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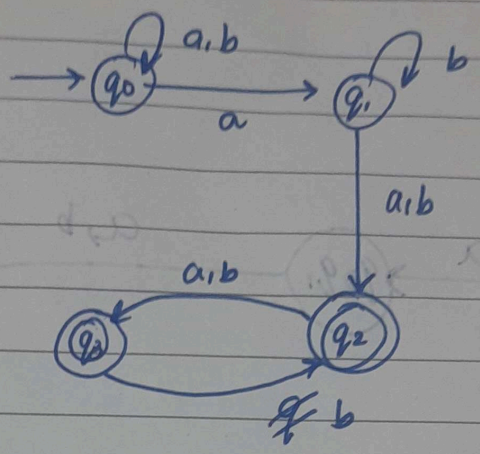
# TACD Tutorial 2

Ketaki Mahajan
160140122050

## NFA to DFA.

Q.1. NFA:



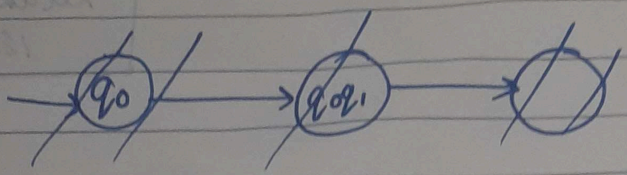

M = ( { q0, q1 } ,

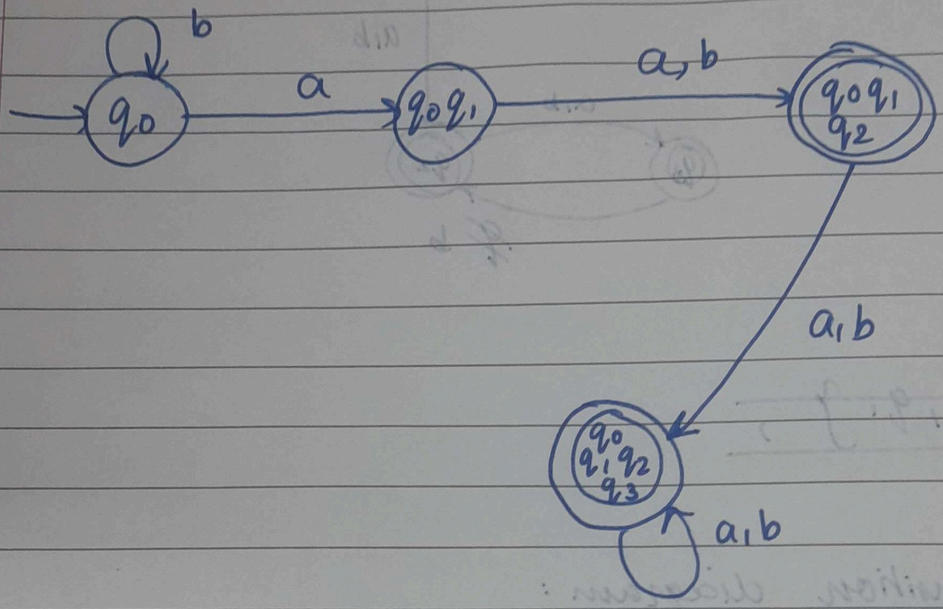
State transition diagram:

| | a | b |
|---|---|---|
| → $q_0$ | $q_0 q_1$ | $q_0$ |
| $q_1$ | $q_2$ | $q_1, q_2$ |
| * $q_2$ | $q_3$ | $q_3$ |
| * $q_3$ | - | $q_2$ |

For DFA,

| State | a | b |
|---|---|---|
| → { $q_0$ } | $q_0 q_1$ | $q_0$ |
| { $q_0 q_1$ } | $q_0 q_1 q_2$ | $q_0, q_1, q_2$ |
| { $q_0 q_1 q_2$ } | $q_0, q_1, q_2, q_3$ | $q_0, q_1, q_2, q_3$ |
| { $q_0 q_1 q_2 q_3$ } | $q_0, q_1, q_2, q_3$ | $q_0, q_1, q_2, q_3$ |




