lecture 2:-

PALINDROME:- Λ and String s defined over Σ such that $Rev(s) = s$.

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

PALINDROME = $\{\Lambda, a, b, aa, bb, aaa, aba, bab, bbb, ----\}$.

How to form a palindrome String.

For length = 1.

$s = a$ is a String. $rev(s) = a$.

For length > 1. $\Sigma = \{a, b\}$.

s Reverse(s). $s = ab$.

abba ✓ Reverse(s) = ba.

Ex:- $\Sigma = \{A, abab, d\}$.

$s = Aabab$ find palindrome ?

s Reverse(s).

Aabab ababA.

n^m if palindrome is of even length.

s $rev(s)$. $Len(s) = n$. $\Sigma = \{a, b\}$.

$Len(rev(s)) = n$.

1 ------- n

2 2 2 2 ----2

length = $2n$ = ? $n = 2$. 2^n = How many.

length = 8 = $2n$

$n = 4$.

aa aa

ab ba

ba ab

bb bb.

if palindrome is of odd. length

$$\underset{1}{\_}\ \underset{2}{\_}\ \_\ \_\ \_\ \_\ \_\ \_\ \underset{n}{\boxed{-}}\ \Big|\ \underset{1}{\_}\ \underset{2}{\_}\ \_\ \_\ \_\ \underset{n-1}{\_}$$

$n+n-1 = 2n-1.$

Ex:- $\Sigma = \{a,b\}$. $s = ababb$

s a reverse(s).

s b reverse(s). $2n-1.$

ababb b, bbaba. $2\times6-1 = 11$

$$(\underset{2}{\_}\ \underset{2}{\_}\ \underset{2}{\_} - - - \underset{2}{\_}\ \underset{2}{\_})\ \underset{2}{\_}\ (\underset{2}{\_}\ \underset{2}{\_} - - - \underset{2}{\_})$$

$\xleftrightarrow{n-1}$ $\xleftrightarrow{n-1}$

2^{n-1} 2^{n-1}

palindromes with a in middle $= 2^{n-1}$

" " b " " $= 2^{n-1}$

$2^{n-1} + 2^{n-1} = 2.2 + 2^{-1}2^n$

$= 2^{-1}(2^n + 2^n)$

$= 2^{-1}(2^1 \cdot 2^n)$

$= \cancel{2^{-1}} \cdot \cancel{2^1}\, 2^n$.

length = 7 = $2n-1$ 2^n = How many.

$2n = 6$ $2^3 = 8$ Answer.

$n = 3$

length = 5 = $2n-1$ $2^2 = 4$

$2n = 6$

$n = 3$

$\boxed{aa\ a}$ a a

ab a b a

ba b a b

bb b b b.

ba a ab.

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

length = 6 = $2n$. 3^n. $= 3^3$

$n = 3$. $= 27$.

$\Sigma = \{a,b\}$.   x is any word in Σ. which is a palindrome.

x^n will also be a ".

$x = (aba)$ x^5

$x^5 =$ aba aba aba aba aba.

$(x^5)^0 =$ aba aba aba aba aba ⌣

KLEENE STAR CLOSURE :- Σ^*

→ The Collection of all strings defined over Σ Including Null.

Ex:- $\Sigma = \{x\}$.

$\underline{\Sigma^*} = \{\Lambda, x, xx, xxx, xxxx, ---\}$.

$\Sigma = \{0, 1\}$.

$\Sigma^* = \{\Lambda, 0, 1, 00, 01, 10, 11, ---\}$.

$\Sigma = \{aaB, c\}$.

$\Sigma^* = \{\Lambda, aaB, c, aaBc, caaBc, ----\}$.

Ex. $S = \{ab, ba\}$.

$S^* = \{\Lambda, ab, ba, abba, abab, ----\}$.

Ex:-

Let $S = \{ab, bb\}$ $T = \{ab, bb, bbbb\}$.

Show that $S^* = T^*$.

(i) $S^* = \{\Lambda$ and all possible Combinations of $S\}$.

(ii) $T^* = \{\Lambda$ and all " " " ab, bb, bbbb$\}$.

$= \{\Lambda$ and all " " " ab, bb$\}$.

$S^* = T^*$.

Ex:- $S^* = \{ab, bb\}$ $T^* = \{ab, \underline{bb}, bbb\}$.

$S^* = \{\Lambda$ & all possible Combination of $S\}$.

$T^* = \{\Lambda$ & " " " of ab, bb, bbb$\}$.

$S^* \subseteq T^*$.

$S \subset T$

$S^* \subseteq T^*$.

Plus Operator. Σ^+.

All Combinations of Σ excluding Null.

Ex. $\Sigma = \{x\}$.

$\Sigma^+ = \{x, xx, xxx, \ldots\}$.

$\Sigma = \{0, 1\}$.

$\Sigma^+ = \{0, 1, 00, 01, 10, 11 \ldots\}$.