6.045J/18.400J: Automata, Computability and Complexity Prof. Ron Rivest

Homework 3

Due: 6 March 2002

Problem 1: Problem 1.23, parts b and c.

Problem 2: Problem 1.25

Problem 3: Problem 1.32, part a

Problem 4: Suppose we allow a FA to move its head left or right after each symbol is scanned. Formally, the transition function now will have the form:

$$\delta : Q \times \Sigma \to Q \times \{L, R\}$$

where L and R denote "left" and "right" respectively.

The machine begins computation with the read head on the leftmost input symbol as usual. At each step, the current state and the current symbol being scanned determine the next state and also whether the read head moves left or right. The machine "halts" if the read head moves to the left of the first symbol or to the right of the last symbol. It accepts the string if and only if the state entered during such a final move is an accepting state. Note that the machine may loop forever; in this case it does not accept the input.

Argue that such "left-right FA" (or LRFA) are no more powerful than ordinary FA. That is, argue that LRFA accept only regular languages.

(Hint: for each prefix of the input, determine inductively what happens if the machine moves left onto the last symbol of that prefix. Does it accept, loop, reject, or exit the prefix again moving to the right in some state? Use this approach to construct a DFA that recognizes the same language.)