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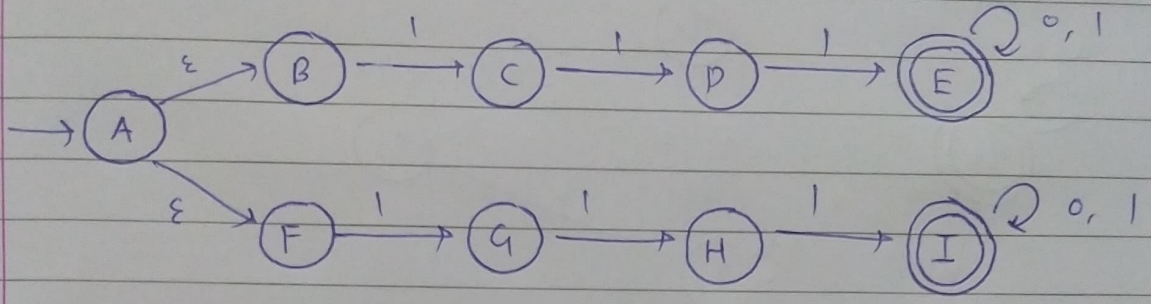
1) Create DFA for strings starting or ending with 111. NFA with ε-moves to be converted to DFA.

→ The required NFA would be



Transition table for NFA:

δ	0	1	ε
A	ϕ	ϕ	B, F
B	ϕ	C	
C	ϕ	D	
D	ϕ	E	
E	E	E	
F	F	G, F	
G	ϕ	H	
H	ϕ	I	
I	I	I	

Now, find ε closure of each state.

{A} = {A, B, F}
{B} = {B}
{C} = {C}
{D} = {D}
{E} = {E}
{F} = {F}

{ G } = { G }
{ H } = { H }
{ I } = { I }

ε closure { A } = { A, B, F } → state q_0

$\delta'(q_0, 0) = \{F\} \rightarrow q_1$
$\delta'(q_0, 1) = \{C, F, G\} \rightarrow q_2$
$\delta'(q_1, 0) = \{F\} = q_1$
$\delta'(q_1, 1) = \{F, G\} = \rightarrow q_3$
$\delta'(q_2, 0) = \{F\} \rightarrow q_1$
$\delta'(q_2, 1) = \{D, F, G, H\} \rightarrow q_4$
$\delta'(q_3, 0) = \{F\} \rightarrow q_1$
$\delta'(q_3, 1) = \{F, G, H\} \rightarrow q_5$
$\delta'(q_4, 0) = \{F\} \rightarrow q_1$
$\delta'(q_4, 1) = \{E, F, G, H, I\} \rightarrow q_6^*$
$\delta'(q_5, 0) = \{F\} \rightarrow q_1$
$\delta'(q_5, 1) = \{F, G, H, I\} \rightarrow q_7^*$
$\delta'(q_6, 0) = \{E, F\} \rightarrow q_8^*$
$\delta'(q_6, 1) = \{E, F, G, H, I\} \rightarrow q_6^*$
$\delta'(q_7, 0) = \{F\} \rightarrow q_1$
$\delta'(q_7, 1) = \{F, G, H, I\} \rightarrow q_7^*$
$\delta'(q_8, 0) = \{E, F\} \rightarrow q_8^*$
$\delta'(q_8, 1) = \{E, F, G\} \rightarrow q_9^*$
$\delta'(q_9, 0) = \{E, F\} \rightarrow q_8^*$
$\delta'(q_9, 1) = \{E, F, G, H\} \rightarrow q_{10}^*$
$\delta'(q_{10}, 0) = \{E, F\} \rightarrow q_8^*$
$\delta'(q_{10}, 1) = \{E, F, G, H, I\} \rightarrow q_6^*$

