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Q4

ANS

Let L be a regular language and $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automata with n-states. Language L is accepted by m. Let $w \in L$ and $|w| \geq n$, then w can be written as xyz where

(i) $|y| > 0$

(ii) $|xy| \leq n$

(iii) $xy^iz \in L$ for all $i \geq 0$ here y^i denotes that y is repeated or pumped i times

Interpretation of pumping lemma :

- Pumping lemma gives a necessary condition for an input string to belong to a regular set
- Pumping lemma does not give sufficient condition for a language to be regular.
- pumping lemma should not be used to establish that a given language is regular.
- pumping lemma should be used to establish that a given language is not regular.
- It uses the pigeonhole principle.

$L = \{ w = w^R \mid w \in \{a, b\} \}$

let $L = \{ w | w^R \mid w \in \{a, b\} \}$ is a regular language.

let n be a pumping lemma constant

let $z = w$

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Represent Z in P.L.C

let $Z = a^n b a^n = \omega^R$

Z can also be written as

$Z = uvw$ such that $|uv| \leq n$ and $1 \leq |v| \leq n$

select values of u, v, w satisfying above two conditions

let $u = a^{n-1}$

$v = a$

$w = ba^n$

then

$uv^i w = a^{n-1} (b)^i b a^n$

For $i = 0$, we get

$uv^0 w = a^{n-1} b a^n \notin L$

$\because$ Resultant ω $(a^{n-1} b a^n)$ cannot be reverse of $\omega(\omega^R)$.

Hence it contradicts our assumption.

$\therefore$ L is not a regular language.

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Q5

ANS Convert given grammer to CNF

$S \rightarrow ABC \mid BAB$
$A \rightarrow aA \mid BaC \mid aaa$
$B \rightarrow bBb \mid a \mid D$
$C \rightarrow CA \mid AC$
$D \rightarrow \varepsilon$

(i) Removing ε transition

$D \rightarrow B$
$B \rightarrow D$
$\therefore B \rightarrow \varepsilon$
$S \rightarrow ABC$
$B \rightarrow e$
$S \rightarrow AC$

$S \rightarrow BAB$

1: $B \rightarrow \varepsilon$
$S \rightarrow AB$

2: $B \rightarrow \varepsilon$ (last)
$S \rightarrow BA$

3: both $B \rightarrow \varepsilon$
$S \rightarrow A$

$A \rightarrow BaC$
$B \rightarrow \varepsilon$
$A \rightarrow aC$

$B \rightarrow bBb$
$\therefore B \rightarrow \varepsilon$
$B \rightarrow bb$

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$S \rightarrow ABC \mid BAB \mid AC \mid AB \mid BA \mid A$
$A \rightarrow aA \mid BaC \mid aaa \mid aC$
$B \rightarrow bBb \mid a \mid bb$
$C \rightarrow cA \mid AC$

(ii) Removing unit production

$S \rightarrow A$
$S \rightarrow aA \mid BaC \mid aaa \mid aC$
$\therefore S \rightarrow ABC \mid BAB \mid AC \mid AB \mid BA \mid aA \mid BaC \mid aaa \mid aC$
$A \rightarrow aA \mid BaC \mid aaa \mid aC$
$B \rightarrow bBb \mid a \mid bb$
$C \rightarrow cA \mid AC$

(iii) Removing useless productions

There are no useless productions

For CNF,

let $C_a = a$
$C_b = b$

$\therefore S \rightarrow ABC \mid BAB \mid AC \mid AB \mid BA \mid C_aA \mid BC_aC \mid C_aC_aC_a \mid C_aC$
$A \rightarrow C_aA \mid BC_aC \mid C_aC_aC_a \mid C_aC$
$B \rightarrow C_bBC_b \mid a \mid C_bC_b$
$C \rightarrow CA \mid AC$

let $F_1 \rightarrow AB$
$F_2 \rightarrow BC_a$
$F_3 \rightarrow C_aC_a$
$F_4 \rightarrow C_bB$

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∴ CNF form :

$S \rightarrow F_1 C \mid B F_1 \mid AC \mid AB \mid BA \mid C_a A \mid F_2 C \mid F_3 C_a \mid C_a C$

$A \rightarrow C_a A \mid F_2 C \mid F_3 C_a \mid C_a C$

$B \rightarrow F_4 C_b \mid a \mid C_b C_b$

$C \rightarrow CA \mid AC$

$C_a \longrightarrow a$

$C_b \longrightarrow b$

$F_1 \longrightarrow AB$

$F_2 \longrightarrow B C_a$

$F_3 \longrightarrow C_a C_a$

$F_4 \longrightarrow C_b B$

FOR EDUCATIONAL USE

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Q6

ANS

A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

LOGIC : N_c q_{nc} no carry (state with)
c q_c carry (state with)

$\Sigma \backslash Q$	00	01	10	11
q_{nc}	0	1	1	0
q_c	1	0	0	1

$\Sigma \backslash Q$	00	01	10	11
q_{nc}	q_{nc}	q_{nc}	q_{nc}	q_{nc}
q_c	q_{nc}	q_c	q_c	q_c

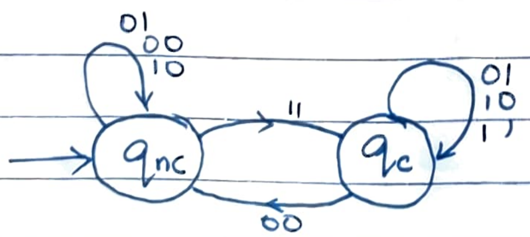
mealy machine

λ_1

ORIGINAL TRANSITION.

Moore machine transition diagram

Q	λ
q_{nc}	0
q_c	1



ORIGINAL TRANSITION DIAGRAM

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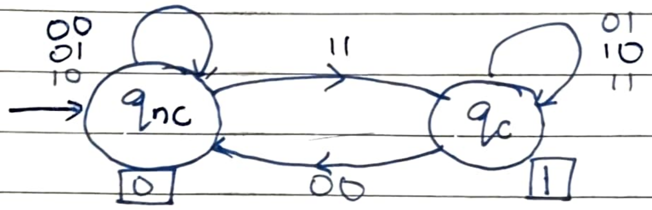
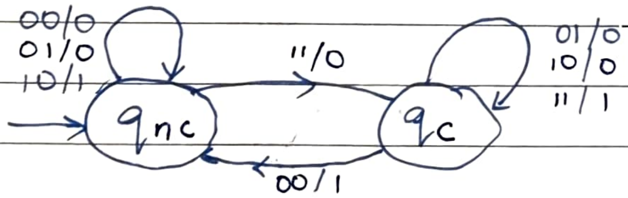


Moore transition diagram.



Mealy Transition Diagram