

# Langages formels

## Exercise 5

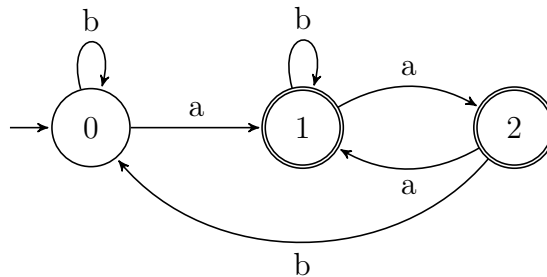
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*Hand this exercise in before the end of the 11th March*

### Exercise 1 : Transition monoid

1. Give the transition monoid of the following automaton  $\mathcal{A}$  :



2. Give a word representing each equivalence class of the syntactic congruence of the language recognized by  $\mathcal{A}$ .

### Exercise 2 : Iterating factors

Let  $\Sigma$  be an alphabet and  $L \subseteq \Sigma^*$  a language. We define the *iterating factors* of  $L$  the set  $\mathcal{I}(L) = \{w \in \Sigma^* \mid \exists u, v \in \Sigma^*. uw^*v \subseteq L\}$ . Prove that if  $L$  is regular, then  $\mathcal{I}(L)$  is also regular.

*Hint : use a monoid  $M$ ,  $P \subseteq M$  and morphism  $\mu$  recognizing  $L$ .*

### Exercise 3 : Syntactic congruence

Let  $P$  be the language of balanced strings of parentheses over alphabet  $\Sigma = \{ ( , ) \}$ , e.g.  $(( ))( ) \in P$  but  $( ) \notin P$  and  $) ( \notin P$ .

1. What are the equivalence classes of the relation  $\equiv_P$  ?
2. Is  $P$  recognizable ?