Computer Science & Information Technology

Theory Of Computation

DPP: 1

DFA/NFA

Q1 Design deterministic finite automata of set of all binary strings over Σ = {0,1}, where every binary string starting with 00100. How many minimum numbers of states required for above FA?

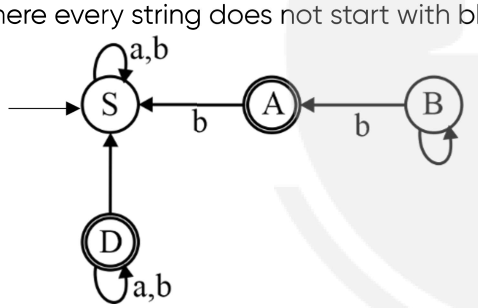
(A) 6 (B) 5

(C) 7 (D) 4

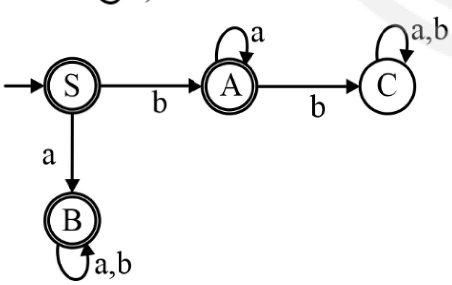
Q2 How many states are required to design a minimal DFA for set of all binary strings over Σ = {0, 1} where every binary string containing '0110' as a substring? ____

Q3 Which of the following is correct design of a minimal DFA for set of all strings over Σ = {a, b} where every string does not start with bb?

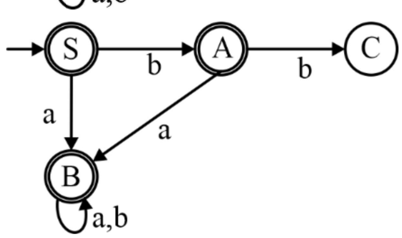
(A)



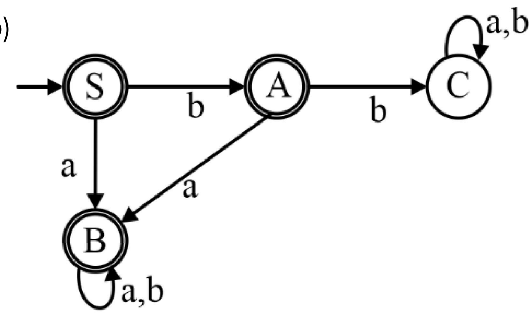
(B)



(C)



(D)



Q4 Which of the following statement is/are correct?

(A) DFA is possible for every regular language

(B) DFA is also possible for some non-regular languages.

(C) DFA is possible for both finite language and regular infinite language.

(D) There exist only 1 unique DFA for every regular language.

Q5 How many states required to design a minimal DFA for L = {X ba | X ∈ {a, b} *}? ________

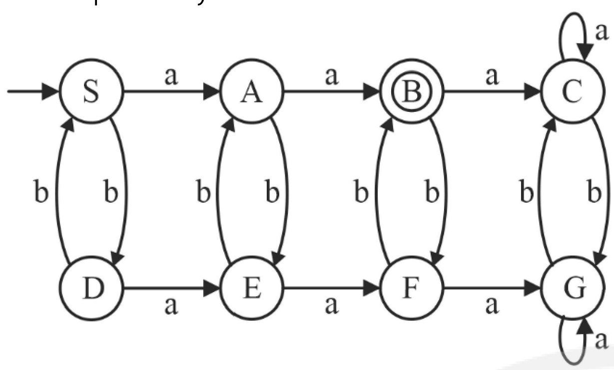
Q6 Number of final states required to design a minimal DFA for L = $\{(\in + b + a)^2 \mid \Sigma = \{a, b\}\}$ is / are _____.

Q7 Let L be the set of all binary strings over $\sum$ = {a, b} whose last three symbols are the same. The number of states in the minimum state DFA accepting L is ___.

Q8 Consider a language L over Σ = {a}, 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?

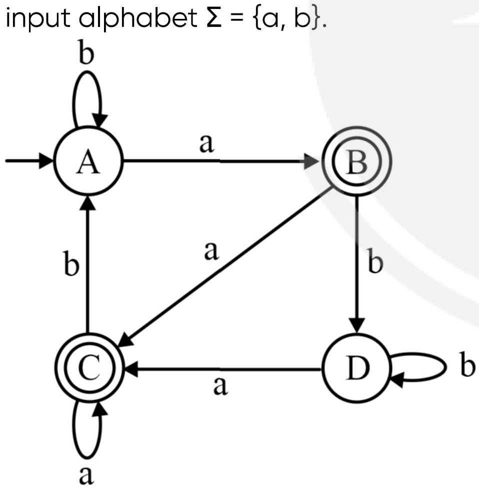
(A) 6 (B) 8
(C) 4 (D) 5

Q9 The following finite state machine accept all those strings in which the number of a's and b's are respectively



