

$= \delta(q_1, Xaabb\#)$

$= \delta(q_2, Xaaybb\#)$

$= \delta(q_2, yaaybb\#)$

$= \delta(q_2, Xaaybb\#)$

$= \delta(q_0, Xaaybb\#)$

$= \delta(q_1, XXaybb\#)$

$= \delta(q_1, XXaybb\#)$

$= \delta(q_1, XXaybb\#)$

$= \delta(q_2, XXayy\#)$

$= \delta(q_2, XXayy\#)$

$= \delta(q_0, XXayy\#)$

$= \delta(q_1, XXXyy\#)$

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$= \delta(q_1, XXX44\#)$

$= \delta(q_1, XXX44\#)$

$= \delta(q_5, XXX44\#) \in F$ (it belongs to final state)

Thus, This string for Turing Machine is accepted when $(n \neq m)$ as Here we are taking the no. of a's are more than no. of b's.