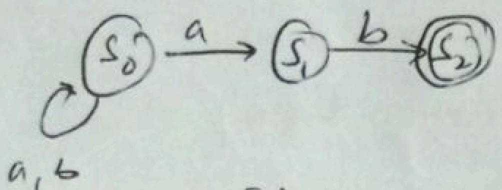
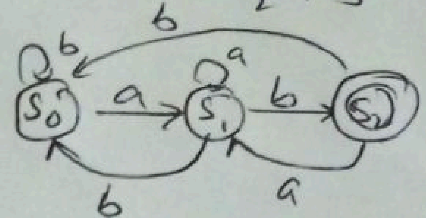
Construct ~~ADFA~~ NFA which accepts a language of all strings that ends with 'ab' over $\Sigma = \{a, b\}$



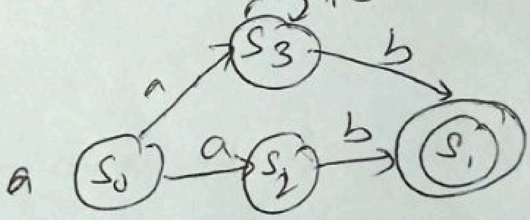
NFA



DFA

S \ I	a	b
s_0	s_0, s_1	s_0
s_1	ϕ	s_2
s_2	ϕ	ϕ

a) $L = \{w : w$ starts with 'a' and ends with 'b' over Σ



Convert NFA to DFA

- In NFA, when specific i/p is given to current state, machine goes to multiple states. It can have zero, one or more more
- In DFA, when a specific input is given, DFA has only one move on input symbol.

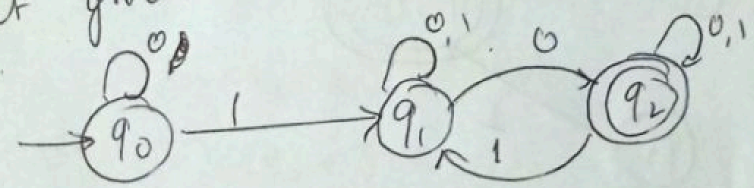
Let $M = (Q, \Sigma, S, I, f, s_0, F)$ is an NFA which accepts $L(M)$. There should be equivalent DFA denoted by
$M' = (S', I', f', s_0', F')$ such that $L(M) = L(M')$

Steps for converting NFA to DFA

1. Initially $S' = \phi$.
2. Add S_0 of NFA to S'. The find transitions from start state
3. In S', find possible set of states for each input symbol. If set of states is not in S', then add it to S'.
4. In DFA, final state will be all states which contain F (final states of NFA)

Example 1

Convert given NFA to DFA



Transition table is

state	0	1
q_0	q_0	q_0, q_1
q_1	$\{q_1, q_2\}$	q_1
q_2	q_2	$\{q_1, q_2\}$

Now we ~~get~~, obtain f' transition for state q_0

$f'(q_0, 0) = q_0$

$f'(q_1, 01) = q_1$

Now f' for state q_1,

$f'(q_1, 0) = (q_1 q_2)$ new transit

$f'(q_1, 1) = q_1$

f' for state q_2,

$f'(q_2, 0) = (q_2)$

$f'(q_2, 1) = (q_1, q_2)$

Now obtain f' on (q_1, q_2)

$f'((q_1 q_2), 0) = f(q_1, 0) \cup f(q_2, 0)$

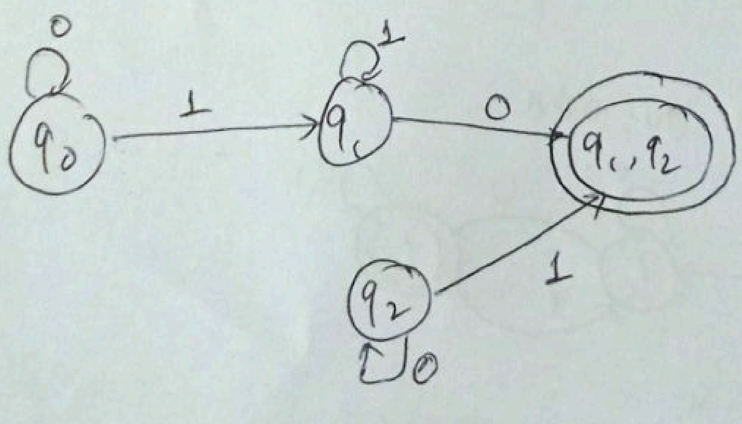
$= \cancel{q_0 \cup q_1} (q_1, q_2) \cup q_2$

