

Chapter 2.1, Problem 9E

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Step-by-step solution

Step 1 of 23

(a)

Consider a language in which every 00 is followed immediately by 1. The DFA for such a language can be drawn in the following way:

- Draw the skeleton for the substring 00.
- Then complete the DFA by creating transitions for every symbol from any state of the DFA.

Comment

Step 2 of 23

Using the above observation, the DFA is drawn as the following:

Comment

Step 3 of 23

- Initial state is q_0 . It represents a substring where the previous symbol is not 0.
- The state q_1 represents that the immediate previous symbol is 0 and there is 1 or nothing before it.
- The state q_2 represents that there are two 0s just before this. So, this is made non-accepting state and states q_0 and q_1 are made accepting states.

Hence, the required DFA has been formed.

Comment

Step 4 of 23

(b)

Consider the language in which strings must contain 00 but not contain any 000 at all. To draw DFA for this, the following steps can be followed:

- Draw the DFA for 000.
- Then for each state, complete transitions appropriately. Every state must have transition for every symbol in the language.

Comment

Step 5 of 23

Using the above observations, the DFA for the language is the following:

Comment

Step 6 of 23

- State q_0 denotes that the previous symbol is either 1 or nothing.
- State q_1 denotes that the previous symbol is 0.
- State q_2 denotes that the previous symbols are 00. So, the requirement for at least one 00 in the string is fulfilled.
- If another 0 is seen from the state q_2 , then the string has to be rejected. So, control goes to the dead state.
- The final states are q_2 and q_3 .

Hence, the required DFA has been formed.

Comment

Step 7 of 23

(c)

The language where the left most symbol is different from the right most symbol can be draw using the following steps:

- There are two branches in the DFA – one is for the starting symbol being 0 and the other is for the starting symbol being 1.
- Complete the DFA appropriately.

Comment

Step 8 of 23

Using the above observations, the DFA for the language is the following:

Comment

Step 9 of 23

- The initial state is q_0
- The strings - λ is not accepted because in it, there is no left most and right most symbols or in other words, the left most and right most are empty themselves.
- The strings 0 and 1 are not accepted because in these, the left most and the right most symbols are the same which is the string itself.
- The final states are q_2 and q_4 .

Hence, the required DFA has been formed.

Comment

Step 10 of 23

(d)

Consider the language where substring of four symbols has at most two 0s. The following steps can be followed:

- In order to create DFA for such a language, mnemonic labeling of the states can be used.
- Whenever a substring of four symbols with at most two zeroes is created, two sub branches are formed.
- On seeing 0, the string is rejected. On seeing 1, it is further processed.

Comment

Step 11 of 23

Using the above observations, the DFA for the language is the following:

Step 22 of 23

Using the above observations, the DFA can be created as follows:

```
graph LR; q0((q0)) -- 0 --> q1((q1)); q1 -- 0 --> q2((q2)); q2 -- 0 --> q3((q3)); q3 -- 0 --> q4((q4)); q4 -- 1 --> q5(((q5))); q5 -- 1 --> q6((q6)); q6 -- 1 --> q7((q7)); q7 -- 1 --> q8((q8)); q8 -- 0 --> q9((q9)); q9 -- 1 --> q10(((q10))); q10 -- 0 --> q9; q9 -- 1 --> q8; q8 -- 0 --> q7; q7 -- 1 --> q6; q6 -- 0 --> q5; q5 -- 1 --> q4; q4 -- 0 --> q3; q3 -- 1 --> q2; q2 -- 0 --> q1; q1 -- 1 --> q0;
```

[Comment](#)

Step 23 of 23

- The initial state is q_0
- Mnemonic labeling has been used on the states so as to remember the starting four symbols of the string and compare the last symbol to them.
- The final states are q_5^f and q_{10}^f .

Hence, the required DFA has been formed.

[Comment](#)

Was this solution helpful?

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Recommended solutions for you in Chapter 2.1

Chapter 2.1, Solution 7E

(a) Consider the language: There can be three possible values of - 0, 1 and 2. So, create three states in the DFA each...

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