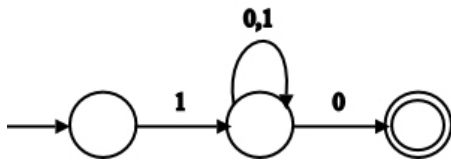a)

Consider the languages,

$L_1 = \{ w \mid w$ begins with 1 and ends with a 0 $\}$ and

$L_2 = \{ w \mid w$ contains at least three 1s$\}$ on $\Sigma = \{0,1\}$

M_1 be the NFA that recognizes L_1 and

M_2 be the NFA that recognizes L_2.

Let $L = L_1 \cup L_2$

Now M be the NFA that recognizes L.

- $L_1 = \{ w \mid w$ begins with a 1 and ends with a 0$\}$

$$L_1 = 1(0,1)^* 0$$

The state diagram of M_1 that recognizes L_1 is

- $L_2 = \{ w \mid w$ contains at least three 1s$\}$

$$L_2 = (0,1)^* 1(0,1)^* 1(0,1)^* 1(0,1)^*$$

The state diagram of M_2 that recognizes L_2 is
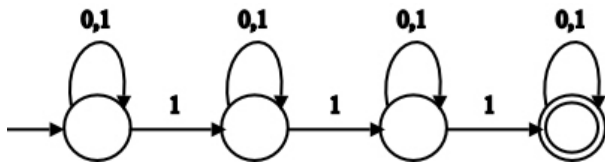
Now L is union of L_1 and L_2.

So the state diagram of M that recognizes L is described as follows.
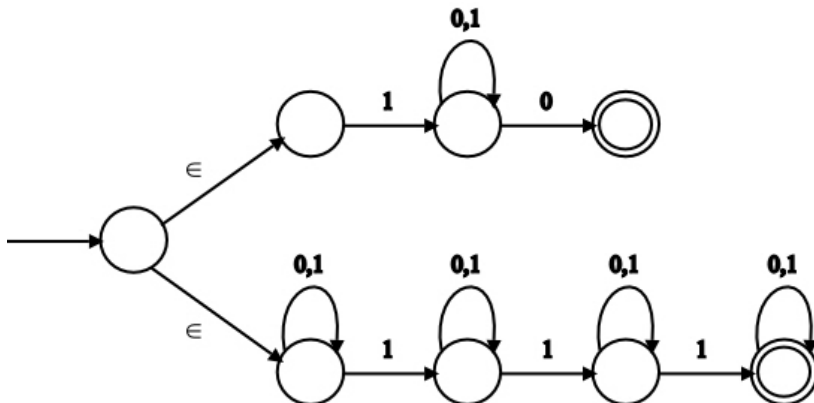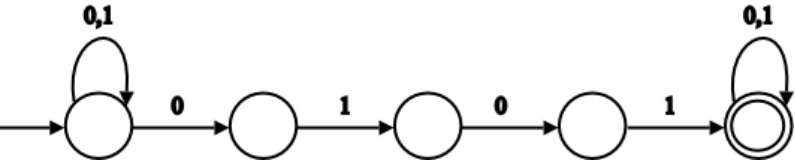

(b) Languages are

$L_1 = \{ w \mid w$ contains the substring 0101 i.e, $w = x0101y$ for some x and $y\}$ on $\sum = \{0,1\}$

$L_1 = \{ w \mid w$ doesn't contain the substring 110$\}$ on $\Sigma = \{0,1\}$

M_1 be NFA that recognizes L_1 and

M_2 be the NFA that recognizes L_2

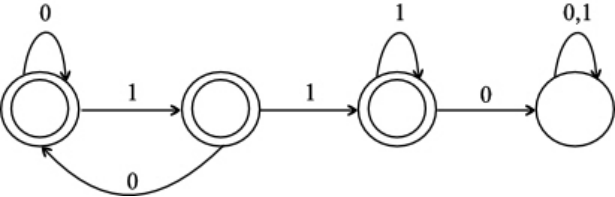Let $L = L_1 \cup L_2$

Now M be the NFA that recognizes L.

- $L_1 = \{w \mid w \text{ contains the substring } 0101\}$

The state diagram of M_1 that recognizes L_1 is

- $L_2 = \{w \mid w \text{ doesn't contain the substring } 110\}$

First we give the state diagram of the machine which recognize the language machine which recognize the language

Now L is the union of L_1 and L_2

So the state diagram of M that recognizes L is described as follows