THEORY OF COMPUTATION

Regular Expression

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Regular Expression.

Formal Definition of a RE: **Let ∑ be a given alphabet. Then,**

(i) ϕ, ∧, and a belongs to ∑, are all regular expressions. [primitive Regular Expressions]

(ii) If r1 and r2 are regular expressions, then r1+r2, r1r2, r1*, (r1) are also regular expression if and only if it can be derived from the primitive RE by the finite number of applications of the rules in (ii).

Operators of Regular Expressions

The union of two languages, L and M is denoted by L U M which are a set of strings that are either in L or M or both.

Example:

L = {001, 10, 111}
M = { ∧, 001}
LUM = { ∧, 00, 10,111}

The concatenation of languages L and M, denoted L.M which are a set of strings that can be formed by taking any string in L and concatenating with any string in M.

Example:

L = {001, 10, 111}
M = { ∧, 001}
LM = {001, 001001, 10, 1000, 111, 111001}

The closure of a language, L is denoted as L* represent the set of those strings that can be formed by taking any number of strings from L, possibly with repetitions and concatenating all of them.

Example:

L = {0, 1}
L0 = { ∧ }
L1 = {0, 1}
L2 = {01, 00, 11, 10}

1. Write a RE for the language accepting all combinations of a's over the set ∑ = {a}
   L = {all combination of a's over {a}}
   = { ʌ, a, aa, aaa,…….}
   R = a*

2. **Design the RE for the language accepting all combinations of a's except the null string over**
   L = {all combination of a over {a }except ʌ }
   = {a, aa, aaa,aaaa…….}
   R = a+

3. Design a RE for the languages containing all thes strings containing any number of a's and b's .
   L = { ʌ,a,b, aa, bb, ab,aab,….}
   R = (a+b)*

4. Construct the RE for the language contai9ning all strings having any number of a's and b's except the null string.
   L = {a, ab, b, aa, abb, aabb ,..}
   R = $(a+b)^+$

5. Construct a RE for the language accepting all strings which are ending with 00 over the set, ∑ = {0,1}
   L = {00, 000, 100, 0100, 1000, 01000, 01000, 11100,..}
   R = (0+1)* 00.

6. Write a RE for the language accepting the strings which are starting with 1 and ending with 0, over the set ∑ = {0,1}
   L = {10, 100, 110, 1000, 10101, 111000 ….}
   R = 1(0+1)*0

7. Write a RE to denote a language, L over ∑* where ∑ = {a, b} that the third character from right end of the string is always a.
   L = aab, aba, aaa, abb, babb, aaaa,…
   R = (a+b)* a(a+b)(a+b)