example 2 For palindrome

Rule 1: Λ, a and b are in a palindrom

Rule 2: if w ∈ palindrom, then so are awa and bwb

Rule 3: No other string is is Palindrom unless it can be produced by rules 1 & 2.

Regular Expressions

↳ Third method of defining language.

↳ language is represented in terms of strings.

i.e string (concentenation of letters aaabaa)

i.e Power of string

$ba^2b = baab$ (Fixed power)

$ba^*b = bb, bab, baab, baaaab$ kleene star (null string ✓)

$ba^+b = bab$; baab or baaab (Null string ✗) (kleene plus)

Example :- string cointains only a letters → No b, c, d ya letter a

$L = \{\Lambda, a, aa, aaa, aaaa, \ldots\}$

$R = a^*$

Regular expression

Example 2:-

string contains only a letters

$R = a^+$

$L = \{a, aa, aaa, \ldots$

Ex : string start with a and containg any b letters.

$L = \{a, ab, abb, abbb, abbbbb\}$

$R = ab^*$ — contentenation of string

OR .AND

Ex : language string contains a or b $L = \{a, b\}$

$R = \underbrace{a + b}$ → + means (or)

⇒ union of string

Ex: string contain any a or any b

$R = \cancel{(a+b)^*}$ $(a+b)^*$

Ex : string starts with a and ends with a.

$L = \{aa, aaa, aba, aaaa, abba, abaa, aaba, \ldots\}$

$R = a(a+b)^* a$

↳ sub-string

ex:- All string starting and ending with different letters.

$a(a+b)^* b + b(a+b)^* a$

Power of Sigma Σ :-

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

2^0 Σ^0 = set of strings with length 0 = λ, ε

2^1 Σ^1 = " " " " " 1 = $\{a, b\}$

2^2 Σ^2 = " " " " " 2

= $\Sigma \cdot \Sigma$ $\{a, b\}\{a, b\}$

= $\{aa, ab, ba, bb\}$

2^3 Σ^3 = " " " " length 3

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

= aaa, aab, aba, abb, baa, bab, bba, bbb}

Σ^* (Kleene closure) = $(a+b)^*$ — Infinite language

Kleene closure = $\Sigma^+ = \Sigma^* - \lambda$

Regular expression containing substring :-

↳ one of defining language methods by which language is represend in terms of strings (Power, concentenation, Union)

Contetenation (AND) = $A \cdot B = AB$

Union (OR) = $A + B = A/B$

$R = ab^*$ $L = \{a, ab, abb, abbb, \ldots\}$

⇒ b^* comes because ek dafa a single hy!

$R = (a+b)^*$ $L = \{\lambda, a, b, aa, ab, ba, bb, aaa, aab, \ldots\}$

(start mey a or end pe a)

$L = \{aa, aaa, aba, aaaa, aaba, \ldots\}$

$R = a(a+b)^* a$

Substring:-

① Define a languge for RE that contains the substring ba.

$(a+b)^* ba (a+b)^*$

kuch a b skta or nahi b a skta

② All strings which do not contain the ba.

~~b^*~~ ~~a^*~~ $a^* b^*$ - b a nahi aana chahiye ab tu a skta hy!

③ Define a RE languge that contain substring 00.

$(0+1)^* 00 (0+1)^*$

④ All string which do not cont substring 00.

$0 + 1^* + 1^* 01^*$

⑤ All strings which do not contain substring 101.

$0^* (1^* 000^*)^* 1^* 0^*$

Regular expression of even

* **Even - Even:**
  ↳ language contain even no. of string a's and b's, abab, aa, bb, bbaa, aabb → 0, 2, 4, 6, 8, 10

a = even, b = even E(a, b)

① aabb, bbaa, abab, baba, aa, ab

R.E = aa + bb + (ab + ba)(ab + ba)
(It's for four)

R.E = [aa + bb + (ab + ba)(aa + bb)* (ab + ba)]*

abaaab
abbbab

② Define a R.E that contain even no. of a's → b jitthay marzi ayein - babab, bbaa

$b^* + (b^* a b^* a b^*)^*$ → b, bb, aaaa, babab, bbaa

③ R.E for even no of b's

$a^* + (a^* b a^* b a^*)^*$ → bb, bbbb, ababa, aabb, a, aa → bbbb

a, aa
b = 0 even