

# Introduction to Computation and Complexity

## Exercise Sheet 2

Adrien Pommellet, EPITA

December 12, 2023

### Exercise 1

Design a Turing machine  $M$  recognizing the language  $\{ww^R \mid w \in \Sigma^*\}$ , where  $w^R$  is the reverse of the word  $w$ .

### Exercise 2

Design a Turing machine  $M$  recognizing the language  $\{a^n b^n c^n \mid n \geq 1\}$ .

### Exercise 3

Let  $L$  be a language such that  $\bar{L}$  is not RE. Prove that:

$$L' = \{0w \mid w \in L\} \cup \{1w \mid w \in \bar{L}\}$$

is not RE.

### Exercise 4

Let  $L_1, \dots, L_n$  be a collection of RE languages that is also a *partition* of  $\Sigma^*$ , i.e.  $\forall i \neq j, L_i \cap L_j = \emptyset$  and  $L_1 \cup \dots \cup L_n = \Sigma^*$ . Prove that for  $i = 1, \dots, n$ , the language  $L_i$  is recursive.