



SNS COLLEGE OF TECHNOLOGY



Coimbatore-36.

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**COURSE CODE & NAME : 19CSB301 & AUTOMATA THEORY AND COMPILER
DESIGN**

III YEAR/ V SEMESTER

UNIT – I FINITE AUTOMATA AND REGULAR LANGUAGES

Topic: Regular Expression Dr.B.Vinodhini

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Regular Expression

Regular Expression

Regular Expressions are used for representing certain sets of strings in an algebraic fashion.

- 1) Any terminal symbol i.e. symbols $\in \Sigma$ including Λ and Φ are regular expressions. $a, b, c, \dots, \Lambda, \Phi$
- 2) The Union of two regular expressions is also a regular expression. $R_1, R_2 \rightarrow (R_1 + R_2)$
- 3) The Concatenation of two regular expressions is also a regular expression. $R_1, R_2 \rightarrow (R_1.R_2)$
- 4) The iteration (or Closure) of a regular expression is also a regular expression. $R \rightarrow R^+ \quad a^* = \Lambda, a, aa, aaa, \dots$
- 5) The regular expression over Σ are precisely those obtained recursively by the application of the above rules once or several times.



Regular Expression

The language $L(r)$ denoted by any regular expression r is defined by the following rules.

1. \emptyset is a regular expression denoting the empty set,
2. λ is a regular expression denoting $\{\lambda\}$,
3. For every $a \in \Sigma$, a is a regular expression denoting $\{a\}$.

If r_1 and r_2 are regular expressions, then

4. $L(r_1 + r_2) = L(r_1) \cup L(r_2)$,
5. $L(r_1 \cdot r_2) = L(r_1) L(r_2)$,
6. $L((r_1)) = L(r_1)$,
7. $L(r_1^*) = (L(r_1))^*$.



Regular Expression

$L = \{00, 10\}$ and $M = \{01, 11\}$

LUM	$\{00, 10, 01, 11\}$
LM	$\{0001, 0011, 1001, 1011\} ..$
L^0	$\{\epsilon\}$
L^1	$\{00, 10\}$
L^2	$\{0000, 0010, 1000, 1010\}$
M^2	$\{0101, 0111, 1101, 1111\}$
L^*	$\{\epsilon, 00, 10, 0000, 0010, \dots\} .$
L^+	$\{00, 10, 0000, 0010, \dots\}$



Regular Expression

Let $\Sigma = \{a, b\}$. Give the regular set for the following regular expressions.

$$a \mid b = \{a, b\}$$

$$(a \mid b)(b \mid a) = \{ab, aa, ba, bb\}$$

$$a^* = \{\epsilon, a, aa, aaa, \dots\}$$

$$a \mid a^* b = \{a, b, ab, aab, \dots\}$$



Regular Expression



Regular Expression - Examples

Describe the following sets as Regular Expressions

1) $\{0,1,2\}$ $0 \text{ or } 1 \text{ or } 2$

$$R = 0 + 1 + 2$$

2) $\{\wedge, ab\}$

$$R = \wedge ab$$

3) $\{abb, a, b, bba\}$ $abb \text{ or } a \text{ or } b \text{ or } bba$

$$R = abb + a + b + bba$$

4) $\{\wedge, 0, 00, 000, \dots\}$ closure of 0

$$R = 0^*$$

5) $\{1, 11, 111, 1111, \dots\}$

$$R = 1^+$$



References

- John E. Hopcroft and Rajeev Motwani and Jeffrey D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Second Edition, Pearson Education, New Delhi, (2007) (UNIT-I)
- Linz P. An introduction to formal languages and automata. Sixth edition, Jones and Bartlett Publishers; 2016.(UNIT-I)
- [Ramaiah k. Dasaradh](#) “Introduction to Automata and Compiler Design “ First Edition ,Prentice Hall India Learning Private Limited(2011)(UNIT-I to V)

