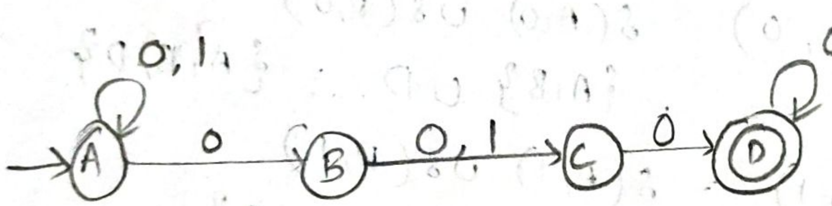
1) Construct DFA equivalent to the given NFA :

	0	1
→A	{A, B}	A
B	C	C
C	D	∅
(D)	D	D

Given NFA,



To construct DFA, Transition table for DFA is :-

	0	1
→A	{A, B}	A
{A,B}	{A, B, C}	{A, C}
{A,B,C}	{A, B, C, D}	{A, C}
{A, C}	{A, B, D}	A
{A,B,C,D}	{A, B, C, D}	{A, C, D}
{A,B,D}	{A, B, C, D}	{A, C, D}
{A,C,D}	{A, B, D}	{A, D}
{A, D}	{A, B, D}	{A, D}

$\delta(\{A,B\},0) \Rightarrow \delta(A,0) \cup \delta(B,0)$
$\Rightarrow \{A,B\} \cup C$
$\Rightarrow \{A,B,C\}$

$\delta(\{A,B\},1) \Rightarrow \delta(A,1) \cup \delta(B,1)$
$\Rightarrow A \cup C \Rightarrow \{A,C\}$

$\delta(\{A,B,C\},0) \Rightarrow \delta(A,0) \cup \delta(B,0) \cup \delta(C,0)$
$\Rightarrow \{A,B\} \cup C \cup D = \{A,B,C,D\}$

$\delta(\{A,B,C\},1) \Rightarrow \delta(A,1) \cup \delta(B,1) \cup \delta(C,1)$
$\Rightarrow A \cup C \cup \emptyset = \{A,C\}$

$\delta(\{A,C\},0) \Rightarrow \delta(A,0) \cup \delta(C,0)$
$= \{A,B\} \cup D = \{A,B,D\}$

$\delta(\{A,C\},1) \Rightarrow \delta(A,1) \cup \delta(C,1)$
$= A \cup \emptyset = A$

$\delta(\{A,B,C,D\},0) \Rightarrow \delta(A,0) \cup \delta(B,0) \cup \delta(C,0) \cup \delta(D,0)$
$\Rightarrow \{A,B\} \cup C \cup D \cup D = \{A,B,C,D\}$

$\delta(\{A,B,C,D\},1) \Rightarrow \delta(A,1) \cup \delta(B,1) \cup \delta(C,1) \cup \delta(D,1)$
$= A \cup C \cup \emptyset \cup D = \{A,C,D\}$

$\delta(\{A,B,D\}, 0) = \delta(A,0) \cup \delta(B,0) \cup \delta(C,0)$

$= \{A,B\} \cup C \cup D = \{A,B,C,D\}$

$\delta(\{A,B,D\}, 1) = \delta(A,1) \cup \delta(B,1) \cup \delta(D,1)$

$= A \cup C \cup \phi D = \{A,C,D\}$

$\delta(\{A,C,D\}, 0) = \delta(A,0) \cup \delta(C,0) \cup \delta(D,0)$

$= \{A,B\} \cup D \cup D = \{A,B,D\}$

$\delta(\{A,C,D\}, 1) = \delta(A,1) \cup \delta(C,1) \cup \delta(D,1)$

$= A \cup \phi \cup D = \{A,D\}$

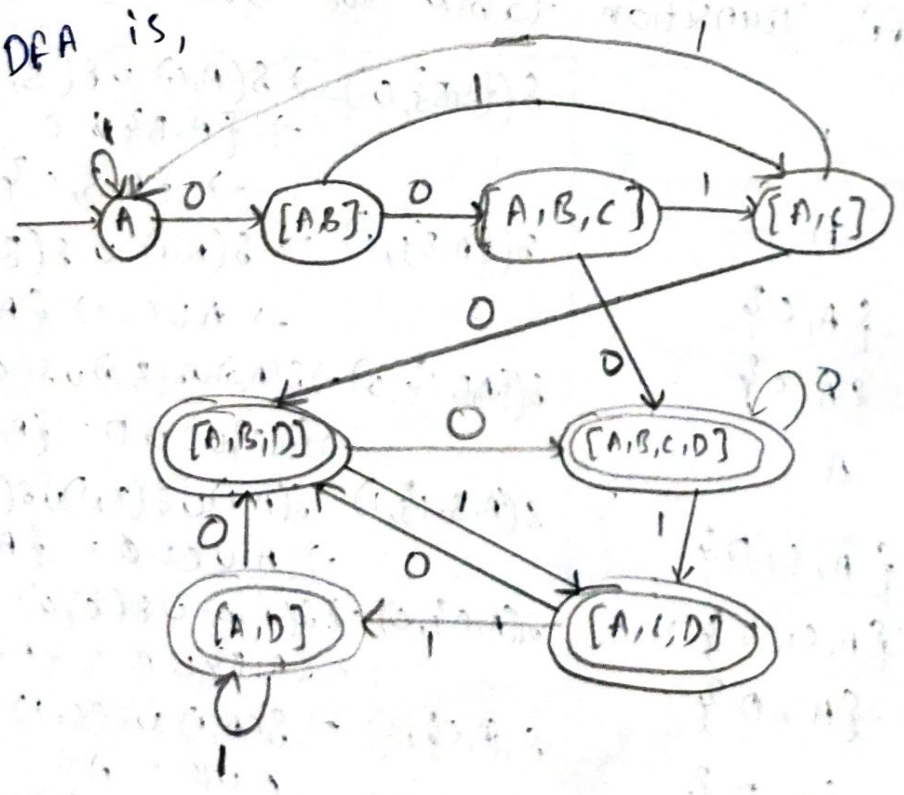
$\delta(\{A,D\}, 0) = \delta(A,0) \cup \delta(D,0)$

