

1999 Paper 2 Question 7

Regular Languages and Finite Automata

Suppose that L is a language over the alphabet $\{0, 1\}$. Let L' consist of all strings u' over $\{0, 1\}$ with the property that there is some string $u \in L$ with the same length as u' and differing from u' in at most one position in the string. Show that if L is regular, then so is L' . [Hint: if Q is the set of states of some finite automaton accepting L , construct a non-deterministic automaton accepting L' with states $Q \times \{0, 1\}$, where the second component counts how many differences have been seen so far.] [10 marks]

If a deterministic finite automaton M accepts any string at all, it accepts one whose length is less than the number of states in M . Explain why. [5 marks]

State Kleene's theorem about regular expressions and deterministic finite automata. [2 marks]

Describe how to decide for any given regular expression whether or not there is a string that matches it. [3 marks]