Faculty of Mathematics and informatics
Computer science department
Level: L2
Course: Theory of computation
A/Y: 2025/2026

TD Series N°1

Exercise1

1-Give the alphabet set for each language:

- Language of the prime numbers ≤23
- Language of the even numbers≤34
- Languages of the odd numbers ≤23
- Language of, binary numbers.

2-Give a set of words that may be generated from the first alphabet set. , what do you observe?

Exercise2

Let $A = \{a, b, c\}$ be an alphabet set, and $u = abcca$, $v = baac$ are two words (strings).

- Calculate $u^0, v^0, u^2, u.u^2, u^3$, what do you observe?
- Calculate $u.v, v.u$, what do you observe?
- Calculate $|u|, |v|, |u.v|$, what do you observe?
- Calculate $\bar{u}$, $\bar{v}$, $\overline{u.v}$, what do you observe?
- Calculate $|u|_a, |u|_b$, $|u|_c, |u|_{cc}, |u.v|_{aa}$
- Determine the suffixes and the prefixes of u and v
- Determine the proper suffixes and the proper prefixes of u and v

Exercise3

Let's consider the two languages **L1={ab,aba,baa,bb}, L2={ba,aa,aba}** defined

On the alphabet $A = \{a, b\}$

1. Give the right quotient of $L1.L2^{-1}$

2. Give the left quotient of $L2^{-1}.L1$

Exercise4

Use proof techniques to proof the following proposition: $|u^n| = n.|u|$

Exercise5

Let A be an alphabet and let $a, b, c, d \in A^*$, be (four words) such as : $ab = cd$

Proof the following:

- $if\ |a| < |c|\ then\ \exists w \in A^+\ such\ as\ c = aw\ and\ b = wd$
- $if\ |a| = |c|\ then\ a = c\ and\ b = d$
- $if\ |a| > |c|\ then\ \exists w \in A^+\ such\ as\ a = cw\ and\ d = wb$

Exercise6

Let L1,L2,L3 three languages on the alphabets set $A = \{0,1\}$

$L1 = \{0^n 1^n\ /n \in N\}$ $L2 = \{0^n 1^m\ /n \in N\}$, $L3 = \{01^n\ /n \in N\}$

Give words whose the length: 0,1,2,3,4 for each language.

Exercise7

Let L1 and L2 be two languages defined on the alphabet set $A = \{0,1\}$ as follow:

$$L1 = \{01^n\ | n \in N\}$$

$$L2 = \{0^n 1\ | n \in N\}$$

Determine these languages: $L1.L2, L1 \cap L2, L1^2$.

Exercise8

We consider the two languages L1, L2 defined on the alphabet set $A = \{0,1,2\}$ as the following:

L1: the set of words have an even length.

L2: the set of words have the same number of occurrences of 0,1, and 2.

Give the formal definition of the two languages, determine for the two languages if the concatenation operator is internal law, and if the empty word is neutral element.