Branch : CSE & IT Batch:Hinglish

Theory of Computation

Regular Languages

DPP-06

[NAT]

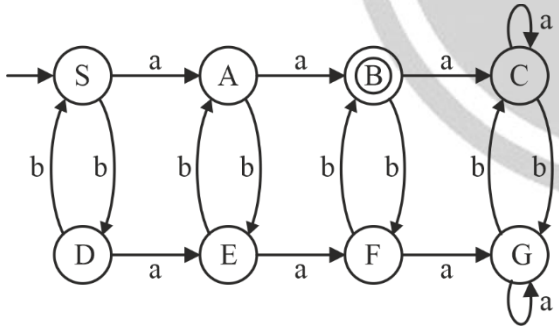
1. Let L be the set of all binary strings whose last three symbols are the same. The number of states in the minimum state DFA accepting L is ___.

[MCQ]

2. Consider a language L over Σ = {b}, L= {w | $n_a(w)$ multiple of 2 but not multiple of 4}.
How many states are required to design a minimum state DFA for above language L?
(a) 6 (b) 8
(c) 4 (d) 5

[MCQ]

3. The following finite state machine accept all those strings in which the number of a's and b's are respectively



(a) Divisible by 2 and even.
(b) Equal to 2 and odd.
(c) Equal to 3 and even.
(d) Equal to 2 and even.

[MCQ]

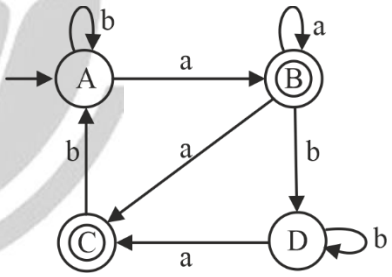
4. Consider the following given language L on alphabet Σ = {a, b}.
L = {w | w ∈ {a, b}*, 2nd symbol is 'a' OR 4th symbol of w is 'b'}.
How many states are required to design a minimal DFA for L?
(a) 6 (b) 7
(c) 5 (d) None of these

[MCQ]

5. Which one of the following language over the alphabet {a, b} is described by the regular expression:
$(a + b)^*a(a + b)^*a(a^*b^*)^*a\ (a + b)^*$?
(a) The set of all the strings containing the substring 000.
(b) The set of all the strings that begin and end with same alphabet.
(c) The set of all strings containing almost three a's.
(d) The set of all strings containing at least three a's.

[MCQ]

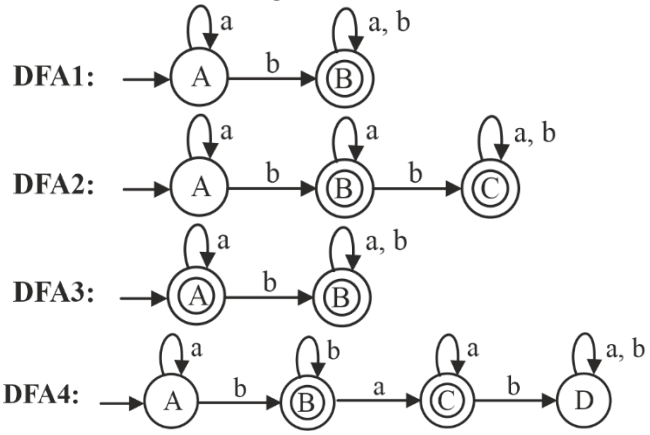
6. Identify the language accepted by the following deterministic finite automata over the input alphabet Σ = {a, b}.



(a) All strings of a's and b's.
(b) All strings which are ending with a.
(c) All strings which do not end with b.
(d) All strings which contain 'a' as the substring.

[MCQ]

7. Consider the following DFA's.



Which of the above DFA's are equivalent?

(a) DFA1 and DFA2
(b) DFA2 and DFA3
(c) DFA3 and DFA4
(d) None of these

[MCQ]

8. Consider the following regular expression (RE)
RE = $(a+b)^*(a+b+\varepsilon)a$

Which of the following is equivalent to the above RE?

