operation on language

two language set let A & B.

union – $A \cup B = \{ x \mid x \in A \text{ or } x \in B \}$

→ taking all the elements in A & B

concatenation – $A \circ B = \{ xy \mid x \in A \text{ and } y \in B \}$

joining one element from A and another from B.

Star (Closure) – $A^* = \{ x_1 x_2 x_3 \ldots x_n \mid n \geq 0$ and each $x_i \in A \}$

example →

$A = \{ pq, r \}$ $B = \{ t, uv \}$

union, $A \cup B = \{ pq, r, t, uv \}$

concatenation, ~~$A \circ B = \{ pqt, ruv, pquv$~~

$A \circ B = \{ pqt, pquv, rt, ruv \}$

closure (star) $A^* = \{ \varepsilon, pq, r, pqr, rpq, pqpq \ldots \}$

↑ epsilon / empty string

we can take as many symbol as we like and we can join as we like

Defn of a language in toc

Language → language is a set of string.

when any language doc not contain any string then it is said as empty language.

B.

operation on language —
total 5 operation
1. union 2 intersection 3 difference 4 concatenation
5. kleen closure

1. union
let two language L_1 & L_2

$L_1 = \{0, 1\}$ $L_1 = \{a^n / n>0\}$
$L_2 = \{1, 0\}$ $L_2 = \{b^n / n>0\}$

$L_3 = L_1 \cup L_2$
$= \{a^n \cup b^n / n>0\}$
⇒ that means all the string from both language will be in same language after union

n=2
$L_1 = \{aa\}$
$L_2 = \{bb\}$
$L_1 \cup L_2 = \{aa, bb\}$

2. Intersection
$L_1 = \{a^m b^n / n>0 \text{ and } m>0\}$
$L_2 = \{a^m b^n \cup b^n a^m / n>0, m>0\}$
$L_1 \cap L_2 = \{a^m b^n / n>0 \text{ and } m>0\}$

$n = 2 \quad m = 2$

$L_1 = \{ a^2 b^2 \}$

1) union. ← all the elements from both language.

Let $L_1 = \{ p, q, r \}$

$L_2 = \{ q, r, s \}$

$L_1 \cup L_2 = \{ p, q, r, s \}$

=) elements in $L_1 \cup L_2 \in L_1$ or L_2

2). intersection.

getting common strings.

$L_1 = \{ p, q, r \} \quad L_2 = \{ q, r, s \}$

$L_3 = L_1 \cap L_2 = \{ q, r \}$ where element of $L_3 \in L_1$ and L_2.

3). concatenation.

$L_1 = \{ p, q, r \} \quad L_2 = \{ q, r, s \}$

then $L_3 = L_1 . L_2$

$= \{ p, q, r \} \{ q, r, s \}$

$= \{ pq, pr, ps, qq, qr, qs, rq, rr, rs \}$

4) Kleene closure –

When operation is performed on a single language

Let ⇒ $L_1 = \{a, abc, ba\}$

$L_1^2 = \{a, abc, ba\}.\{a, abc, ba\}$

$= \{aa, aabc, aba, abca, abcabc, abcba, baa, baabc, baba\}$

$L^3 = L_1 \cdot L_1^2$

⋮

but $L_1^0 = \{\varepsilon\}$

↑ epsilon → for null

⇒ Kleene closure of L_1, $L_1^* = \{\varepsilon, L_1, L_1^2, L_1^3 \ldots\}$

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