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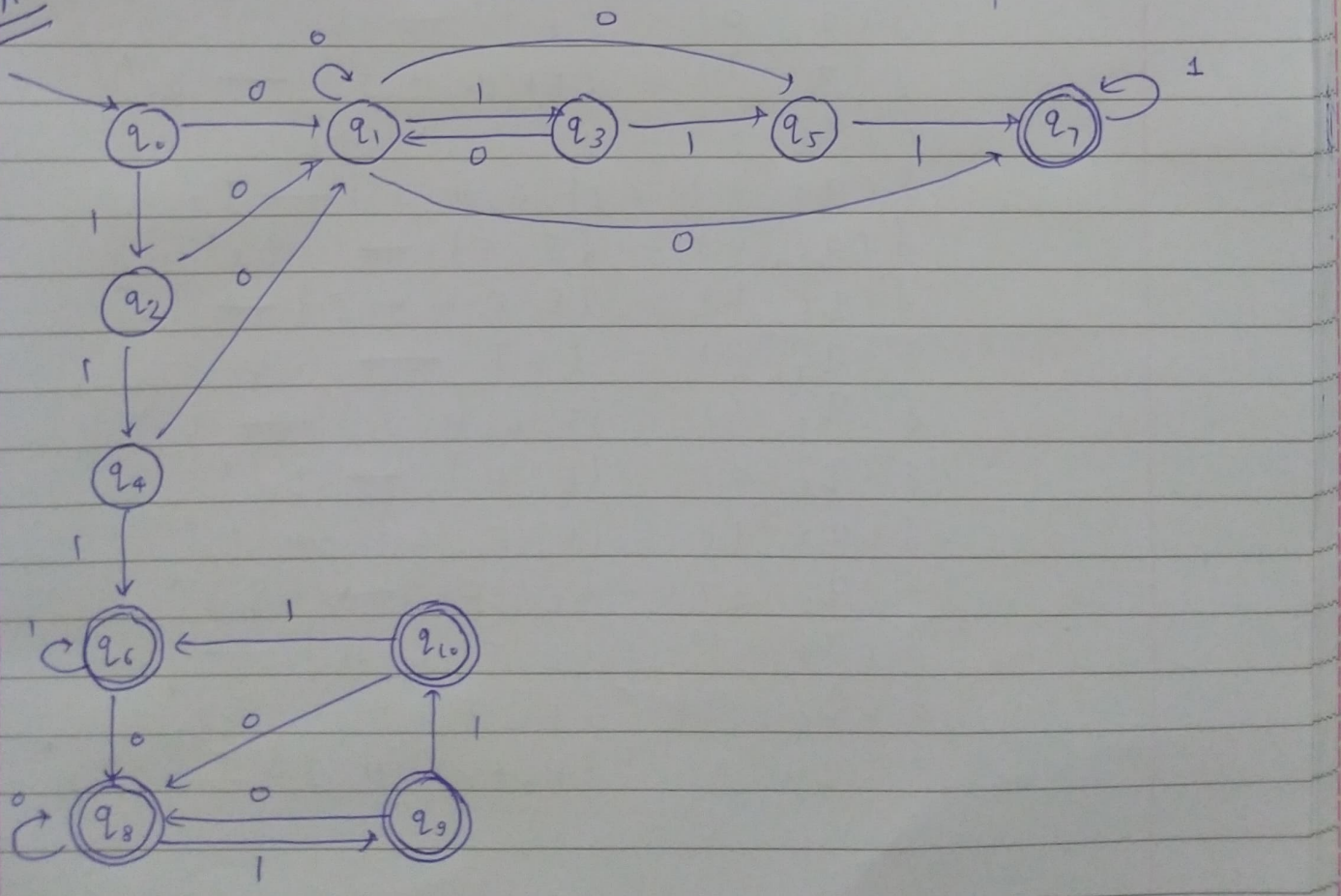
Transition table:

δ'	0	1
q_0	q_1	q_2
q_1	q_1	q_3
q_2	q_1	q_4
q_3	q_1	q_5 *
q_4	q_1	q_6
q_5	q_1	q_7 *
q_6 *	q_8 *	q_6 *
q_7 *	q_1	q_7 *
q_8 *	q_8 *	q_9 *
q_9	q_8 *	q_{10} *
q_{10} *	q_8 *	q_6 *