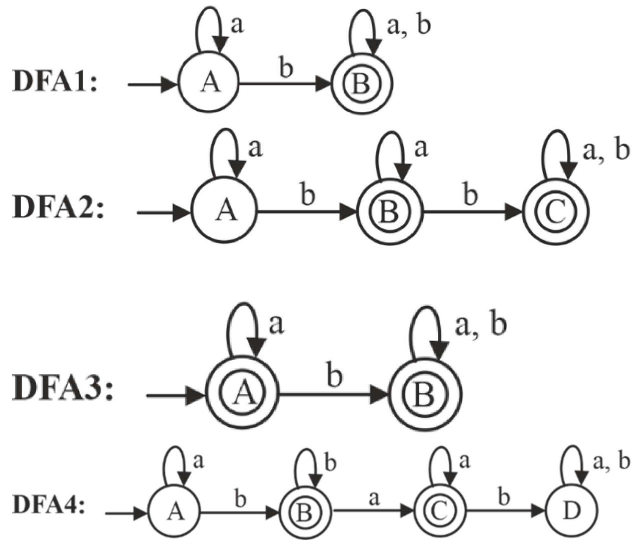
(A) Divisible by 2 and even.
(B) Equal to 2 and odd.
(C) Equal to 3 and even.
(D) Equal to 2 and even.

Q10 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.

Q11 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

Q12 Consider following two statements:
S_1: If every state is final state in DFA, then L(DFA) = Σ^*
S_2: If every state is non-final state in DFA, then L(DFA) = {∈}
(A) S_1 only.
(B) S_2 only.
(C) Both S_1 and S_2 are correct.
(D) Both are incorrect.

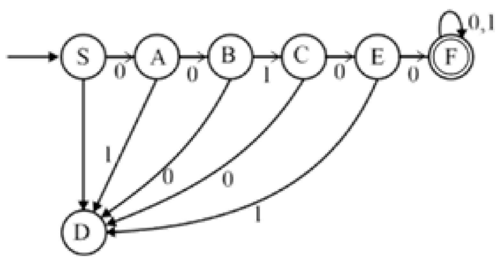
Q13 For L = {$(a + b)^2$}, how many states are required in minimal DFA?
(A) 2 (B) 3
(C) 4 (D) 1

Answer Key

Q1	(C)
Q2	5
Q3	(D)
Q4	(A, C)
Q5	3
Q6	3
Q7	7
Q8	(C)
Q9	(D)
Q10	(B)
Q11	(A)
Q12	(A)
Q13	(C)

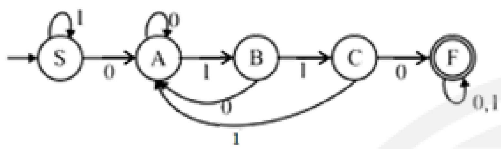
Hints & Solutions

Q1 Text Solution:



Number of states = 7.

Q2 Text Solution:

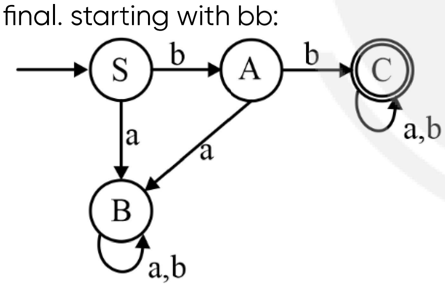


Number of States = 5.

Q3 Text Solution:

Every string does not start with bb is a complement of the language of starting with ab.

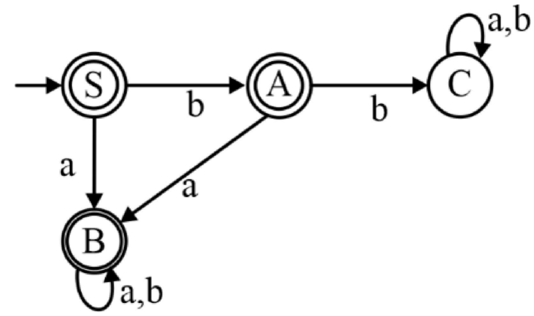
- To design complement of the DFA make non-final states and final. Final states make non-final. starting with bb:



Final states = {C}

Non final states = {S, A, B}

⇓ complement of above DFA



Final states = {S, A, B}

Non final states = {C}

Hence, option (d) is correct.

