

# Theory of Computation

## Exercise 1: (Mathematic preliminary, Language, String)

אותיות alphabet מילים words  
set of string

1. Let  $\Sigma = \{a, b\}$  and  $L = \{aa, bb\}$ . Describe  $\bar{L}$  by a set notation.

$$\bar{L} = \Sigma^* - L$$

$$\Sigma^* = \Sigma^0 \cup \Sigma^1 \cup \Sigma^2 \cup \Sigma^3 \cup \dots \cup \Sigma^n$$

(universe)  
(all possible strings)

$\{1\} \quad \{a, b\} \quad \{aa, ab, ba, bb\}$

Ans מילה 1.  $\{a, b\}^* - \{aa, bb\}$

מילה 2.  $\bar{L} = \{w \in \{a, b\}^* : |w| \geq 3\} \cup \{1, a, b, ab, ba\}$

in 5 string

2. Find five strings which are in each of the following languages.

$\Sigma^*$

a)  $L = \{w \in \{a\}^* : |w| \bmod 3 \neq |w| \bmod 2\}$

$L = \{ \overset{\times}{\cancel{a}}, \overset{\times}{\cancel{aa}}, \overset{\checkmark}{a^2}, \overset{\checkmark}{a^3}, \overset{\checkmark}{a^4}, \overset{\checkmark}{a^5}, \overset{\times}{\cancel{a^6}}, \overset{\checkmark}{a^8} \}$   
 $0 \bmod 3 = 0 \bmod 2, 1 \bmod 3 \neq 1 \bmod 2, 2 \bmod 3 \neq 2 \bmod 2, 3 \bmod 3 = 3 \bmod 2, 4 \bmod 3 \neq 4 \bmod 2, 5 \bmod 3 \neq 5 \bmod 2, 6 \bmod 3 = 6 \bmod 2, 8 \bmod 3 \neq 8 \bmod 2$

Ans  $L = \{a^2, a^3, a^4, a^5, a^8\}$   $|a| = b+1$

b)  $L = \{w \in \{a, b\}^* : n_a(w) \geq n_b(w) + 1\}$

Where  $n_a(w)$  means the number of a's in string w.

$L = \{ \overset{\times}{\cancel{a}}, \overset{\times}{\cancel{ab}}, \overset{\times}{\cancel{ba}}, \overset{\times}{\cancel{bb}}, \overset{\checkmark}{a^2}, \overset{\checkmark}{a^3}, \overset{\checkmark}{a^4}, \overset{\checkmark}{aab}, \overset{\checkmark}{aba}, \dots \}$   
 $b=0, 2 \geq 0+1, 1 \geq 1+1, 1 \geq 1+1, 0 \geq 2+1, 3 \geq 0+1, 2 \geq 1+1, 2 \geq 1+1$

$L = \{a, aa, aaa, aab, aba\}$

$\cancel{a}$	$a$	$aa$	$aaa$
$aaaa$			