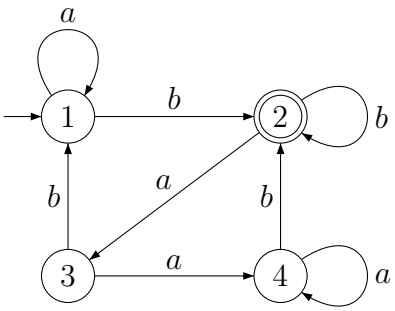
Deterministic Finite Automata

Questions:

Question 1

Given the automaton:



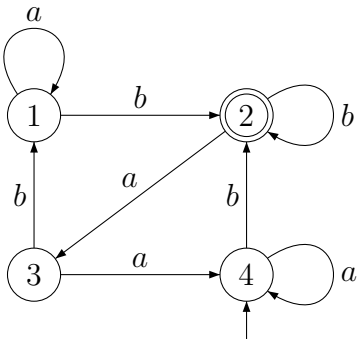
enumerate the first ten words in canonical order of the language it accepts.

Solución:

$b, ab, bb, aab, abb, bbb, aaab, aabb, abbb, baab$

Question 2

Given the automaton:



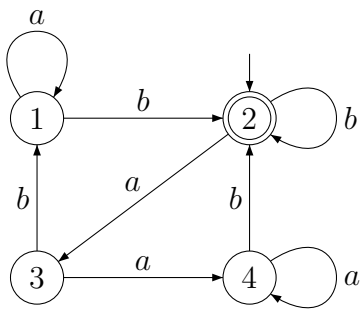
enumerate the first ten words in canonical order of the language it accepts.

Solución:

$b, ab, bb, aab, abb, bbb, aaab, aabb, abbb, bbbb$

Question 3

Given the automaton:



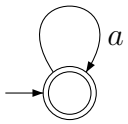
enumerate the first ten words in canonical order of the language it accepts.

Solución:

$\lambda, b, bb, aab, abb, bbb, aaab, aabb, abab, abbb$

Question 4

Provide a description (the shorter the better) of the language accepted by the following automaton:

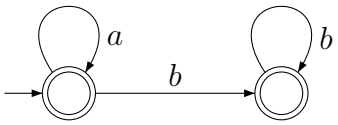


Solución:

$L(A) = \{a\}^*$

Question 5

Provide a description (the shorter the better) of the language accepted by the following automaton:

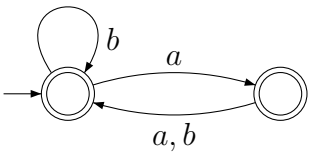


Solución:

$L(A) = \{a^n b^m \ : \ n, m \geq 0\}$

Question 6

Provide a description (the shorter the better) of the language accepted by the following automaton:

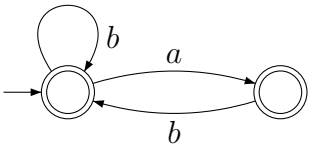


Solución:

$L(A) = \{a, b\}^*$

Question 7

Provide a description (the shorter the better) of the language accepted by the following automaton:

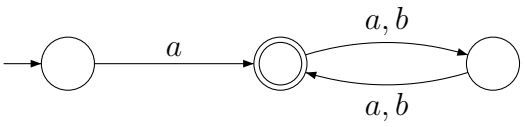


Solución:

$L(A) = \{x \in \{a, b\}^* \ : \ aa \notin Seg(x)\}$

Question 8

Provide a description (the shorter the better) of the language accepted by the following automaton:

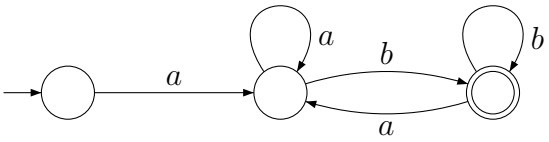


Solución:

$L(A) = \{x \in \{a,b\}^* \ : \ a \in Pref(x) \wedge |x| \equiv 1 \text{ mód } 2\}$

Question 9

Provide a description (the shorter the better) of the language accepted by the following automaton:



Solución:

