Branch : CSE & IT Batch:Hinglish

Theory of Computation
Finite Automata – NFA

DPP-07

[MCQ]

1. Let $L_1 = \phi$, $L_2 = \{\varepsilon\}$, $L_3 = \{a, \varepsilon\}$.
L_1, L_2, L_3 are languages defined over $\Sigma = \{a\}$
then, $L_3.L_2.L_1^* + L_1.L_3$ is_____ .

(a) ϕ (b) $\{a\}$
(c) $\{a, \varepsilon\}$ (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

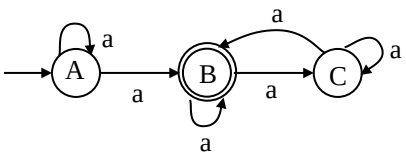
[MCQ]

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) ϕ
(b) Σ^*
(c) $\{\varepsilon\}$
(d) Subset of Σ^*

[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.
$S \rightarrow Sa|Sb|A$
$A \rightarrow Aab|\varepsilon$
Choose the correct language generated by the above grammar.

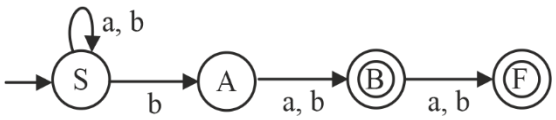
(a) $(a+b)^*$ (b) $(a+b)^+$
(c) $(a+b)^* ab$ (d) $(a+b)^+ ab$

[NAT]

7. Consider a language $L = \{w \mid w \in \{a, b\}^*, 5^{th}$ 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)

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

$L_2 = \varepsilon \Rightarrow L_2 = \varepsilon$

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

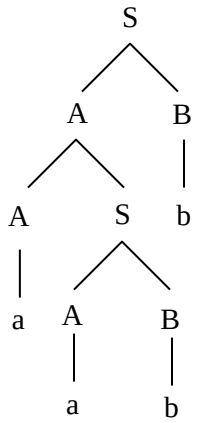
$L_3.L_2.L_1^* + L_1.L_3 = L_3.\varepsilon.\varepsilon + \varphi.L_3$

$= L_3 + \varphi$

$= L_3$

$= \{a, \varepsilon\}$

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 Σ^*.

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

4. (b)

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

$= a^+$

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)

$S \rightarrow Sa|Sb|A$

$A \rightarrow Aab|\varepsilon$

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

$S \rightarrow Sa|Sb|\varepsilon$ is enough to generate $(a + b)^*$.

7. (192)

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

NFA = n + 1 states

MDFA = 2^n states

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

$= 6 * 32$

$= 192$

Hence, (192) is correct answer.

8. (c)

Regular expression of FA

Regular expression = $(a + b)^* b (a + b)^2$

This RE represents third symbol from ends must be b.

Hence, option (c) is correct.