

# Languages, automata and computation II

## Homework 2 (draft version)

### Problems: deadline XX/12/2024

**Problem 1.** A *parametric finite weighted automaton* is a finite weighted automaton where the initial vector, the final vector, and the transition matrices can contain one parameter  $x$  (interpreted in the field of real numbers). Formally, their entries are univariate polynomials in  $\mathbb{Q}[x]$ . Show that the set of real number values for the parameter  $x$  s.t. the automaton has the zero semantics has measure either 0 or 1.

**Problem 2.** A series  $f : \Sigma^* \rightarrow \mathbb{Q}$  is *commutative* if  $f(u) = f(v)$  for all words  $u, v \in \Sigma^*$  s.t.  $u$  and  $v$  are permutations of each other. Show that the following problem is decidable: We are given a weighted finite automaton  $A$  and we need to decide whether the rational series recognised by  $A$  is commutative.

**Problem 3.**