

# CS 4814: Homework 9

due Monday 11/30, 11:59pm  
(late submission not possible)

Each question is worth 20 points.

We say that a language  $L \subseteq \{0, 1\}^*$  is *regular* if there exists a regular expression  $R$  such that  $L(R) = L$ . All languages accepted by deterministic or non-deterministic finite automata are regular. Hence if you want to show that a language is regular, it's enough to construct a finite automata, which is sometimes easier than constructing a regular expression.

## Question 1

Show that the following two languages are regular:

- The set of all binary strings  $x \in \{0, 1\}^*$  such that  $x$  is the binary encoding of a multiple of 7.
- The set of all binary strings that do not contain 001 as a substring.

## Question 2

Show that every *finite* language  $L \subseteq \{0, 1\}^*$  is regular.

## Question 3

Show that the following language is not regular,

$$\{1^s 01^t 01^{\max\{s,t\}} \mid \text{integers } s, t \geq 0\}.$$