lecture 4:- 2) Recursive definition.

1- Some basic words are specified in language.

2- Rules for constructing more words.

3- No string except those constructed above are allowed in the language.

$\Sigma = \{-, 0, 1, \ldots 9\}$.

Language of INTEGER.

1- 1 is in INTEGER.

2- if x is in INTEGER then x+1 & x-1 is in INTEGE

3- ---------

4 + 1 = 5
3 + 1 = 4
2 + 1 = 3 ∈ INTEGER.
1 + 1 = 2 ∈ INTEGER.

1 - 1 = 0 INTEGER.

Language of EVEN.

1- 2 is in EVEN.

2- if x is Even then x+2 & x-2 is also EVEN.

3- ----------

8 + 2 = 10
6 + 2 = 8
4 + 2 = 6
2 + 2 = 4 ∈ EVEN.

Language of ODD.

Language of PALINDROME. $\Sigma = \{a, b\}$.

1- a and b are in PALINDROMES.

2- if x is in PALINDROME then
s x Reverse(s) ∈ PALINDROME.
xx. ∈ PALINDROME.
s ∈ Σ*.

x = a

= a aa.
s x s^r ∈ P

s = a.
Reverse(s) = a.

a aaa a.
x

x
b a bb a b

Language of $\{a^n b^n, n = 1,2,3 \cdots\}$ $\Sigma = \{a, b\}$.

1- ab is in $\{a^n b^n\}$
2- if x is in $\{a^n b^n\}$ then axb ∈ $\{a^n b^n\}$.
3 - - - - - - -

1
aaa b bb ∈ $\{a^n b^n\}$.
a x b
a X · b
X

A language L that begins & ends in same letter
$\Sigma = \{a, b\}$.

1, a, and b are in L.
2- if x is in L then axa ∈ L and bxb ∈ L.
3 - - - - - - -

a bbbaa a ∈ L. think.

3- Regular Expression. (Regex).

5- Regular Expression. (Regex).

$\Sigma = \{a\}$ $\quad \Sigma^* = \{\Lambda, a, aa, aaa, \dots\}$.

$\Sigma^+ = \{a\}^+ = \{a, aa, \dots\}$

$a^+ = a, aa, aaa, \dots$

$a^* = \Lambda, a, aa, aaa, \dots$

$a^* = 0, 1, 2, \dots$ of a's

$a^+ = 1, 2, 3 \dots$ of a's.

$(ab)^* = \Lambda, ab, abab, ababab, \dots$

Ex. $(ab)^* = a^*b^*$? $\quad$ abab.

$a^*b^* = \Lambda, b,$

Ex. $a^* + b^*$ (or) $= \Lambda, a, aa, \dots$
$\Lambda, b, bb, bbb, \dots$

Ex. $a^* + b^* = (a+b)^*$. Not Equal.

$\Sigma^* = (a+b)^* = (a+b)^0 = \Lambda$.

$(a+b) = a, b$.

$(a+b)(a+b) = aa, ab, ba, bb$.

$(a+b)(a+b)(a+b) = \dots$

Ex. $(a+b^*)^* = (a+b)^*$. ✓

$(a+b^*)^*$

$(a+b^*)^0 = \Lambda$

$(a+b^*)^1 = a, b^*$

$(a + \{\Lambda, b, bb, bbb \dots\})^* =$

Ex. $L = \{ab, bc\}$.

$(ab+bc) =$

$L = \{abb, bcb\}$.

$(ab+bc)b = abb, bcb.$

$L = \{a, b\}^* = (a+b)^*$.

$L = \{ac, c\} = (\Lambda + \Lambda)c \rightarrow$

$L_2 = \{ac, c\}$. $= (a+\Lambda)c =$

$L = \{\Lambda, a, b, ab\} = (a+\Lambda)(b+\Lambda)$. $= a, ab, b, \Lambda$.

Define Regex for a language which start with "a" followed by anything - $\Sigma = \{a, b\}$.

$a(a+b)^*$

$(a+b)^*b$ ends with b followed by anything.

$a(a+b)^*$ - atleast one "a"

$((a+b)(a+b))^*$ Even length Strings. Λ.

$((a+b)(a+b))^*(a+b)$ = odd length.

$aa(a+b)^*bb$. = Starting with aa & ending in bb.

$a(a+b)^*b + b(a+b)^*a$ = Starting & ending in diff letters.

$a(a+b)^*a + b(a+b)^*b$ = " " " " Same letters.