1.1 (1)

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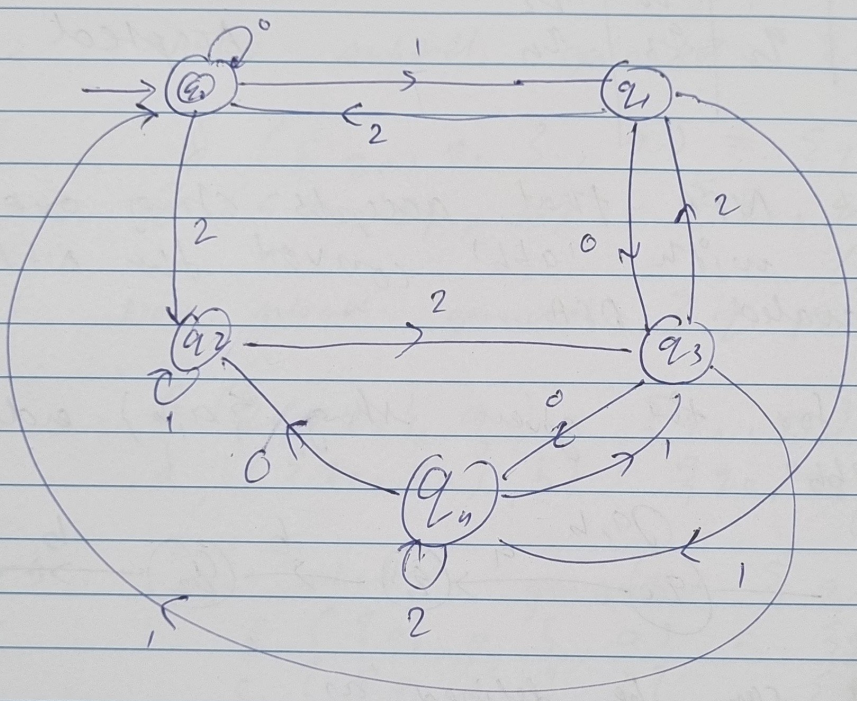
-: Assignment 1 :-

Q1). Design DFA to determine whether ternary number (base 3) is divisible by 5

→ Transition diagram

Ternary no $\Sigma = \{0, 1, 2\}$.



Above DFA can be represented as

$M = (Q, \Sigma, \delta, q_0, f)$

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

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

$q_0 = q_0$

$f = q_0$

Trantion table

Q \ Σ	0	1	2
q_0	q_0	q_1	q_2
q_1	q_3	q_4	q_0
q_2	q_1	q_2	q_3
q_3	q_4	q_0	q_2
q_4	q_2	q_3	q_4

Simulation $(202)_3$

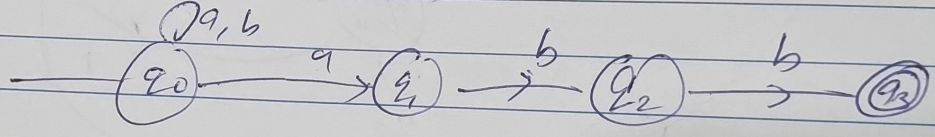
$\delta(q_0, 202) \vdash \delta(q_2,$
$\vdash \delta(q_1,$
$\vdash \delta[q_0)$
= final state

Accepted.

Q2) Construct NFA that accepts string over $\{a, b\}$ ending with 'abb' convert this NFA to equivalent DFA

Sol:

NFA for the given string $\{a, b\}$ ends with "abb"



NFA can be defined as

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

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

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

$q_0 = q_0$

$F = \{q_3\}$

Trantion Table :

	a	b
q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	ϕ	$\{q_2\}$
q_2	ϕ	$\{q_3\}$
q_3	ϕ	ϕ

1.3

NFA to DFA

Step 1: take $\{q_0\}$ as the initial state.

$\delta(q_0, a) = \{q_0, q_1\}$
$\delta(q_0, b) = \{q_0\}$.

Step 2: New subset generated $\{q_0, q_1\}$

$\delta(\{q_0, q_1\}, a) = \{q_0, q_1\}$
$\delta(\{q_0, q_1\}, b) = \{q_0, q_2\}$
↳ new state.

