1. Let $M = (\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_1\})$ be an NFA, where

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

	0	1
q_0	$\{q_0, q_1\}$	$\{q_1\}$
q_1	ϕ	$\{q_0, q_1\}$

Solution:

We can construct a DFA

$$M' = (Q', \{0, 1\}, \delta', [q_0], F').$$

Q' = all subsets of $\{q_0, q_1\}$.

$$Q' = \{[q_0], [q_1], [q_0, q_1], \phi\}.$$

F' = Set of states of Q' containing a state in F

$$F' = \{[q_1], [q_0, q_1]\}$$

Transition Table: δ'

	0	1
$[q_0]$	$[q_0, q_1]$	$[q_1]$
$[q_1]$	ϕ	$[q_0, q_1]$
$[q_0, q_1]$	?	?
ϕ	ϕ	ϕ

To find $\delta'([q_0, q_1], 0)$

$$\delta(\{q_0, q_1\}, 0) = \delta(q_0, 0) \cup \delta(q_1, 0)$$
$$= \{q_0, q_1\} \cup \phi$$
$$= \{q_0, q_1\}$$

$$\delta'([q_0, q_1], 0) = [q_0, q_1]$$

To find $\delta'([q_0, q_1], 1)$

$$\delta(\{q_0, q_1\}, 1) = \delta(q_0, 1) \cup \delta(q_1, 1)$$
$$= \{q_1\} \cup \{q_0, q_1\}$$
$$= \{q_0, q_1\}$$

$$\therefore \delta'([q_0, q_1], 1) = [q_0, q_1]$$

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

$$Q' = \{[q_0], [q_1], [q_0, q_1], \phi\}$$

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

$$q_0' = [q_0]$$

$$F' = \{[q_1], [q_0, q_1]\}$$

δ :

	0	1
$[q_0]$	$[q_0, q_1]$	$[q_1]$
$[q_1]$	ϕ	$[q_0, q_1]$
$[q_0, q_1]$	$[q_0, q_1]$	$[q_0, q_1]$
ϕ	ϕ	ϕ

Transition Diagram :