

## CS 487 – Assignment 2

1. Consider the regular expression

$$(0 \cup 11)0^*1$$

- (a) Convert this regular expression into a nondeterministic finite automaton with  $\epsilon$ -moves.
  - (b) Convert this nondeterministic automata to a deterministic automaton.
2. Write regular expressions for each of the following languages over the alphabet  $\{0, 1\}$ . Provide justification for your answers.
    - (a) The set of all strings not containing 101 as a substring.
    - (b) The set of all strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's.
  3. Let **reverse**( $x$ ) be the reverse of a string  $x$ . For example,

$$\mathbf{reverse}(01001) = 10010.$$

Show that if  $L$  is regular then so is

$$\mathbf{reverse}(L) = \{\mathbf{reverse}(x) \mid x \in L\}.$$

4. Show by giving an example that, if  $M$  is an NFA that recognizes a language  $C$ , swapping the accept and non-accept states in  $M$  doesn't necessarily yield a new NFA that recognizes the complement of  $C$ . Is the class of languages recognized by NFAs closed under complement? Explain your answer.