$= (q_1, q_2)$

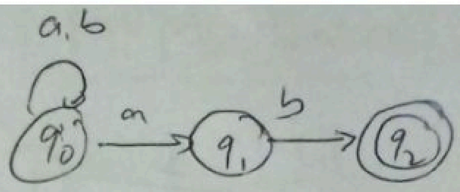
$f'(q_1 q_2, 1) = f(q_1, 1) \cup f(q_2, 1)$

$= q_1 \cup (q_1, q_2)$

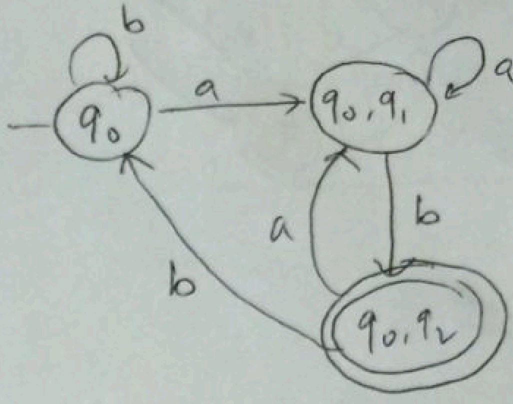
$= (q_1, q_2)$



(2) Convert NFA to DFA



S	a	b
q_0	q_0, q_1	q_0
q_1	–	q_2
q_2	–	–



$f'(q_0, a) = (q_0, q_1)$

$f'(q_0, b) = q_0$

$f'(q_1, a) = \varphi$

$f'(q_1, b) = q_2$

$f'(q_2, a) = \varphi$

$f'(q_2, b) = \varphi$

$f'(q_0, q_1, a) = f'(q_0, a) \cup f'(q_1, a)$

$= (q_0, q_1) \cup (q_0)$

$= (q_0, q_1)$

$f'((q_0, q_1), b) = f'(q_0, b) \cup f'(q_1, b)$

$= q_0 \cup q_2$

$= (q_0 ; q_2)$

$f'((q_0, q_2), a) = f'(q_0, a) \cup f'(q_2, a)$

$= (q_0, q_1) \cup \varphi$

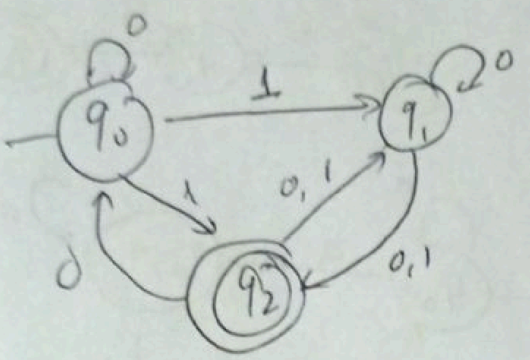
$= (q_0, q_1)$

$f'(q_0, q_2, b) = f'(q_0, b) \cup f'(q_2, b)$

$= q_0 \cup \varphi$

$= q_0$

③ Convert following NFA to DFA

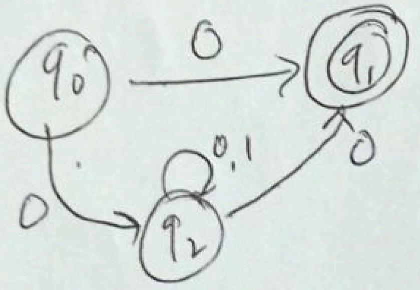


	0	1
q_0	q_0	(q_1, q_2)
q_1	(q_1, q_2)	q_2
q_2	(q_0, q_1)	q_1

DFA

	0	1
q_0	q_0	q_1, q_2
~~q_1~~	~~q_1, q_2~~	~~q_2~~
$(q_1 q_2)$	$q_0 q_1 q_2$	(q_1, q_2)
$q_0, q_1 q_2$	$q_0 q_1 q_2$	$(q_1 q_2)$

④ Convert following NFA to DFA



	0	1
q_0	q_1, q_2	—
q_1	—	—
q_2	q_1, q_2	q_2

	0	1
~~q_2~~	~~q_1, q_2~~	~~q_2~~
$q_1 q_2$	$q_1 q_2$	q_2
q_0	$q_1 q_2$	ϕ

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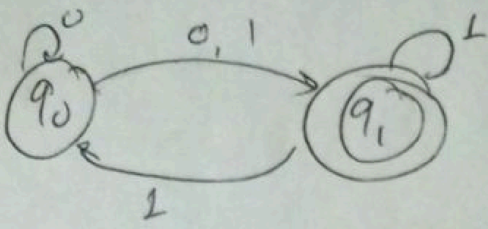
(5)



	0	1
q_0	q_0, q_1	q_1
q_1	ϕ	(q_1, q_0)

DFA

q_1	ϕ	(q_0, q_1)
q_0, q_1	q_0, q_1	(q_0, q_1)
q_0	q_0, q_1	q_1