# Branch: CSE/IT Batch: Hinglish

## Theory of Computation (TOC)
## Finite Automata
## Basics of TOC

**DPP-01**

**[MCQ]**

**1.** Consider decimal alphabet $\Sigma = \{0, 1, 2, ...9\}$, then how many two length strings are possible?

(a) 4 (b) 20
(c) 100 (d) 2

**[MCQ]**

**2.** Consider a binary alphabet $(\Sigma) = \{0, 1\}$
How many 3 length strings are possible, the third symbol of the string must be 0?

(a) 4 (b) 8
(c) 3 (d) 5

**[MSQ]**

**3.** Consider the following strings and their respective lengths:
$|w_1| = p$
$|w_2| = q$
$|w_3| = r$
Then, which of the following is/ are correct?

(a) The length of the string $w_1 \cdot w_2 = pq$
(b) The length of the string $w_1 \cdot w_2 \cdot w_3 = p + q + r$
(c) The length of the string $w_1 \cdot w_2 \cdot w_3 = pqr$
(d) The length of the string $w_1 \cdot w_3 = p + r$

**[MCQ]**

**4.** Which of the following is correct about Regular Grammar?

(a) Every Regular grammar is Left Linear Grammar.
(b) Every Right Linear grammar may/may not be Regular Grammar.
(c) If grammar is regular then it must be left linear as well as right linear.
(d) If grammar is regular then it must be either left linear or right linear.

**[MSQ]**

**5.** Which of the following is / are not an alphabet?

(a) $\Sigma = \{a, b, ab\}$
(b) $\Sigma = \{1, 2, 3, 4 ....\}$
(c) $\Sigma = \{ \}$
(d) $\Sigma = \{\in\}$

**[MCQ]**

**6.** If w is a string and $w^R$ is reversal of the string then which of the following is incorrect?

(a) $\left(w^R\right)^R = w$
(b) $\left(ww^R\right)^R = w \cdot w^R$
(c) $\left(wxw^R\right)^R = w \cdot x \cdot w^R$
(d) $\left(ww^R\right)^R = w^R \cdot w$

**[NAT]**

**7.** For 10 length strings, Total number of maximum substrings possible are _____.

**[NAT]**

**8.** Consider following statements:

**$S_1$:** Every prefix or suffix is a substring.
**$S_2$:** Total number of prefixes are same as total number of suffixes in a string.
**$S_3$:** Total number of suffixes for n length string is (n + 1).

Number of correct statements are _____.

# Answer Key

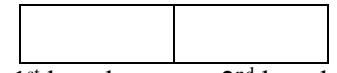
1. **(c)**
2. **(a)**
3. **(b, d)**
4. **(d)**
5. **(a, b, c)**
6. **(d)**
7. **(56)**
8. **(3)**

# Hints and solutions

**1. (c)**

Alphabet (Σ) = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

- Zero length string = 1 i.e., {∈}
- One Length strings = 10
  {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
- Two Length Strings = 100



1st length 2nd length

[0 - 9] [0 - 9]

10 * 10 = 100

**2. (a)**

- Alphabet (Σ) = {0, 1}
- 3rd symbol of the string must be 0 means last symbol fix. i.e., 0
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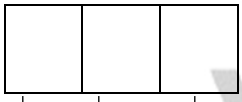


1st length 2nd length 3rd length

(0, 1) (0, 1) *(0)

= 2 * 2 * 1 = 4

Strings = {010, 000, 100, 110}

Hence, option (a) is correct.

**3. (b, d)**

$|w_1| = p$

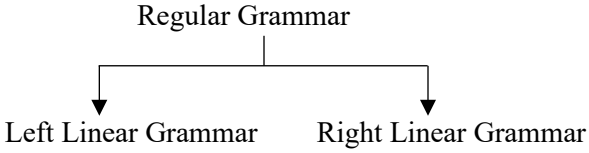
$|w_2| = q$

$|w_3| = r$

- $|w_1 \cdot w_2 \cdot w_3| = p + q + r$
- $|w_1 \cdot w_2| = p + q$
- $|w_1 \cdot w_3| = p + r$

Hence, option (b, d) are correct.

**4. (d)**




- Grammar is regular if and only if either its LLG or RLG
- Right Linear Grammar: $V \rightarrow TV^*|T^*$
- Left Linear Grammar: $V \rightarrow VT^*|T^*$

**5. (a, b, c)**

- Alphabet is a set of finite non-empty symbol.
- Symbols in alphabet must be atomic.

(a) Σ = {a, b, ab}
part of the symbol not allowed.

(b) Σ = {1, 2, 3, ...}
Set of infinite symbols not allowed.

(c) Σ = { } empty not allowed.

(d) Σ = {∈} Allowed because in place of empty string we can put λ.

**6. (d)**

Let $w = abb$

then $w^R = bba$

**(a)** $\left(w^R\right)^R = (bba)^R = abb = w$ **True**

**(b)** $\left(w \cdot w^R\right)^R = (abbbba)^R$

$= \overline{abb}\ \overline{bba}$ **True**

$\quad\ \ w \quad w^R$

OR

$\left(w \cdot w^R\right)^R = \left(w^R\right)^R \cdot (w)^R = w \cdot w^R$

**(c)** $\left(w\ x\ w^R\right)^R = \left(w^R\right)^R x \cdot w^R = w \cdot x \cdot w^R$

OR

$(abb\ x\ bba)^R = \overline{abb}\ \underline{x}\ \overline{bba}\ (w\ x\ w^R)$ **True**

$\quad\ \ w \quad x \quad w^R$

(d) $\left(ww^R\right)^R \neq w^R \cdot w$ **False**

Hence, option (d) is correct

7. **(56)**

Range [56 to 56]

- for n length string, maximum number of substrings are $\frac{n(n+1)}{2}+1$
- for 10 length string, number of substrings = $\frac{10*11}{2}+1=56$

8. **(3)**

String (w) = 100

Prefix = {∈, 1, 10, 100} = 4

Suffix = {∈, 0, 00, 100} = 4

(1) **True:** Every prefix or suffix is a consecutive subpart of string.

(2) **True:** Number of prefixes = Number of suffixes.

(3) **True:** For n length string (n + 1) are prefix or suffix.