CSPC 105

Automata Theory and Formal Languages

Introduction

Alphabets, Strings and Languages

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Alphabets: non-empty finite set of symbols

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$$\Sigma_1 = \{0, 1\} \rightarrow \text{binary minbuts}$$

$$\Sigma_2 = \{a, b, c, \frac{1}{m}, x, y, z\} \rightarrow English alphabet (lowercase letters)$$

$$\Sigma_3 = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\} \rightarrow \text{decimal numbers}$$

$$\Sigma_{4} = \{0,1,2,3,4,4,6,7,8,9,4,6,0,6,6\} \rightarrow \text{hexadecimal}$$

 $\Sigma_{4} = \{a,b\} \leftarrow$

String: finite sequence of symbols from an alphabet

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

$$w = 0$$

$$w = 1$$

$$w = 1$$

$$w = 0$$

$$w = 0$$

Length of string / cardinality

$$(w) = abcd$$

$$w = 01$$

$$w = automata$$

$$|\mathbf{w}| = 4$$



Null string or empty string

$$w =$$

$$w = \lambda$$

$$|\lambda| = 0$$

Substring

$$w = banana$$
 $w = 01011$ $w = outomata$

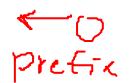
$$z = ana / -consecutively > z = 010 w = cut / v$$

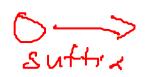
$$z = anb x$$

$$z = 11 / w = vmata / v$$

$$z = 01011 x$$

Concatenation: combine two string





$$x is x_1, x_2, x_3, ..., x_m$$

$$x = 011$$

y is
$$y_1, y_2, y_3, ..., y_n$$

$$y = 100$$

$$x_1x_2x_3...y_1y_2y_3...y_n$$

$$w = ab$$
 $w^{1} = ab$

$$\mathbf{w}^1 = \mathbf{ab}$$

$$W^2 = abab$$

Language (L): set of all possible strings from an alphabet, given a condition

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\Sigma = \{0, 1\} - no two consecutive 1's
100, 101, 0000, 0001, 0010,
0100, 0101, 1000, 1001, 1010, ... }
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Language (L): set of all possible strings from an alphabet, given a condition

$$\Sigma = \{0, 1\}$$
 - no two consecutive 1's

100, 101, 0000, 0001, 0010,

0100, 0101, 1000, 1001, 1010, ...}

Language notation

$$\Sigma = \{x,y\}$$

$$L_1 = \{x, xx, xxx, xxxx, ...\}$$

$$L_1 = \{x^k \mid k \ge 1\}$$

$$L_2 = \{x^k \mid k \ge 1\}$$

$$L_3 = \{x^k \mid k \ge 1\}$$

$$L_4 = \{x^k \mid k \ge 1\}$$

$$L_5 = \{x^k \mid k \ge 1\}$$

$$L_6 = \{x^k \mid k \ge 1\}$$

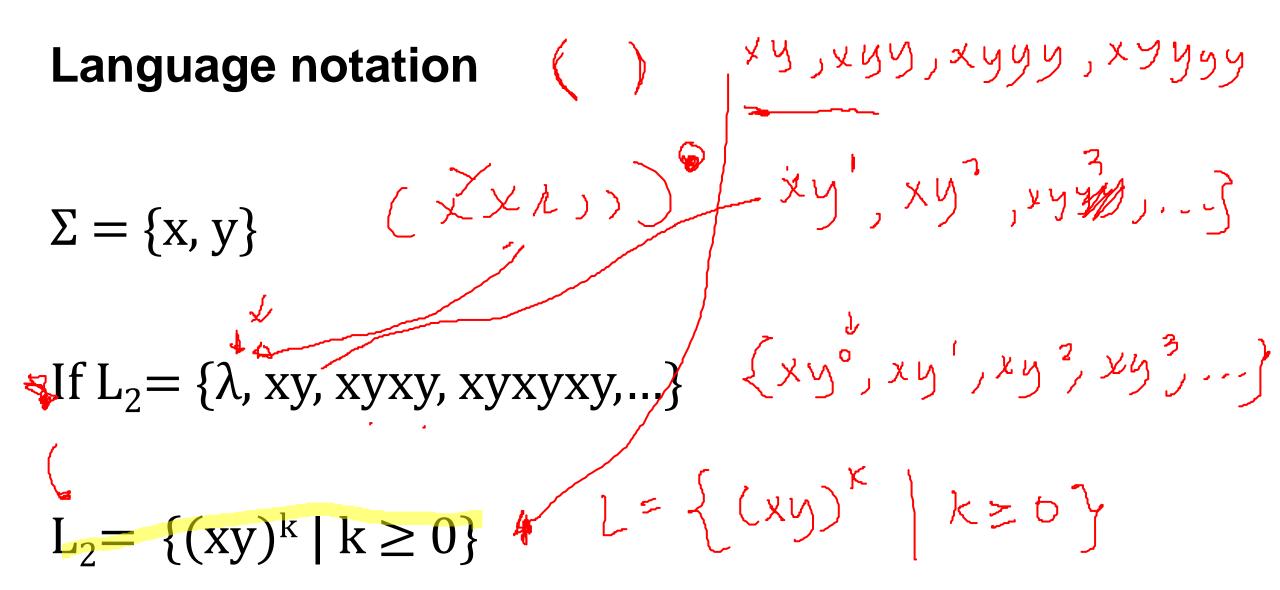
$$L_7 = \{x^k \mid k \ge 1\}$$

$$L_7 = \{x^k \mid k \ge 1\}$$

$$L_8 = \{x^k \mid k \ge 1\}$$

$$L_8 = \{x^k \mid k \ge 1\}$$

$$L_9 = \{x^k \mid k \ge 1\}$$



`{ ... } - Sets 5, - Alphabet W- String > - empty string Questions? | w | - length of string W Xy - concadenation of X and y (1)k - k copies of W