Problem

Give state diagrams of NFAs with the specified number of states recognizing each of the following languages. In all parts, the alphabet is {0,1}.

A**a.** The language {wl w ends with 00} with three states

b. The language of Exercise 1.6c with five states

c. The language of Exercise 1.6l with six states

d. The language {0} with two states

e. The language $0^*1^*0^+$ with three states

A**f.** The language $1^*(001^+)^*$ with three states

g. The language { ε } with one state

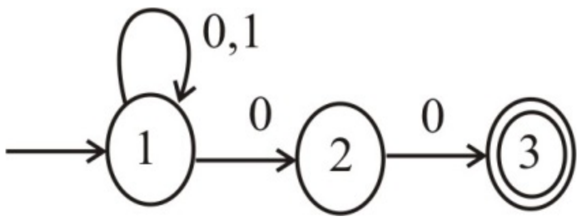
h. The language 0^* with one state

Step-by-step solution

Step 1 of 8

a.

Consider the Language $L = \{w \mid w \text{ ends with } 00\}$ with three states over the alphabet $\Sigma = \{0,1\}$. The language states that the Finite automata should consist of three states that accept the strings over the alphabet $\Sigma = \{0,1\}$ and ends with 00. Let *M* be the NFA that recognizes L. The state diagram of *M* is as follows:



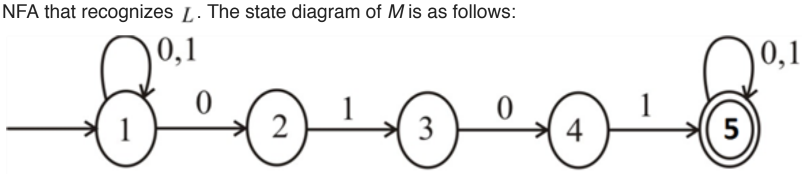
Comment

Step 2 of 8

b.

Consider the Language

$L = \{w \mid w \text{ contains the substring } 0101 \text{ i.e, } w = x0101y \text{ for some } x \text{ and } y\}$ with five states over the alphabet $\Sigma = \{0,1\}$. The language states that the Finite automata should consist of five states that accept the strings over the alphabet $\Sigma = \{0,1\}$ and contains the substring 0101. Let *M* be the NFA that recognizes L. The state diagram of *M* is as follows:



Comment

Step 3 of 8

c.

Consider the Language

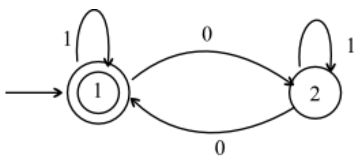
$L = \{w \mid w \text{ contains an even number of 0s, or contains exactly two 1s}\}$ with 6 states over the alphabet $\Sigma = \{0,1\}$. Let *M* be the NFA that recognizes L. Divide *L* into 2 languages L_1 and L_2.

$L_1 = \{w \mid w \text{ contains on even number of 0s}\}$

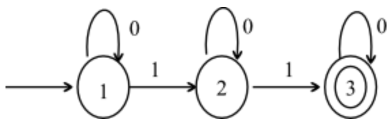
$L_2 = \{w \mid w \text{ contains exactly two 1s}\}$

Let M_1, M_2 be the NFAs recognizes L_1, L_2 respectively.

State diagram of M_1 is as follows:

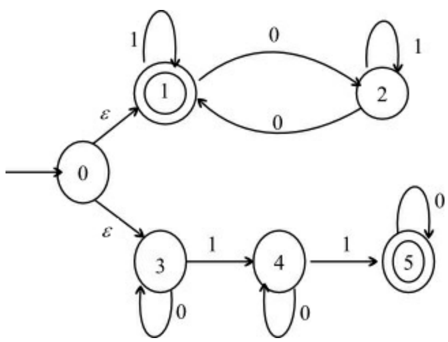


The state diagram of M_2 is as follows:



Now $L = L_1 \cup L_2$

The sate diagram of *M* that recognizes *L* is as follows:

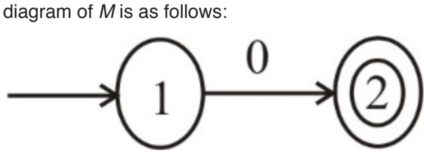


Comments (2)

Step 4 of 8

d.

Consider the Language $L_1 = \{w \mid w \text{ contains only } 0\}$ with 2 states over the alphabet $\Sigma = \{0,1\}$. Let *M* be the NFA that recognizes L_1. The state diagram of *M* is as follows:

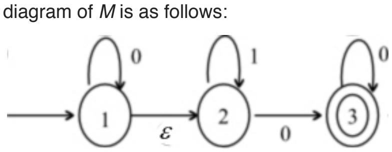


Comment

Step 5 of 8

e.

Consider the Language $L = \{w \mid w \text{ contains only } 0^*1^*0^+\}$ with 3 states over the alphabet $\Sigma = \{0,1\}$. The language states that the finite automata accept all the strings containing any number of zeroes and ones followed by at least one zero. Let *M* be the NFA that recognizes L. The state diagram of *M* is as follows:

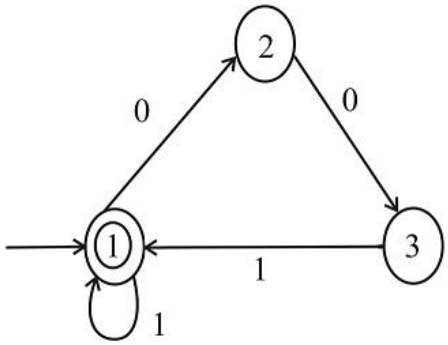


f.

Comments (21)

Step 6 of 8

Consider the Language L that accepts the strings of the form $1^*(001^+)^*$ with 3 states over the alphabet $\Sigma = \{0,1\}$. Let *M* be the NFA that recognizes L. The state diagram of *M* is as follows:

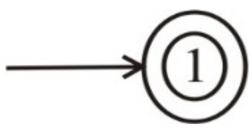


Comment

Step 7 of 8

g.

Consider the Language $L_1 = \{w \mid w \textit{ the language results in empty string } \varepsilon\}$ with one state over the alphabet $\Sigma = \{0,1\}$. The language states that the finite automata accept a null string. Let *M* be the NFA that recognizes L_1. The state diagram of *M* is as follows:

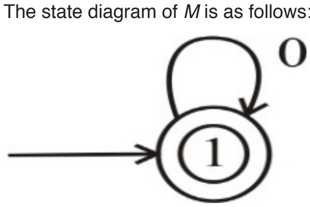


Comment

Step 8 of 8

h.

Consider the Language *L* that accepts the strings of the form $0^*$with one state over the alphabet $\Sigma = \{0,1\}$. Let *M* be the NFA that recognizes *L*. The state diagram of *M* is as follows:



Comment