Q4 Text Solution:

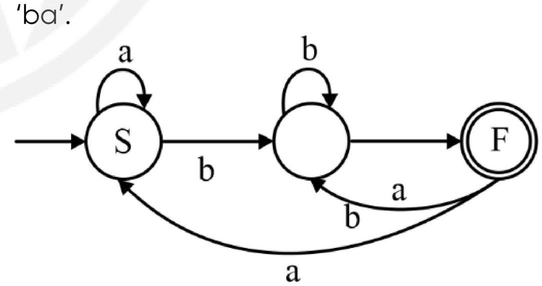
- If language is regular, there exist 1 unique DFA (Minimal DFA).
- If language is non-regular, DFA design not Possible.
- Regular language can be finite or infinite.
- many DFAs possible foa a regiular language but minimal will be 1.

Hence, statement (a, c) are correct.

Q5 Text Solution:

L = {Xba | X ∈ {a, b} *}

L = set of all strings where every string ends with 'ba'.



Number of states = 3

Q6 Text Solution:

L = {(∈ + a + b)^2}

L = {∈, aa, ab, ba, bb, a, b}

Number of states = 6

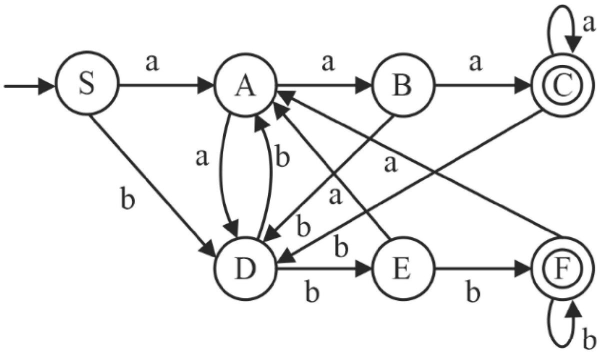
Number of final states = 3

Q7 Text Solution:

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

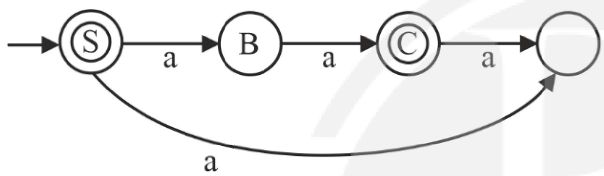
L = {aaa, bbb, abbb, bbbb, baaa, aaaa, ...}

MDFA:



Q8 Text Solution:

MDFA:



$L = \{\in, a^2, a^6, a^{10}, a^{14}, ...\}$

Number of states = 4

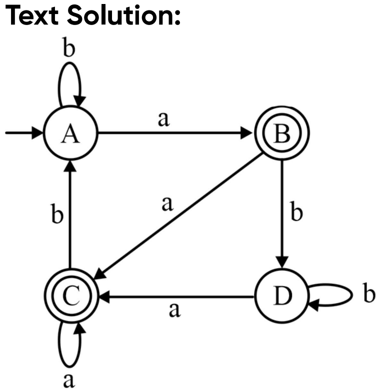
Q9 Text Solution:

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

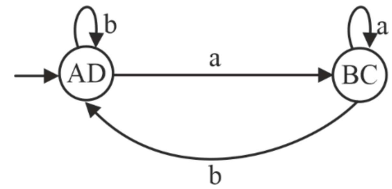
Regular expression = $(bb)^*a(bb)^*a(bb)^*$

Note: Given DFA is not minimized DFA

Q10 Text Solution:



is equivalent to



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

Q11 Text Solution:

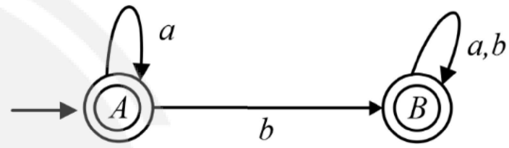
DFA1 and DFA2 are equivalent. Both accepts the same language that has all strings contain b.

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

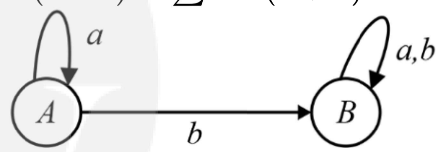
DFA3 accepts the universal language: $(a+b)^*$.

DFA4 accepts $a^*bb^*a^*$.

Q12 Text Solution:



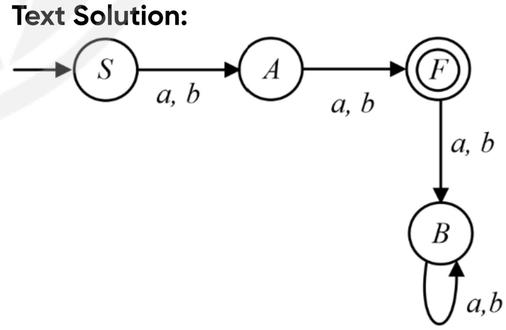
$$L(DFA) = \Sigma^* = (a + b)^*$$



$$L(DFA) = \phi = \{\ \}$$

Hence, only statement (1) is correct.

Q13 Text Solution:



Number of states = 4.