$L(A) = \{x \in \{a,b\}^* \ : \ a \in Pref(x) \wedge b \in Suf(x)\}$

Question 10

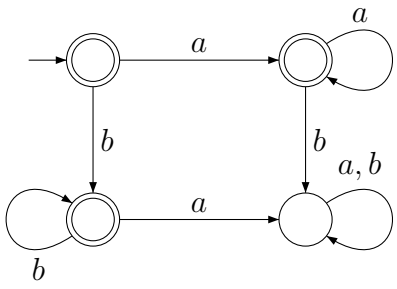
Provide a DFA that accepts the language $\{a\}^* \cup \{b\}^*$

Solución:

It is necessary to consider the following situations:

- The word processed so far has no symbols a or b
- The word processed so far has symbols a but no symbols b
- The word processed so far has symbols b but no symbols a
- The word processed so far has symbols a and symbols b

Taking all the previous into account a DFA for the language is:



Question 11

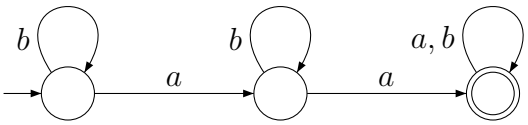
Provide a DFA that accepts the language $L = \{x \in \{a,b\}^* \ : \ |x|_a \geq 2\}$

Solución:

It is necessary to consider the following situations:

- no symbols a has been analyzed
- only one symbol a has been analyzed
- two or more symbols a has been analyzed

Therefore, a DFA for the language is the following:



Question 12

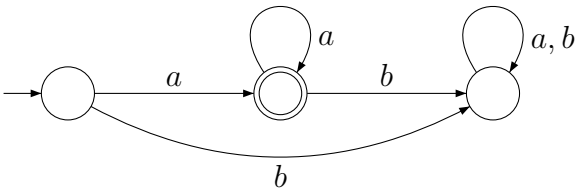
Provide a DFA that accepts the language $L = \{x \in \{a,b\}^* \ : \ a \in Pref(a) \wedge ab \notin Seg(x)\}$

Solución:

It is necessary to consider the following situations:

- The word processed so far has no symbols
- The word begins with a and has no segment ab
- The word begins with b
- The word has a prefix a and also has a segmente ab

It is interesting to note that both third and fourth situations, and regardless the symbols left to anaylze, imply that the word does not belong to the language. Therefore, a DFA for the language is the following:



Question 13

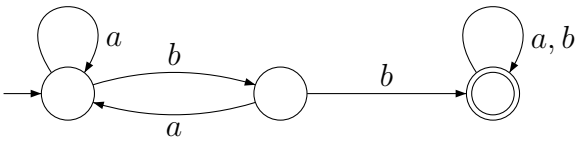
Provide a DFA that accepts the language $L = \{x \in \{a,b\}^* \ : \ bb \in Seg(x)\}$

Solución:

It is necessary to consider the following situations:

- La palabra procesada no contiene el segmento bb y no acaba en b
- La palabra procesada no contiene el segmento bb y acaba en b
- La palabra procesada contiene el segmento bb

Therefore, a DFA for the language is the following:



Question 14

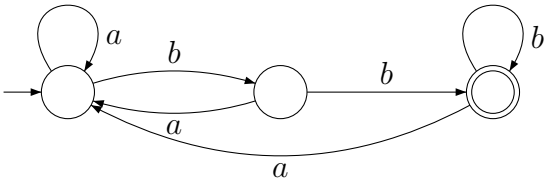
Provide a DFA that accepts the language $L = \{xbb \ : \ x \in \{a,b\}^*\}$

Solución:

It is necessary to consider the following situations:

- The last symbols of the processed word is not b
- The last symbols of the processed word is b but the previous one is not b
- The word processed so far has a suffix bb

Therefore, a DFA for the language is the following:



Question 15

Provide a DFA that accepts the language of words over the alphabet $\{0, 1\}$ such that the second and rhe last symbols are 1.

Solución:

It is necessary to consider the following situations:

- The word has length 0
- The word has length 1
- The second and last symbols are 1
- The second symbols is not 1
- The second symbols is 1 but the last is not 1

Therefore, a DFA for the language is the following: