Problem

Each of the following languages is the complement of a simpler language. In each part, construct a DFA for the simpler language, then use it to give the state diagram of a DFA for the language given. In all parts, ∑ = {a, b}.

A**a.** {wl w does not contain the substring ab}

A**b.** {wl w does not contain the substring baba}

c. {wl w contains neither the substrings ab nor ba}

d. {wl w is any string not in a*b*}

e. {wl w is any string not in (ab**+**)*}

f. {wl w is any string not in a* ∪ b*}

g. {wl w is any string that doesn't contain exactly two a's}

h. {wl w is any string except a and b}

Step-by-step solution

Step 1 of 16

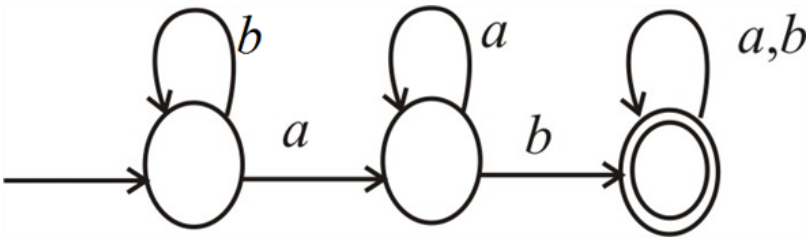
(a) The language is

$\overline{L} = \{ w \mid w$ does not contain the substring *ab*$\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ contain the substring *ab*$\}$

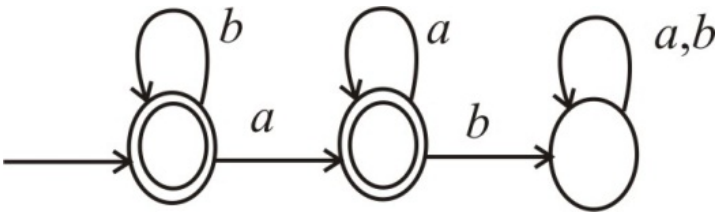
DFA recognizes the language *L* is a follows:



Comments (4)

Step 2 of 16

DFA that recognizes the language $\overline{L}$ is as follows:



Comment

Step 3 of 16

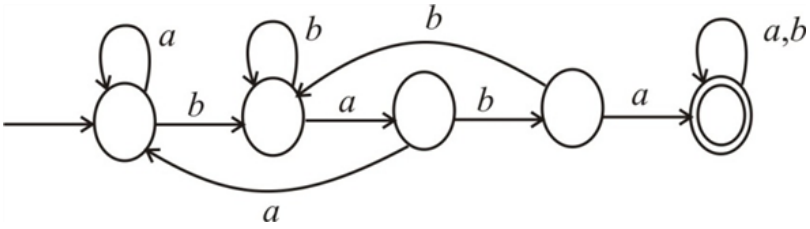
(b) The language is

$\overline{L} = \{ w \mid w$ does not contain the substring *baba*$\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ contain the substring *baba*$\}$

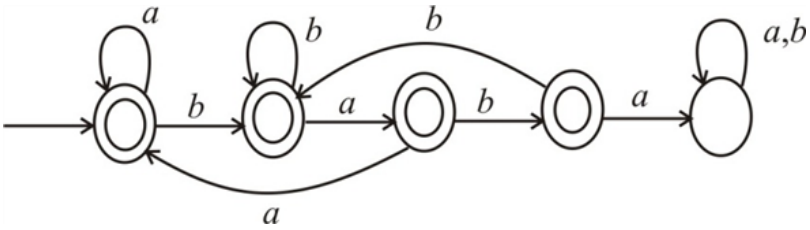
DFA that recognizes the language *L* is as follows:



Comment

Step 4 of 16

DFA that recognizes the language *L* is as follows:



Comment

Step 5 of 16

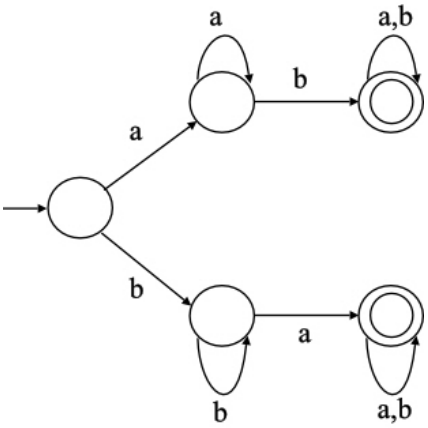
(c) The language is

$\overline{L} = \{ w \mid w$ contains neither the substrings *ab* nor *ba*$\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ contains either the substring *ab* or *ba*$\}$

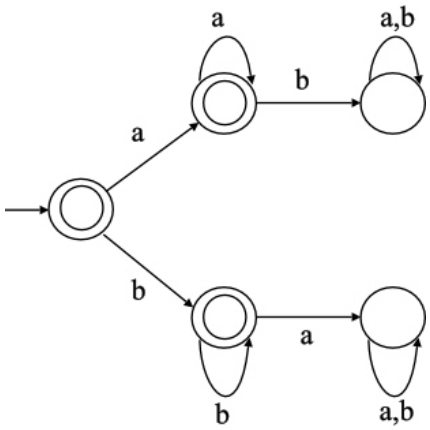
DFA that recognizes the language *L* is as follows



DFA that recognizes the language $\overline{L}$ is as follows:

Comment

Step 6 of 16



Comment

Step 7 of 16

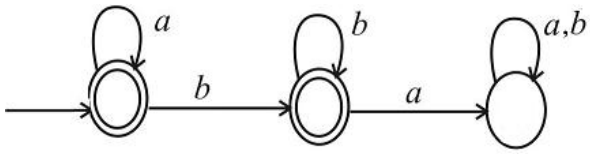
(d) The language is

$\overline{L} = \{ w \mid w$ is any string not in $a^*b^*\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ is any string in $a^*b^*\}$

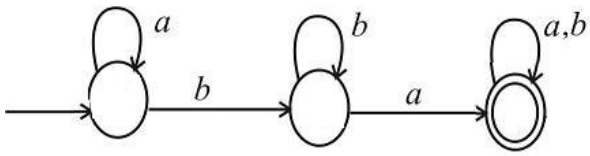
DFA that recognizes the language *L* as follows



Comments (7)

Step 8 of 16

DFA that recognizes the language $\overline{L}$ is as follows:



Comments (4)

Step 9 of 16

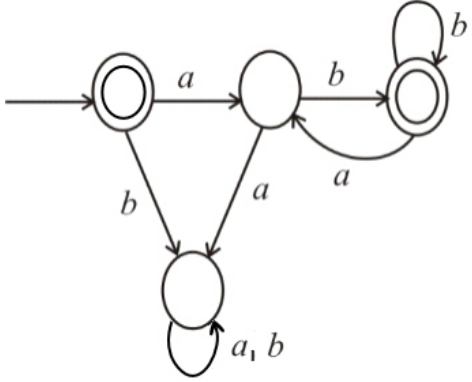
(e) The language is

$\overline{L} = \{ w \mid w$ is any string not in $\left(ab^+\right)^*\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ is any string in $\left(ab^+\right)^*\}$

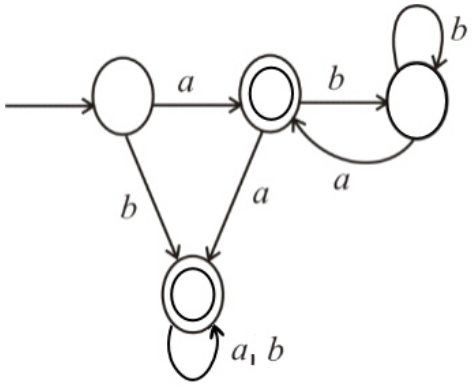
DFA that recognizes the language *L* is as follows:



Comments (7)

Step 10 of 16

DFA that recognizes the language $\overline{L}$ is as follows:



(f)

Comments (5)

Step 11 of 16

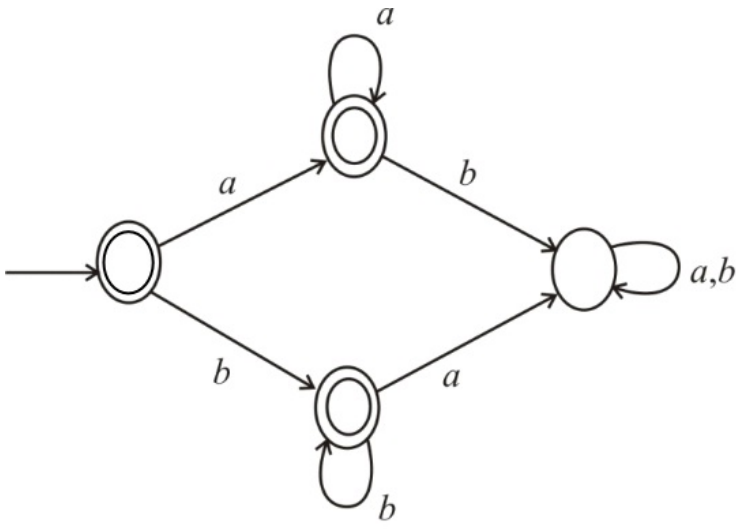
The language is

$\overline{L} = \{ w \mid w$ is any string not in $a^* \cup b^* \}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ is any string in $a^* \cup b^* \}$

