

CSE 355 HOMEWORK TWO

DUE 26 FEBRUARY 2013, START OF CLASS

(1) Give a regular expression to generate
   (a) \{ w \in \{0, 1\}^* : w \text{ has at least three 0s and at most two 1s} \}
   (b) \{ w \in \{0, 1\}^* : w \text{ contains the substring 101 but does not contain the substring 1101} \}
   (c) \{ w \in \{0, 1\}^* : w \text{ does not have 00 or 11 as a substring} \}
   (d) (not to be graded) \{ w \in \{0, 1\}^* : w \not\in 1^*0^* \}
   (e) (not to be graded) \{ w \in \{0, 1\}^* : w \text{ has even length and an even number of 1s} \}

(2) Convert each of your regular expressions from Question 1 to an equivalent NFA using the methods from class. ((a), (b), (c) parts only to be graded)

(3) A grammar \( G = (V, \Sigma, R, S) \) is regular if every rule is of the form \( A \to \epsilon \), \( A \to x \), or \( A \to xB \) where \( A, B \in V \) and \( x \in \Sigma \).

   • Show that every language generated by a regular grammar is a regular language.
   • (not to be graded) Show that if a language is regular, it is generated by some regular grammar.

(4) The reversal \( w^R \) of a string \( w = w_1 \cdots w_k \) with \( w_i \in \Sigma \) for \( 1 \leq i \leq k \) is the string \( w = w_k \cdots w_1 \). The reversal \( L^R \) of a language \( L \) is \( L^R = \{ w^R : w \in L \} \). Using the inductive definition of regular expressions, show that if \( L \) is regular, so is \( L^R \).

(5) (not to be graded) Suppose that \( L \) is a language that we know to be regular, and suppose that \( L' \subseteq L \). Can we conclude that \( L' \) is regular? Why, or why not?