University of Waterloo
CS 462 — Formal Languages and Parsing
Winter 2018
Problem Set 5

Distributed Monday, February 5 2018.

Due Monday, February 12 2018 by 5 PM. Hand in to LEARN.

All answers should be accompanied by proofs. In all problems the underlying alphabet Σ is assumed to be finite.

1. [10 marks] What is the relationship between the Myhill-Nerode equivalence classes for L (not necessarily regular) and those for the complement $\overline{L}$? Be as specific as possible.

2. [10 marks] What are the Myhill-Nerode equivalence classes of the language

$$L = \{x \in \{0,1\}^* \ : \ |x|_0 = |x|_1\}?$$

   Describe them. (Recall that $|x|_a$ is the number of occurrences of the symbol a in the word x.)

3. [10 marks] Show that the following problem is decidable – that is, give an algorithm for it.

   Input: a DFA $A = (Q, \Sigma, \delta, q_0, F)$, and an integer c.

   Output: "Yes", if there exists an integer $n \geq 0$ such that A accepts exactly c words of length n, and "No" otherwise.

   Hint: use the matrix approach for representing the DFA and look at Theorem 3.8.6.