lecture 3:- (i) prove that $(S+)^* = (S^*)^*$.

$S+ = \{$All possible Concatenations of alphabets in S excluding $\Lambda\}$.

$\Sigma = \{x\}$.

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

$\Sigma^* = \{\Lambda, \Sigma^+\}$.

LHS.

$(S+)^* = \{\Lambda$ & all possible Concatenations of $S+\}$.

$= \{\Lambda$ & all possible Concatenations of $\{$All possible Concatenations of $S\}\}$.

$= \{\Lambda$ & all possible Concatenations of $S\}$.

$= S^*$.

RHS:- $S^* = \{\Lambda$ & all possible Concatenations of $S\}$.

$(S^*)^* = \{\Lambda$ & all possible " " $S^*\}$.

$= \{\Lambda$ & all " " " $\{\Lambda$ & all possible Concatenations of $S\}\}$.

$= \{\Lambda$ & all possible Concatenations of $S\}$

$= S^*$.

(ii) $(S+)+ = S+$ (HW).

(iii) $(S^*)+ = (S+)^*$ (HW)

Example:- Let $S = \{a, bb, bab, abaab\}$.

bba

bbbab.

(i) abbabaabab $\in S^*$ false.

X

?

(ii) abaabbabbaab $\in S^*$.

X.

X.

(iii) Does S^* Contains any word with odd b's?

No.

Example :- $L = \{$ A concatenation of two words will exist iff. two words are Not the Same $\}$.

Can such a language exist.

Let $w_1 \in L$ & $w_2 \in L$ $\quad w_1 \neq w_2$.

$\Rightarrow w_1 w_2 \in L$.

Let $w_1 w_2 \in L$ & $w_1 \in L$ $\quad w_1 w_2 \neq w_1$.

$\rightarrow w_1 w_2 w_1 \in L$

$w_1 w_2 w_1 \in L$ & $w_2 \in L$ $\quad w_1 w_2 w_1 \neq w_2$.

$\rightarrow \underline{w_1 w_2 w_1} \underline{w_2} \in L$.

$(w_1 w_2)(w_1 w_2)$ $\quad w_1 w_2 = w_1 w_2$.

therefore such a language does Not exist.

Four ways for defining a language.

1- Descriptive

2- Recursive

3- Regular Expression. (Week six). online Course.
Certificate Print.

4- Finite Automata. 30th September 2022.

Descriptive :- - Semi formal way.
- plain English.

Ex:- $L = \{$ strings of even length $\}$ $\quad \Sigma = \{b\}$.

$L = \{ bb, bbbb, bbbbbb, ---- \}$.

$L = \{$ strings not starting with a $\}$ $\quad \Sigma = \{a, b, c\}$.

$L = \{ b, c, ba, bb, bc, ca, cb, cc, baa, ---- \}$.

$L = \{$ strings of length 3 $\}$ $\quad \Sigma = \{0, 1, 2\}$.

$= \{ 000, 001, 002, ---\}$

$L = \{$ strings ending in 1 $\}$. $\Sigma = \{0, 1\}$.

$= \{ 1, 01, 11, 001, 011, 101, 111, ----\}$.

EQUAL $= \{$ # of a's = # of b's $\}$ $\Sigma = \{a, b\}$.

$= \{ \Lambda, ab, ba, aabb, bbaa, abab, baba, abba, baab, ---\}$.

EVEN-EVEN. $= \{$ Even number of a's & even number of b's $\}$.
$\Sigma = \{a, b\}$.

$= \{ \Lambda, aa, bb, aaaa, bbbb, aabb, bbaa, abab, baba ---\}$.

INTEGER $= \{$ All concatenations of Σ, $-$ will not be alone and it always at the begining $\}$.

$\Sigma = \{-, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$.

$L = \{a^n b^n : n = 1, 2, 3, ---\}$ $\Sigma = \{a, b\}$.

$= \{ab, aabb, aaabbb,$

$L = \{a^n b^n c^n : n = 1, 2, 3 ---\}$. $\Sigma = \{a, b, c\}$.

$= \{abc, aabbcc, ---\}$.

W