Lecture 1:- "Theory of Automata".

less pratical & More Mathematical

Automaton.
→ Self acting.

→ theoretical Aspects of CS.

Book : " Introduction to Computer theory". 1991.

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Applications:
- Compiler Construction.
- Parsing
- Formal Verification.
- Defining Computer languages.

Languages → formal :- C++, C, Java, ---
Rules → language.
→ Informal :- Human
first language → Rules.

Language Basic Elements:-
Alphabets:- A finite non empty Set of Symbols (letters). Called alphabets.
Σ

Eg:- $\Sigma = \{1, 2, 3\}$.
$\Sigma = \{0, 1\}$. | Binary.
$\Sigma = \{a, b, c ---- z\}$.

Strings:- A Combination of alphabets.

Example $\Sigma = \{0, 1\}$. 0, 1, 00, 01, 10, 11 ----

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

Null String:- A String with no Symbol. "λ" "Λ"

WORDS:- words are string that belongs to a language.

Ex:- $\Sigma = \{a\}$ a, aa, aaa,
ab
x. String but not a word in Σ.

Ex: $\Sigma = \{a\}$ ... a, aa, aaa,

ab

x. String but not a word in Σ.

Rules for alphabets:-

1- $\neg$ (Λ)
2- Should be finite.
3- Should not be ambigious.

Ex:- $\Sigma_1 = \{A, Aa, bab, d\}$.

AababA. $\rightarrow$ is it a word?

(Aa), (bab) (A). $\rightarrow$ x.

(A), (abab) (A). $\rightarrow$.

?

$\rightarrow$ A Symbol should not start with a letter already being used by some other letter.

Example:- $\Sigma_1 = \{A, aA, bab, d\}$.

$\Sigma_2 = \{A, Aa, bab, d\}$. x.

$\Sigma_1 = \{a, ab, ac\}$ x.

$\Sigma_2 = \{a, ba, ca\}$.

Length of String:- Number of letters or Symbols in a String. $|S|$.

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

$S = aaabb$.

$|S| = 5$

Example:- $\Sigma = \{A, aA, bab, d\}$.

$S = \underline{A}\,\underline{a}\underline{A}\,\underline{bab}\,\underline{A}\underline{d}$.

Factoring:- $|S| = 5$. $\neq 8$

Length of a String over n alphabets.

Formula:- Number of strings of length 'm' defined over alphabets 'n' is $\boxed{n^m}$

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

Length 2 Strings:- aa, ab, ba, bb.

3 " :- aaa, aab, aba, abb, baa, bab, bba, bbb.

Reverse:- s reverse(s) s^r

s = aba reverse(s) = aba.

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

$s = \underbrace{A}\underbrace{aA}\underbrace{bab}\underbrace{A}\underbrace{d}$.

$s^r = \underbrace{d}\underbrace{A}\underbrace{bab}\underbrace{aA}\underbrace{A}$