$= \{A,B\} \cup D = \{A,B,D\}$

$\delta(\{A,D\}, 1) = \delta(A,1) \cup \delta(D,1)$

$= A \cup D = \{A,D\}$

DFA is,

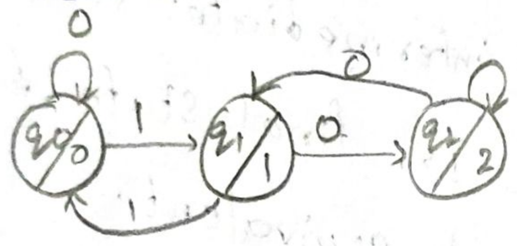


Construct the moore machine to determine residue mod 3.

Let, $\Sigma = \{0, 1\}$

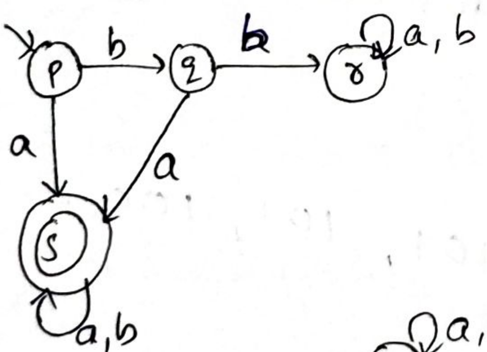
$\Delta = \{0, 1, 2\}$

Moore machine:-

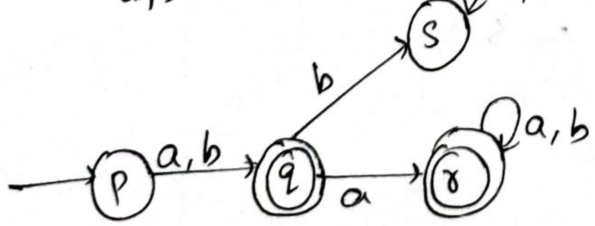


Check whether the two DFAs (A) and (B) given below are equivalent or not.

(A)



(B)



Sol:

	a	b
$\{p,p\}$	$\{s,q\}$	$\{q,q\}$
$\{q,q\}$	$\{s,r\}$	$\{r,s\}$
$\{r,r\}$	$\{r,r\}$	$\{r,r\}$
$\{s,s\}$	$\{s,s\}$	$\{s,s\}$

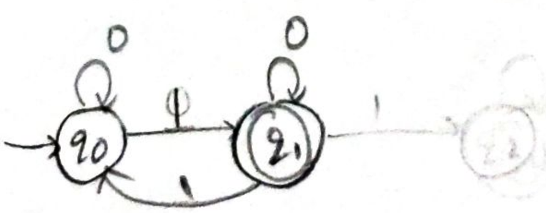
In $\{p,p\}$ one is intermediate state and the other one is final state for $\{q,q\}$ in $\{p,p\}$ so it is not equivalent.

4) Design a DFA $L(M) = \{w \mid w \in \{0,1\}^* \}$ and w is a string that does not contain consecutive 1's.

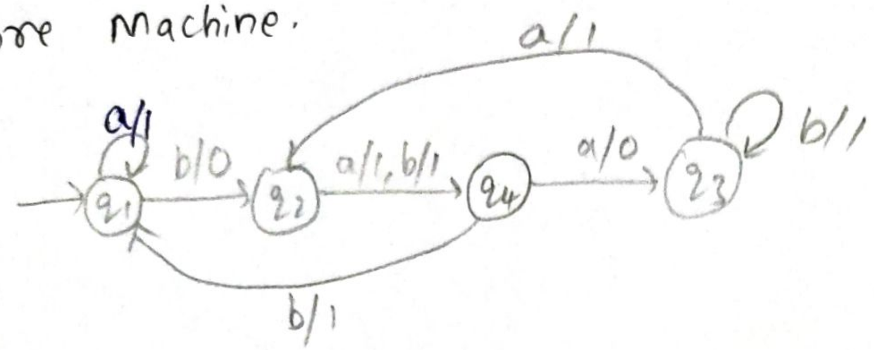
Sol:

$L = \{1, 01, 001, 0101, 101, 100, \ldots\}$

No. of states $= 2+1 = 3$



Convert the following Melay machine into equivalent Moore machine.



Truth table for melay machine:-

Current state	a		b	
	Next State	Output	Next state	Output
q_1	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_4	q_3	0	q_1	1
q_3	q_2	1	q_3	1

Truth table for moore machine is,

Current state	Next state		Output
	a	b	
q_{10}	q_{11}	q_2	0
q_{11}	q_{11}	q_2	1
q_2	q_{41}	q_{41}	1
q_{40}	q_3	q_{11}	0
q_{41}	q_3	q_{11}	1
q_3	q_2	q_3	1

From above truth table Moore Machine is shown as :-