# HOMEWORK 5

**1** Determine the equivalence classes of $\equiv_L$ for each of the following regular languages $L$ over the binary alphabet:

- **a.** $L = \{w : w \text{ begins with a 1 and ends with a 0}\}$
- **b.** $L = \{w : w \text{ contains at least three 1s}\}$
- **c.** $L = \{w : w \text{ does not contain 000 as a substring}\}$

**2** Determine the equivalence classes of $\equiv_L$ for each of the following nonregular languages $L$ over the binary alphabet:

- **a.** $L = \{w : w \text{ is a palindrome}\}$
- **b.** $L = \{0^n 1^n : n \geq 0\}$

**3** Use the Myhill-Nerode theorem to prove that the following languages are nonregular:

- **a.** $L = \{0^n 1^n 2^n : n = 0, 1, 2, 3, \dots\}$
- **b.** $L = \{www : w \in \{0, 1\}^*\}$
- **c.** $L = \{0^{2^n} : n = 0, 1, 2, 3, \dots\}$

**4** Construct the smallest possible DFA for each of the following languages, using the Myhill-Nerode theorem to prove that your DFA is indeed the smallest possible:

- **a.** $L = \{\epsilon\}$
- **b.** $L = \{w : w \text{ ends with 00}\}$
- **c.** the language $L$ of binary strings that contain a pair of 1s separated by an even number of symbols.