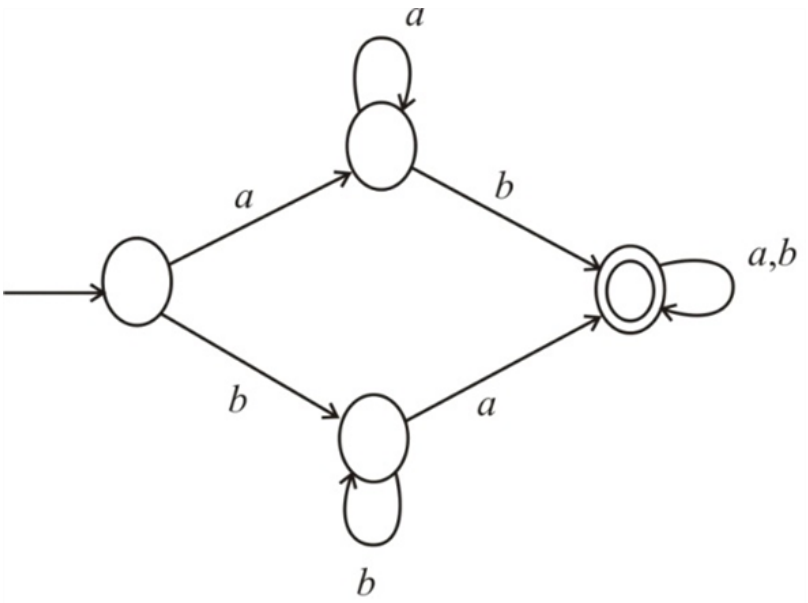
DFA that recognizes the language *L* is as follows:



Comments (3)

Step 12 of 16

DFA that recognizes the language $\overline{L}$ is as follows:



Comment

Step 13 of 16

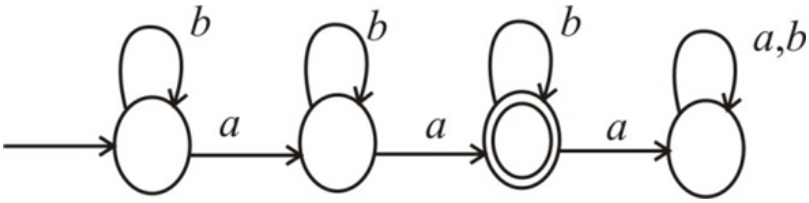
(g) The language is

$\overline{L} = \{ w \mid w$ is any string that doesn't contain exactly two a's$\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ is any string contain exactly two *a*'s$\}$

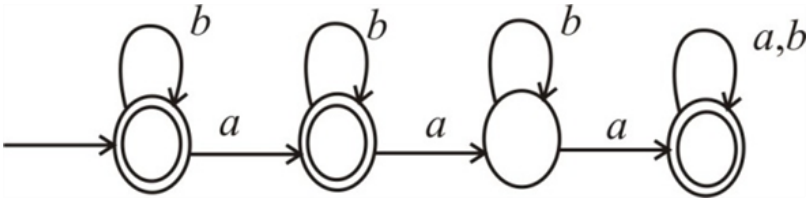
DFA that recognizes *L* is as follows:



Comment

Step 14 of 16

DFA that recognizes $\overline{L}$ is as follows:



Comment

Step 15 of 16

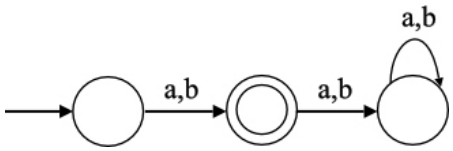
(h) The language is

$\overline{L} = \{ w \mid w$ is any string except *a* and *b*$\}$

$\overline{L}$ is the complement of a simpler language *L*.

Then the simple language is $L = \{ w \mid w$ is *a* and *b*$\}$

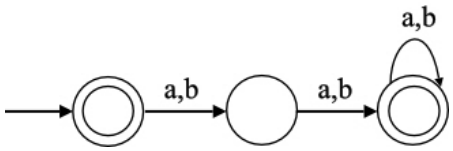
DFA that recognizes *L* is as follows:



Comments (6)

Step 16 of 16

DFA that recognizes $\overline{L}$ is as follows:



Comment