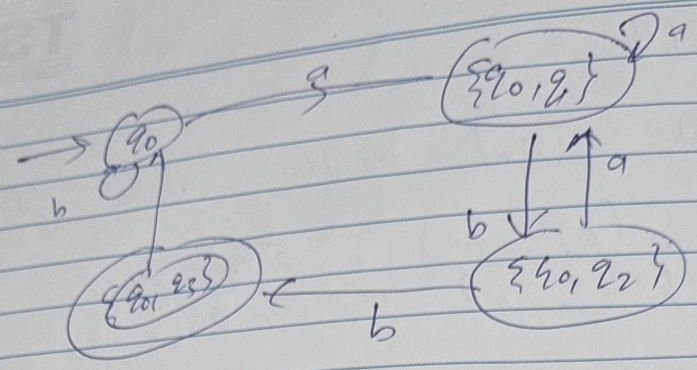
Step 3: New subset generated $\{q_0, q_2\}$.

$\delta(\{q_0, q_2\}, a) = \{q_0, q_1\}$
$\delta(\{q_0, q_2\}, b) = \{q_0, q_3\}$
↳ new state.

Step 4: new subset generated $\{q_0, q_3\}$
$\delta(\{q_0, q_3\}, a) = \{q_0, q_1\}$
$\delta(\{q_0, q_3\}, b) = \{q_0\}$.

No new state is generated
steps are partion table.

q \ Σ	a	b
q_0	$\{q_0, q_1\}$	$\{q_0\}$
$\{q_0, q_1\}$	$\{q_0, q_1\}$	$\{q_0, q_2\}$
$\{q_0, q_3\}$	$\{q_0, q_1\}$	$\{q_0\}$
$\{q_0, q_2\}$	$\{q_0, q_1\}$	$\{q_0, q_3\}$



Above DFA can be represented as

$M = \{Q', \Sigma', \delta', q_0, F'\}$

$Q' = \{\{q_0\}, \{q_0, q_1\}, \{q_0, q_3\}, \{q_0, q_2\}\}$

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

$q_0 = q_0$

$F' = \{q_0, q_3\}$

Simulation: str : aabaabb.

$\delta'(q_0, aabaabb) \vdash \delta(\{q_0, q_1\}, abaabb)$

$\vdash \delta(\{q_0, q_1\}, baabb)$

$\vdash \delta(\{q_0, q_2\}, aabb)$

$\vdash \delta(\{q_0, q_3\}, abb)$

$\vdash \delta(\{q_0, q_3\}, bb)$

$\vdash \delta(\{q_0, q_3\}, b)$

= Final state.

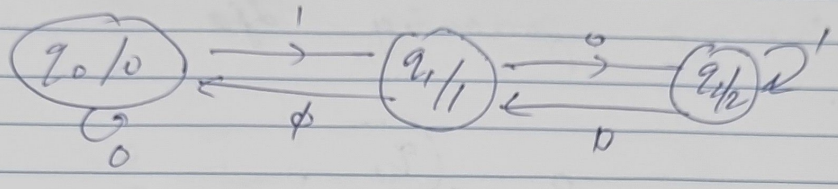
$\vdash \delta'(\{q_0, q_3\})$.

Accepted.

Q3) Construct more machine to find out module -3 for binary number.

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

o/p is 0, 1, 2, $\Delta = \{0, 1, 2\}$



Moore machine can be defined as :-

$$M = (Q, q_0, \Sigma, \Delta, \delta, \lambda)$$

$Q = \{q_0, q_1, q_2\}$.

$q_0 = q_0$.

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

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

Transition table.

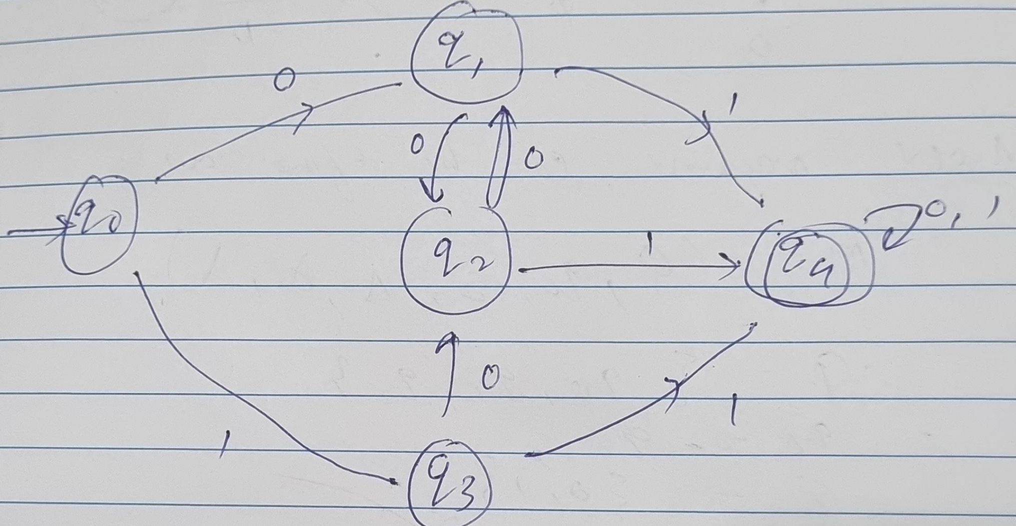
Current state	Next state		output
	0	1	
→ q_0	q_0	q_1	0
q_1	q_2	q_0	1
q_2	q_1	q_2	2