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

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

$\delta(q_0, b) = q_0$

$\delta[(q_0 q_1), (a, b)] = q_0 q_1 q_2$

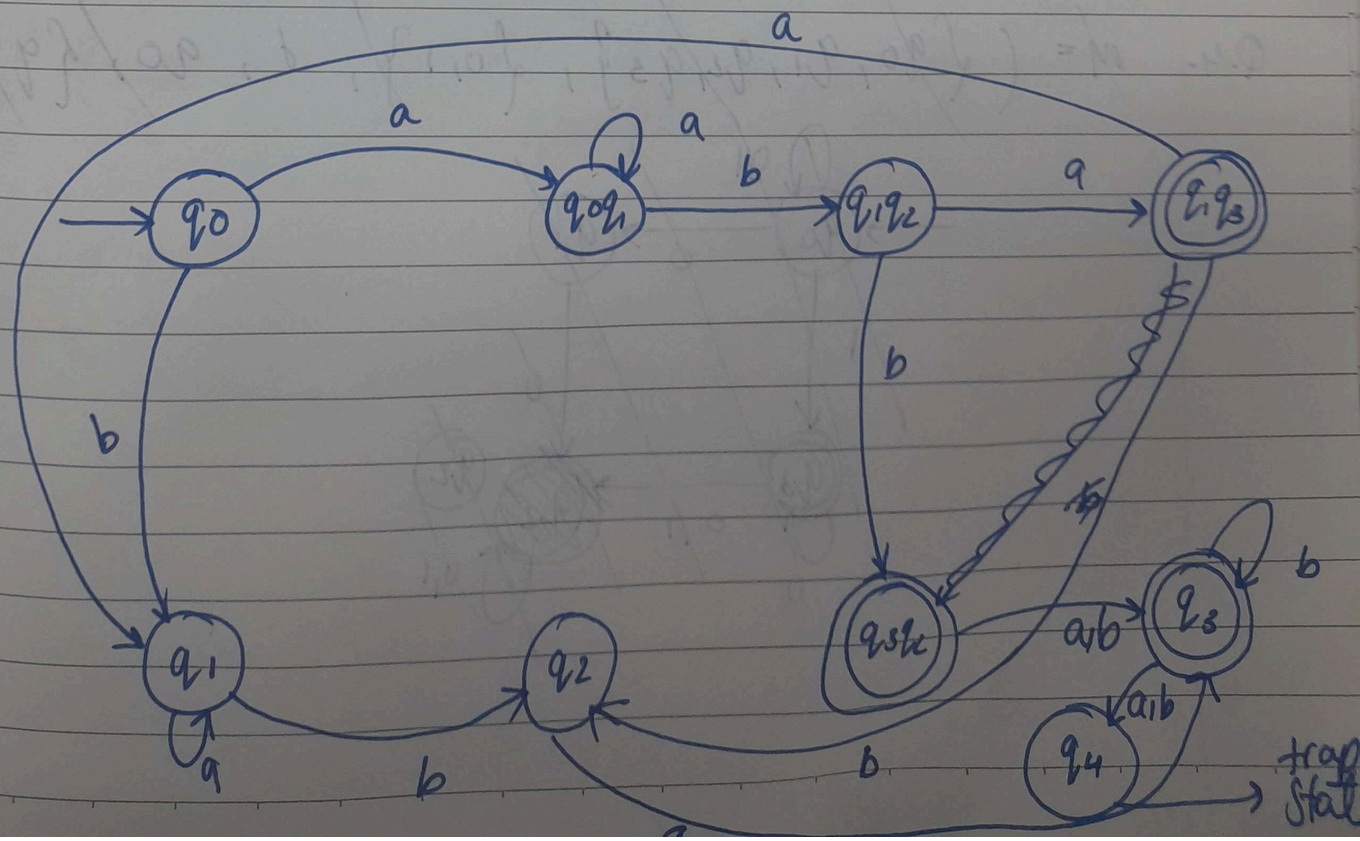
$\delta((q_0, q_1, q_2), (a, b)) = q_0, q_1, q_2, q_3$

Q.2. State transition table:

| | a | b |
|---|---|---|
| → $q_0$ | $q_0, q_1$ | $q_1$ |
| $q_1$ | $q_1$ | $q_2$ |
| $q_2$ | $q_3$ | $q_3$ |
| * $q_3$ | | |

