Regular Expression - Definition

- Let $\sum$ be an alphabet, the set of regular expression over the $\sum^*$ is defined as

- **1. Basis Clause**

- (a) Φ is a RE representing the empty set i.e. $L(\Phi)= \Phi=\{ \}$

- (b) ε is a RE representing the set having single element ε i.e. $L(\varepsilon)=\{\varepsilon\}$

- (a) a is a RE representing the set having element a .i.e $L(a)=\{a\}$

Regular Expression – Definition

◎ **2. Inductive Clause**

◎ Suppose r_1 and r_2 are Regular Expressions representing language L_1 and L_2 then

◎ (a) r_1+r_2 is a RE representing language $L_1 \cup L_2$

◎ (b) $r_1 r_2$ is a RE representing language $L_1 L_2$

◎ (c) r_1^* is a RE representing language L_1^*

◎ **Note– Nothing else is Regular Expression**

Regular Expression - Example

- 1. L={aa,ab,ba,bb}
- R=aa+ab+ba+bb=(a+b)(b+a)
- 2. L={wε{a,b}*|length of w>=2}
- R=(a+b)(a+b)(a+b)*
- 3. L={wε{a,b}*|length of w<=2}
- R=ε+a+b+aa+ab+ba+bb
- 4. L={wε{a,b}*|w starts with symbol 'a'}
- R=a(a+b)*

Regular Expression - Example

◉ 5. L={wε{a,b}*|w ends with symbol 'a'}

◎ R=(a+b)*a

◉ 6. L={wε{a,b}*|w contains symbol 'a'}

◎ R=(a+b)*a(a+b)*

◉ 7. L={wε{a,b}*|w begins with symbol 'aa'}

◎ R=aa(a+b)*

◉ 8. L={wε{a,b}*|w ends with symbol 'ab'}

◎ R=(a+b)*ab

Regular Expression - Example

◉ 9. L={w∈{a,b}*|w contains symbol 'bb'}

◉ R=(a+b)*bb(a+b)*

◉ 10. L={w∈{a,b}*|w contains symbol 'aa' or 'bb'}

◉ R=(a+b)*(aa+bb)(a+b)*

◉ 11. L={w∈{a,b}*|length of w is even}

◉ R=((a+b)(a+b))*

◉ 12. L={w∈{a,b}*|length of w is odd}

◉ R=((a+b)(a+b))*(a+b)

Regular Expression - Example

- 13. L={w∈{a,b}*|length of w is divisible by 3}
- R=((a+b)(a+b)(a+b))*
- 14. L={w∈{a,b}*|w starts and ends with symbol 'a'}
- R=a(a+b)*a
- 15. L={w∈{a,b}*|w starts and ends with the same symbol}
- R=a(a+b)*a + b(a+b)*b
- 16. L={w∈{a,b}*|w starts and ends with the different symbol}
- R=a(a+b)*b + b(a+b)*a

Regular Expression - Example

◉ 17. L={w∈{a,b}*|w contains series of 'a' followed by series of 'b'}

◉ R=a*b* (a⁺b⁺)

◉ 18. L={w∈{a,b}*|w even number of a's}

◉ 19. L={w∈{a,b}*|w odd number of b's}

◉ 20. L={w∈{a,b}*|w even numbers of a's and odd number of b's}

◉ 21. L={w∈{a,b}*|w is of the form (ab)ⁿ,n>=1}

◉ Hint –Construct DFA and then write RE

Regular Expression - Example

- ∑={a,b,c,d,e,f,....z}
- 1. L={w∈∑*|w ends with 'singh'}
- R=(a+b+....z)*singh
- 2. L={w∈∑*|w begins with 'amit'}
- R=amit(a+b+....z)*
- 3. L={w∈∑*|w contains with 'kumar'}
- R=(a+b+....z)*kumar(a+b+....z)

Regular Expression - Example

- $\Sigma = \{0, 1, 2, 3, 4, \ldots, 9\}$
- 1. $R = (1+2+\ldots+9+\varepsilon)(0+1+2+\ldots+9)^*$
- RE for Integer
- 2. $R = (+ + -)(1+2+\ldots+9+\varepsilon)$ $(0+1+2+\ldots+9)^*$
- RE for Signed Integer
- 3. $R = (1+2+\ldots+9+\varepsilon)(0+1+2+\ldots+9)^*$. $(0+1+2+\ldots+9)^*$
- RE for Float Point Number