1 0 0 = (80)$_{10}$.

Simulation:

Input		1 ~~0~~ 0	1	0		
State	q_0	q_1	q_2	q_2	q_1	
o/p	0	1	2	2	[1]	= 10 % 3 = 1

Q4.) Minimize following dfa.

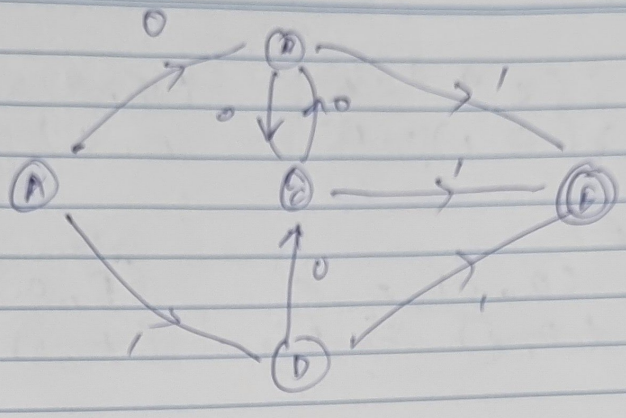


Step 1: Transition table

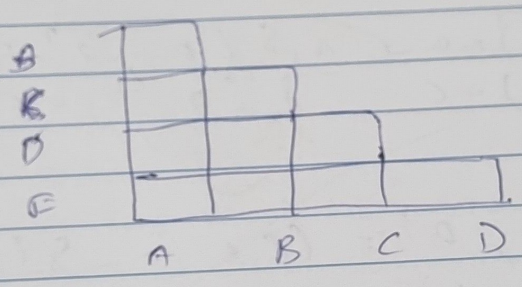
	0	1
→ q_0	q_1	q_3
q_1	q_2	q_4
q_2	q_1	q_4
q_3	q_2	q_4
q_4	q_4	q_4

Consider q_0 = A, q_1 = B, q_2 = C, q_3 = D, q_4^* =

The diag. is:



Step 2:



More all final states are final
(B, E), (C, E), (D, E)

Step 3: Process all the states.

1) (A, E)

$\delta(A, 0) = B$ $\delta(E, 0) = D$

$\delta(A, 1) = E$ $\delta(E, 1) = E$

Not equivalent.

2) (B, E)

$\delta(B, 0) = C$ $\delta(E, 0) = E$

$\delta(B, 1) = E$ $\delta(E, 1) = E$ Not equivalent.

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3) (C, E)
$\delta(C, 0) = B$ $\quad (B, 0) = E$
$\delta(C, 1) = E$ $\quad (E, 1) = E$

4) (D, E)
$(D, 0) = C$ $\quad (E, 0) = E$
$(D, 1) = E$ $\quad (E, 1) = E$

5) (A, D)
$\delta(A, 0) = B$ $\quad \delta(D, 0) = D$
$\delta(B, 1) = C$ $\quad \delta(D, 1) = E$

6) (B, D)
$\delta(B, 0) = (E, E)$ $\quad \delta(D, 0) = E$
$\delta(B, 1) = C$ $\quad \delta(D, 1) = E$
equivalent

7) (C, D)
$\delta(C, 0) = B$ $\quad \delta(D, 0) = F$
$\delta(C, 1) = C$ $\quad \delta(D, 1) = F$
equivalent.

8) (C, A)
$\delta(C, 0) = A$ $\quad \delta(A, 0) = B$
$\delta(C, 1) = B$ $\quad \delta(A, 1) = E$

9) (B, C)
$\delta(B, 0) = C$ $\quad \delta(C, 0) = E$
$\delta(B, 1) = B$ $\quad \delta(C, 1) = E$

(B)

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AB

$\delta(A, 0) = B$ $\quad \delta(B, 0) = E$

$\delta(A, 1) = C$ $\quad \delta(B, 1) = D$

Minimized DFA