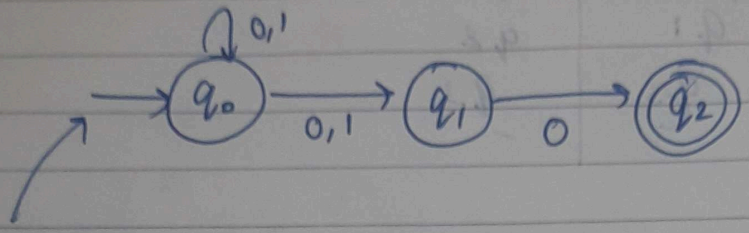
Transition table for DFA -

| State | a | b |
|---|---|---|
| $\{q_0\}$ | $q_0, q_1$ | $q_1$ |
| $\{q_0 q_1\}$ | $q_0 q_1$ | $q_1, q_2$ |
| $\{q_1 q_2\}$ | $q_1 q_3$ | $q_3 q_2$ |
| * $\{q_1 q_3\}$ | $q_1$ | $q_2$ |
| $\{q_1\}$ | $q_1$ | $q_2$ |
| $\{q_2\}$ | $q_3$ | $q_3$ |
| * $\{q_3 q_2\}$ | $q_3$ | $q_3$ |
| * $\{q_3\}$ | $q_4$ | $q_4$ → trap state. |



$M = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, \delta, q_0, \{q_2, q_3\})$

Q3.




NFA for accepting strings ending with either '10' or '00'.

$M = (\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, \{q_2\})$

| | 0 | 1 |
|---|---|---|
| $\rightarrow q_0$ | $q_0, q_1$ | $q_0, q_1$ |
| $q_1$ | $q_2$ | $\phi$ |
| $*q_2$ | $\phi$ | $\phi$ |

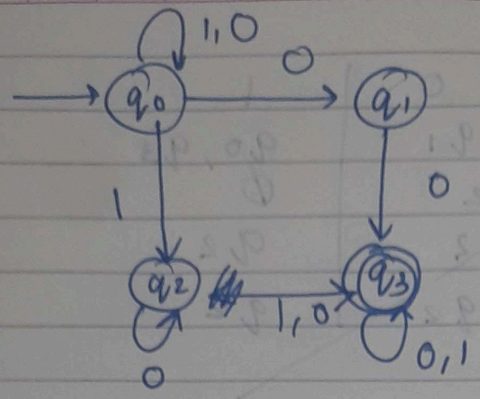
$\delta(q_0, 0) = q_0, q_1$

$\delta(q_0, 1) = q_0, q_1$

$\delta(q_1, 0) = q_2$

$\delta((q_0, 0), q_1) = q_0, q_1, q_2$

Q.4.

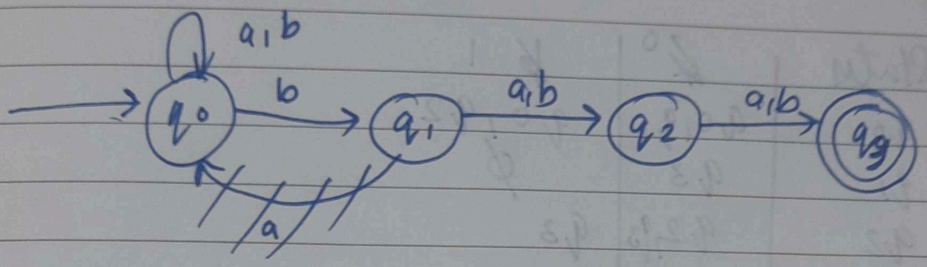



$M = (\{q_0, q_1, q_2, q_3\}, \{0,1\}, \delta, \{q_0\}, \{q_3\})$

| States | 0 | 1 |
|---|---|---|
| → $q_0$ | $q_0, q_1$ | $q_0, q_2$ |
| $q_1$ | $q_3$ | $\phi$ |
| $q_2$ | $q_2, q_3$ | $q_3$ |
| * $q_3$ | $q_3$ | $q_3$ |

$\delta(q_0, 0) = q_0 q_1$
$\delta(q_0, 1) = q_0, q_2$
$\delta(q_1, 0) = q_3$
$\delta(q_1, 1) = \phi$
$\delta(q_2, 0) = q_2 q_3$
$\delta(q_2, 1) = q_3$
$\delta(q_3, 0) = q_3$
$\delta(q_3, 1) = q_3$.

Q5. NFA with $\Sigma = \{a, b\}$ accepting strings in which 3rd symbol from right is b.




$M = (\{q_0, q_1, q_2, q_3\}, \{a, b\}, \delta, \{q_0\}, \{q_3\})$

| States | a | b |
|---|---|---|
| → $q_0$ | $q_0$ | $q_0, q_1$ |
| $q_1$ | $q_2$ | $q_2$ |
| $q_2$ | $q_3$ | $q_3$ |
| * $q_3$ | — | — |

$\delta(q_0, a) = q_0$
$\delta(q_0, b) = q_1, q_0$
$\delta(q_1, a) = q_0 q_2$
$\delta(q_1, b) = q_2$
$\delta(q_2, a) = q_3$
$\delta(q_2, b) = q_3$