Branch : CSE & IT **Batch:Hinglish**

Theory of Computation

Finite Automata

DPP-10

[MCQ]

1. Consider alphabet $\Sigma = \{a, b\}$, the empty string $\in$ and the set of strings S, P, Q and R generated by the corresponding non-terminals of a regular grammar. S, P, Q and R related as follows (S is a start symbol):

$S \rightarrow aP \mid bQ \mid \in$

$P \rightarrow bR \mid aS$

$Q \rightarrow aR \mid bS$

$R \rightarrow aQ \mid bP$

(a) $L = \{w{:}n_a(w) \text{ and } n_b(w) \text{ both are even}\}$.
(b) $L = \{w{:}n_a(w) \text{ and } n_b(w) \text{ both are odd}\}$.
(c) $L = \{w{:}n_a(w) \text{ or } n_b(w) \text{ are even}\}$.
(d) None of these.

[MSQ]

2. Consider the following language L on alphabet $\Sigma = \{a, b\}$

$L = \{wxw^R \mid w, x \in \{a, b\}^+\}$

The correct regular grammar of above language is/are possible?

(a) $S \rightarrow aAa \mid bAb$
$A \rightarrow aA \mid bA \mid a \mid b$
$B \rightarrow aA \mid bA \mid a \mid b$

(b) $S \rightarrow aAa \mid bAb \mid \in$
$A \rightarrow ab$

(c) $S \rightarrow aA \mid bB$
$A \rightarrow aA \mid bA \mid a$
$B \rightarrow bB \mid aB \mid b$

(d) $S \rightarrow Aa \mid Bb$
$A \rightarrow Aa \mid Ab \mid a$
$B \rightarrow Bb \mid Ba \mid b$

[MCQ]

3. Consider the following statements:

S_1: If language is regular then, grammar must be regular.

S_2: If grammar is regular then, language can't be regular.

Which of the following is correct?

(a) S_1 is true.
(b) S_2 is true.
(c) Both S_1 and S_2 are true.
(d) None of these

[MCQ]

4. Consider the following grammar G:

G:

$S \rightarrow A\,B\,C$
$A \rightarrow aA \mid a$
$B \rightarrow bc$
$C \rightarrow cC \mid \in$

The language generated by above grammar is?

(a) $L = \{a^* \, bc \, c^*\}$
(b) $L = \{a^+ \, b \, c^+\}$
(c) $L = \{a^* \, b \, c^*\}$
(d) None of these

[NAT]

5. For language $\{a^*bb^*a^+b^* \cup b\,a^*b\}$ the minimum pumping length will be _____.

[NAT]

6. Consider some regular expression:

r_1: $a^*bb^*c^*(ab)^*$
r_2: $a^*b^*\,ab \cup (bb)^*$

If minimum pumping length of r_1 is P_1 and minimum pumping of r_2 is P_2 then the value of $P_1 * P_2$ will be _____.

[MCQ]

7. Suppose, a language L has finite automata M with N states. The language generated by FA is L(M) is an infinite if and only if $\exists_w \in L$ such that

(a) $N \geq |w| \leq 2N$

(b) $N \leq |w| \leq 2N-1$

(c) $N \leq |w| \geq 2N-1$

(d) None of these

[MCQ]

8. Consider the following grammars G_1 and G_2:

G_1: $S \rightarrow aS \mid S \mid A$

$A \rightarrow aA \mid abA \mid \in$

G_2: $S \rightarrow aS \mid a$

Which of the following grammar is/are regular?

(a) G_1 only

(b) G_2 only

(c) Both G_1 only G_2

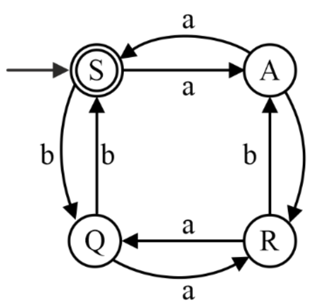
(d) None of these

Answer Key

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

Hints and Solutions

1. (a)



$L = (aa + ab + ba + bb)^*$

Hence, option (a) is correct.

2. (c, d)

$L = \{wxw^R \mid w, x \in \{a, b\}^+\}$

$a(a + b)^+ a \mid b(a + b)^+ b$

$\downarrow \qquad\qquad \downarrow$

$ab(a + b)^+ba \qquad ba(a + b)^+ ba$

$aa(a + b)^+aa \qquad bb(a + b)^+ bb$

L = Regular

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

(a) False: Given grammar is not regular.

(b) False: Given grammar is not regular.

(c) True: $a(a + b)^+a + b(a + b)^+b$ RLRG

(d) True: $a(a + b)^+a + b(a + b)^+ b$ LLRG

Hence, (c, d) are correct.

3. (d)

- False: Grammar may/may not be regular.
- False: If grammar is regular, then language must be regular.

4. (b)

$S \to ABC = aa^*bcc^*$

$A \to aA \mid a = aa^*$

$B \to bc = bc$

$C \to cC \mid \in = c^*$

Regular expression $= aa^*bcc^*$

$= a^+ bc^+$

Hence, option (b) is correct.

5. (3)

$L = \{a^*bb^*a^+b^* \cup ba^* b\}$

Minimal string (w) = ba, bb

Pumping length = |w| + 1

= 2 + 1

= 3

6. (6)

$r_1 = a^*bb^*c^*(ab)^*$

$p_1 = 2$

$r_2 = a^*b^*ab \cup (bb)^*$

$p_2 = 3$

$p_1 * p_2 = 6$

7. (b)

$N \le |w| \le 2N-1$

Option (b) is correct.

8. (c)

G_1: $S \to aS \mid S \mid A$

$A \to aA \mid abA \mid \in$

Regular grammar

Regular grammar

- $V \to T^*V \mid T^*$ RLRG
- $V \to VT^* \mid T^*$ LLRG

G_2: $S \to aS \mid a$

Regular grammar.