(a) $(a^* + b^*) + (aa + ba)$
(b) $(\varepsilon + a + b^*)^+ a$
(c) $(a + b) + (a + b + \varepsilon)a$
(d) None of these

Answer Key

1. **(7)**
2. **(c)**
3. **(d)**
4. **(a)**
5. **(d)**
6. **(b)**
7. **(a)**
8. **(b)**

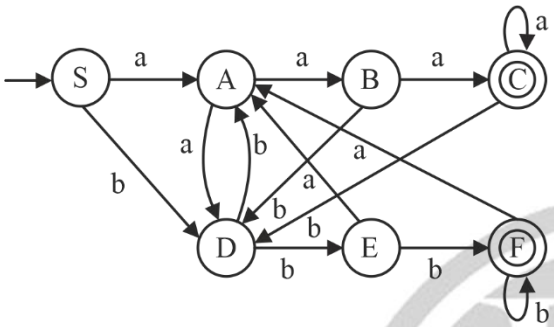
Hints and Solutions

1. (7)

$\Sigma = \{0, 1\}$

L = {aaa, bbb, abbb, bbbb, baaa, aaaa, …}

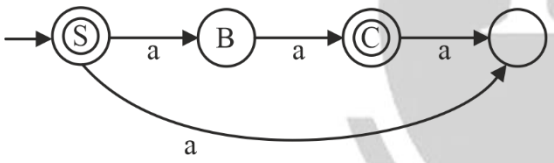
MDFA:



2. (c)

MDFA:

L = {∈, a^2, a^6, a^{10}, a^{14}, …}



Number of states = 4

3. (d)

It will accept number of a's in the language must be 2 and number of b's in the language must be even.

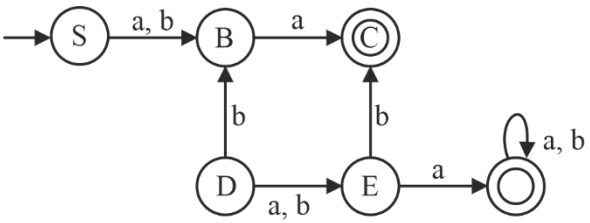
Regular expression = $(bb)^*a(bb)^*a(bb)^*$

Note: Given DFA is not minimized DFA

4. (a)

$L = \left\{ \overline{a|b}\ \overline{a}\ \overline{a|b}\ \overline{a|b}\ \overline{a|b}\ b - - - \right\}$ OR $L = \left\{ \overline{a|b}\ \overline{a|b}\ \overline{a|b}\ \overline{a|b}\ b - - - \right\}$

MDFA:



Number of states = 6

5. (d)

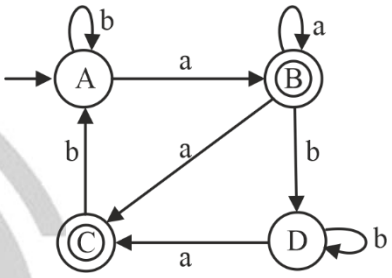
Regular expression: $(a + b)^*a(a + b)^*a(a + b)^*a(a + b)^*(a^* + b^*) = (a + b)^*$

Strings = {aaa, aaaa, $b^*ab^*ab^*ab^*ab^*$….}

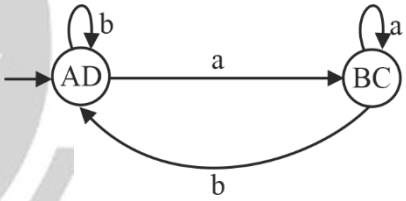
L = {atleast 3a's}

Hence, option (d) is correct

6. (b)



is equivalent to



The given DFA accepts the language of all strings where every string ends with a.

7. (a)

DFA1 and DFA2 are equivalent. Both accepts the same language that has all strings contain b.

$[RE = (a + b)^*b(a + b)^*] = a^*b(a + b)^*$.

DFA3 accepts the universal language: (a+b)*.

DFA4 accepts a*bb*a*.

8. (b)

$RE = (a + b)^*(a + b + \varepsilon)a = (a + b)^*a$

$(\varepsilon + a + b^*)^+ a = (a + b)^* a$

∴ Option (b) is equivalent to given RE.