Problem

Let D = {wl w contains an even number of a’s and an odd number of b’s and does not contain the substring ab}. Give a DFA with five states that recognizes D and a regular expression that generates D. (Suggestion: Describe D more simply.)

Step-by-step solution

Step 1 of 4

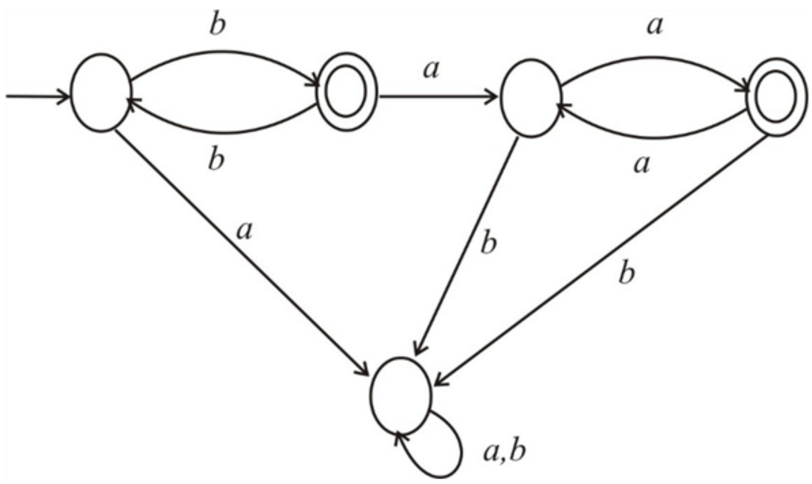
Consider the language $D = \{ w \mid w$ contains an even number of $a's$ and an odd number of $b's$ and does not contain the substring *ab*}.

The language D can be described simply as follows $D = \{ w \mid w$ contains an odd number of *b*’s followed by even number of *a*’s}.

Comment

Step 2 of 4

Let *M* be the DFA with five states that recognizes the language D. The state diagram of M is as follows:



Comments (6)

Step 3 of 4

The language accepts the strings like $\{b, baa, bbbaaaa, ...\}$. The string *b* is accepted by the language because, it contains the odd number of *b*’s (1) followed by even number of *a*’s (0).

Comment

Step 4 of 4

Now, the language D can be expressed as combination of following two languages D_1 and D_2.

$D_1 = \{w \mid w \text{ contain odd number of b's}\}$
$D_2 = \{w \mid w \text{ contains even number of a's}\}$

$D = D_1 o D_2$

R_1 be the regular expression that generates D_1

R_2 be the regular expression that generates D_2

R be the regular expression that generates *D*

$R = R_1 o R_2$

$R_1 = b(bb)^*$
$R_2 = (aa)^*$
$R = b(bb)^* o (aa)^*$
$R = b(bb)^*(aa)^*$

Therefore, the regular expression that generates the language *D* is $b(bb)^*(aa)^*$.

Comment