DFA



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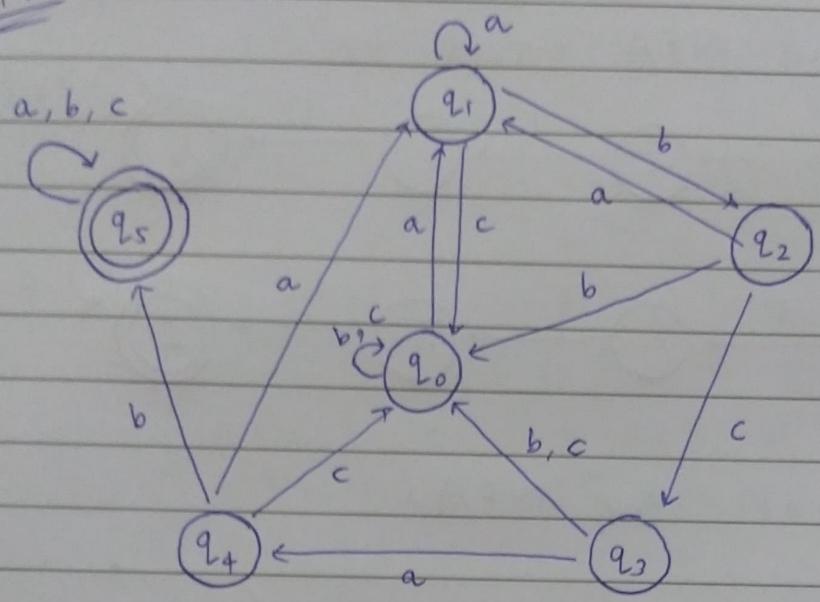
2) Create a DFA that accepts all strings having substring "abcab".

DFA



$Q = \{ q_0, q_1, q_2, q_3, q_4, q_5 \}$

$q_0 = \{ q_0 \}$ $\quad F = \{ q_5 \}$

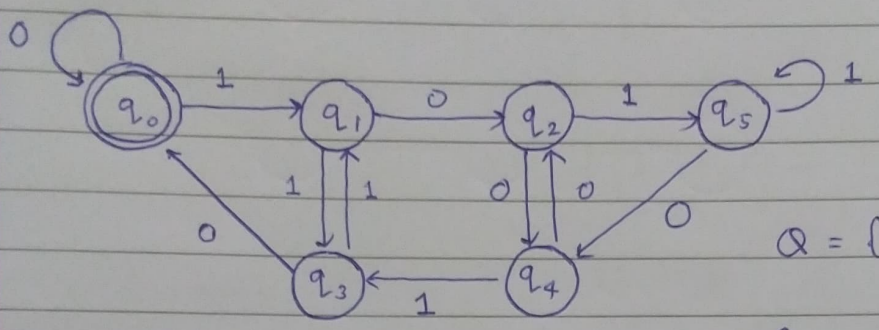
$\Sigma = \{ a, b, c \}$

Transition table :-

States	a	b	c
q_0	q_1	q_0	q_0
q_1	q_1	q_2	q_0
q_2	q_1	q_0	q_3
q_3	q_4	q_0	q_0
q_4	q_1	q_5	q_0
q_5	q_5	q_5	q_5

3) Create a DFA that accepts all binary strings whose value divide by 5.

→ Consider states $q_0, q_1, q_2, q_3, q_4, q_5$ each representing a remainder after divison by 6 respectively.



$Q = \{ q_0, q_1, q_2, q_3, q_4, q_5 \}$

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

$q_0 = \{ q_0 \}$, $F = \{ q_0 \}$

Transition table:

states	0	1
q_0	q_0	q_1
q_1	q_2	q_3
q_2	q_4	q_5
q_3	q_0	q_1
q_4	q_2	q_3
q_5	q_4	q_5