Problem

Use the construction in the proof of Theorem 1.47 to give the state diagrams of NFAs recognizing the concatenation of the languages described in

a. Exercises 1.6g and 1.6i.

b. Exercises 1.6b and 1.6m.

THEOREM **1.47**

The class of regular languages is closed under the concatenation operation.

Step-by-step solution

Step 1 of 8

(a) Languages are

$L_1 = \{w \mid \text{the length of } w \text{ is at most } 5\}$ on $\Sigma = \{0,1\}$

And $L_2 = \{w \mid \text{every odd position of } w \text{ is a } 1\}$ on $\Sigma = \{0,1\}$

M_1 be the NFA that recognizes L_1 and

M_2 be the NFA that recognizes L_2.

Comment

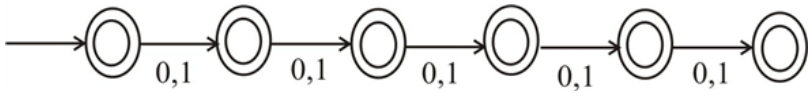
Step 2 of 8

Let $L = L_1 0 L_2$

M be the NFA that recognizes *L*.

- $L_1 = \{w \mid \text{ the length of } w \text{ is at most } 5\}$

The state diagram of M_1 that recognizes L_1 is



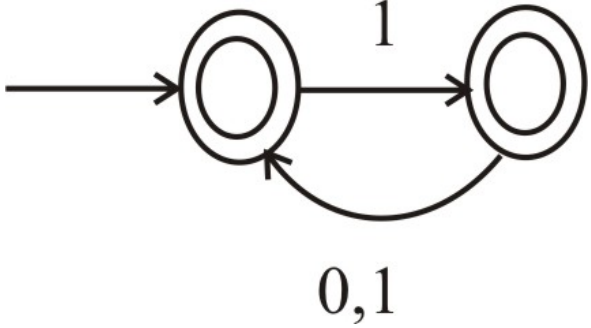
Comment

Step 3 of 8

- $L_2 = \{w\}$ every odd position of w is a $1\}$

$L_2 = (1\Sigma)^*$

The state diagram of M_2 that recognizes L_2 is

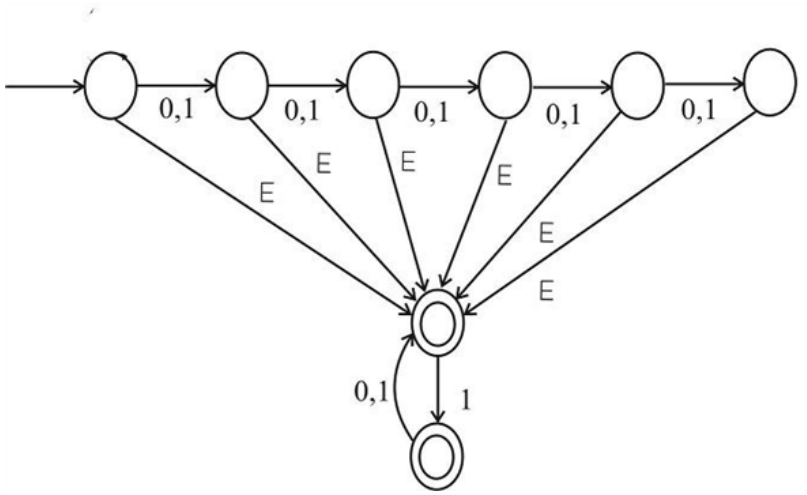


Comment

Step 4 of 8

L is concatenation of L_1 and L_2

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



Comment

Step 5 of 8

(b) Given Languages are

$L_1 = \{w \mid w \text{ contains at least three 1s}\}$ on $\Sigma = \{0,1\}$

And $L_2 = \{w \mid w \text{ is a empty set}\}$ on $\Sigma = \{0,1\}$

M_1 be the NFA that recognizes L_1 and

M_2 be the NFA that recognizes L_2.

Comment

Step 6 of 8

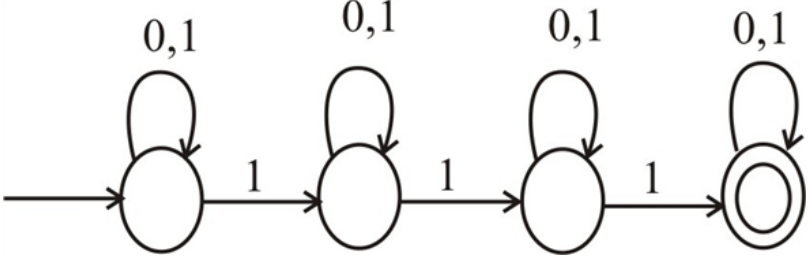
Let $L = L_1 0 L_2$

M be the NFA that recognizes *L*.

- $L_1 = \{w \mid w \text{ contains at least three 1s}\}$

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

The state diagram of M_1 that recognizes L_1 is



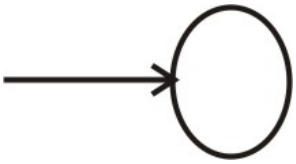
Comments (2)

Step 7 of 8

- $L_2 = \{w \mid w \text{ is a empty set}\}$

$L_2 = \phi = \{\ \}$

The state diagram of M_2 that recognizes L_2 is

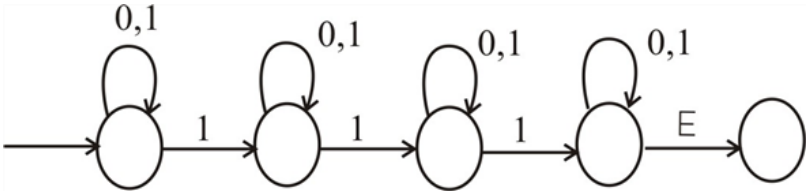


Comments (2)

Step 8 of 8

L is concatenation of L_1 and L_2

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



Comment