

# Theory of Computation

## Finite Automata

DPP-07

[MCQ]

1. Let  $L_1 = \phi$ ,  $L_2 = \{\epsilon\}$ ,  $L_3 = \{a, \epsilon\}$ .  
 $L_1, L_2, L_3$  are languages defined over  $\Sigma = \{a\}$   
 then,  $L_3 \cdot L_2 \cdot L_1^* + L_1 \cdot L_3$  is \_\_\_\_\_.  
 (a)  $\phi$  (b)  $\{a\}$   
 (c)  $\{a, \epsilon\}$  (d)  $\{a^n \mid n \geq 2\}$

[MCQ]

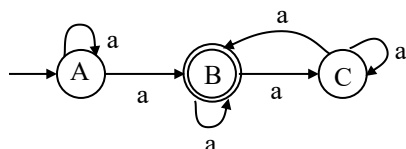
2. Consider the following given grammar  
 $S \rightarrow AB$   
 $A \rightarrow AS \mid a$   
 $B \rightarrow BA \mid SB \mid b$   
 Which of the following string generated by above grammar?  
 (a) bbaa (b) baba  
 (c) aabb (d) baab

[MCQ]

3. If the finite automaton M has 100 states and all the states are Non final except initial state over the alphabet  $\Sigma = \{0, 1\}$  then the set  $L(M)$  can be:  
 (a)  $\phi$   
 (b)  $\Sigma^*$   
 (c)  $\{\epsilon\}$   
 (d) Subset of  $\Sigma^*$

[MCQ]

4. Consider the following finite automata.



Find the language accepted by above FA.

- (a)  $a^*$  (b)  $aa^*$   
 (c)  $aaa^*$  (d)  $a(aa)^*$

[MCQ]

5. Which of the following language does not satisfy the prefix property?  
 (a)  $L = \{a^n b^n \mid n \geq 1\}$   
 (b)  $L = \{wxw^R \mid w \in (0+1)^*\}$   
 (c)  $L = \{a^m b^{2m} \mid m \geq 1\}$   
 (d)  $L = \{w \in (0+1)^* \mid n_0(w) = n_1(w)\}$

[MCQ]

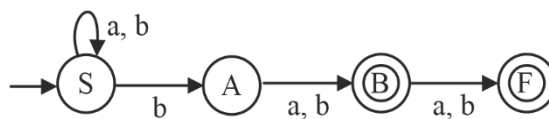
6. Consider the following left linear Grammar.  
 $S \rightarrow Sa \mid Sb \mid A$   
 $A \rightarrow Aab \mid \epsilon$   
 Choose the correct language generated by the above grammar.  
 (a)  $(a+b)^*$  (b)  $(a+b)^+$   
 (c)  $(a+b)^* ab$  (d)  $(a+b)^+ ab$

[NAT]

7. Consider a language  $L = \{w \mid w \in \{a, b\}^*, 5^{\text{th}} \text{ symbol from end is 'a'}\}$   
 If number of state in NFA is P and Number of states in MDFA (minimal DFA) is Q then the value of  $P * Q$  is \_\_\_\_\_.

[MCQ]

8. Consider the following finite automaton:



Which one of the following is correct representation of above finite automaton?

- (a) Second symbol from ends is 'b'.  
 (b) Containing  $(b + ab + ba)$  as a substring.  
 (c) Third symbol from ends is 'b'  
 (d) None of these.

## Answer Key

1. (c)
2. (c)
3. (d)
4. (b)
5. (d)

6. (a)
7. (192)
8. (c)



## Hints and Solutions

1. (c)

$$L_1 = \phi \Rightarrow L_1^* = \epsilon$$

$$L_2 = \epsilon \Rightarrow L_2 = \epsilon$$

$$L_3 = \{a, \epsilon\}$$

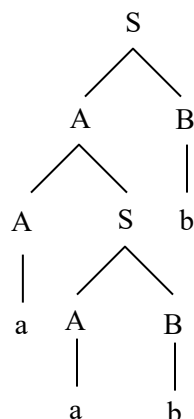
$$L_3 \cdot L_2 \cdot L_1^* + L_1 \cdot L_3 = L_3 \cdot \epsilon \cdot \epsilon + \phi \cdot L_3$$

$$= L_3 + \phi$$

$$= L_3$$

$$= \{a, \epsilon\}$$

2. (c)



S always generates the strings starting with a so, option (a), (b), (d) is not possible.

3. (d)

M is a DFA with 100 states only initial state in final and all other states Non final.

So, language is defined only at initial state and it can be part of  $\Sigma^*$ .

$$\therefore L(M) \subseteq \Sigma^*$$

4. (b)

$$L = \{a, aa, aaa, \dots\}$$

$$= a^+$$

Given FA accepts  $a^+$ .

5. (d)

$$L = \{w \in (0+1)^* \mid n_0(w) = n_1(w)\}$$

Let  $x, y \in L$

$$x = 10, y = 1010$$

$x$  is a proper prefix of  $y$ . If it is possible to find two different strings in  $L$  such that one is proper prefix of other, then  $L$  has no prefix property.

6. (a)

$$S \rightarrow Sa|Sb|A$$

$$A \rightarrow Aab|\epsilon$$

It can generate all strings when  $A$  is substituted with null production.

$$S \rightarrow Sa|Sb|\epsilon \text{ is enough to generate } (a+b)^*.$$

7. (192)

$$L = \{w \mid w \in \{a, b\}^*, n^{\text{th}} \text{ symbol from ends is } a\}$$

$$\text{NFA} = n + 1 \text{ states}$$

$$\text{MDFA} = 2^n \text{ states}$$

$$P * Q = (5 + 1) * (25)$$

$$= 6 * 32$$

$$= 192$$

Hence, (192) is correct answer.

8. (c)

Regular expression of FA

$$\text{Regular expression} = (a+b)^* b (a+b)^2$$

This RE represents third symbol from ends must be  $b$ .

Hence, option (c) is correct.



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