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

**TD Series N°5**

## Exercise1

Using the Regular expressions' algebraic laws, simplify the following Formulas:

- $R.R^* + \varepsilon$
- $\varepsilon.R$
- $\emptyset^*$
- $\varepsilon^*$
- $\emptyset.R, R.\emptyset$
- $\emptyset + R$
- $(\phi + R)^* = R^*$
- $R(\phi + \varepsilon) = R$
- $(\varepsilon + R^*)^* = R^*$
- $\varepsilon + ab + abab(ab)^*$

## Exercise2

Let $\mathbf{R} = (\mathbf{a}|\mathbf{b})(\mathbf{a}^*|\mathbf{b}\mathbf{a}^*|\mathbf{b}^*)^*$ be a regular expression, build the corresponding finite automaton using Thompson's algorithm,

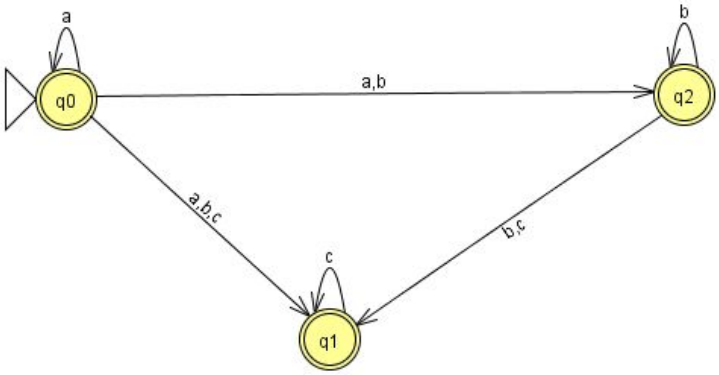
## Exercise3

We consider the grammar G has the following rewriting rules: $P = (S \rightarrow abS|abcA; A \rightarrow \varepsilon)$

Give the correspondent NFA.

## Exercise4

The following scheme represents state diagram of a finite automaton A

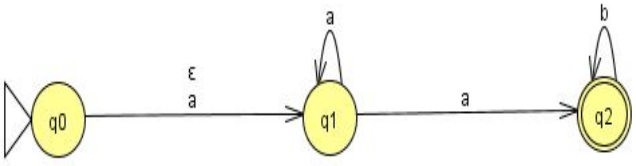



Does A is an NFA? why? If yes construct the corresponding DFA.

## Exercise5

We consider the following automaton A represented by its transition diagram:

- Build the corresponding regular expression using **state elimination technique**

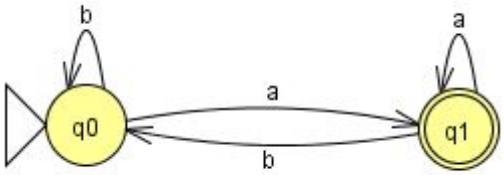


- Check if the following three words may be accepted by the above automaton **(aaaab, abb,abba)**
- Describe the acceptance process using automaton configuration.
- Does A is a complete automaton? why? If not complete it.
- Does A is a NFA,? Why? If yes build the corresponding DFA .

## Exercise6

The following transition diagram represents a DFA:

- Transform this DFA to regular expression, using **equation system technique.**
- Transform this DFA to regular grammar.




## Exercise7

We consider the following finite automaton

- What is the type of this finite automaton?
- Minimize it