Homework Assignment 6
Ling 106, Maribel Romero
Nov 5, 2003
Due on Nov. 12, 2003 by 1pm

1 Exercise 1

For each of the following languages (a)-(d), draw the diagram of a NON-DETERMINISTIC FSA that recognizes it with the indicated number of states. For the languages (e)-(f), draw the diagram of a DETERMINISTIC FSA as economical as possible. $\Sigma = \{0,1\}$.

a. The language $1^*0^*1^*$, with three states.
b. The language $\{w : w \text{ has no sub-string of four or more consecutive } 0\text{s}\}$, with four states, only one of which is an accept state.
c. $\{abc, abba, abbca\}$, with six states, only one of which is an accept state.
d. $\{w : w \text{ contains the sub-string } ab \text{ or it contains exactly two } a\text{s}\}$, with as few states as possible.

e. $\{w : w \text{ contains neither the sub-string } 110 \text{ nor the sub-string } 111\}$
f. $\{w : w \text{ contains an odd number of } (\text{possibly overlapping}) \text{ } 101 \text{ sequences}\}$
   E.g. the strings 101, 1010101 and 101101101 belong to the language in (f). The strings 10101 and 101101 do not.

2 Exercise 2

Exercise 4 in Partee et al. p. 482.

3 Exercise 3

Take NON-deterministic finite state automaton given below. Construct an equivalent DETERMINISTIC finite state automaton that accepts the same language, using the proof we learned in class for Theorem 1.19. That is, apply the algorithm for converting any NFA to an equivalent DFA, and provide the full-fledged description $(Q', \Sigma, \delta', q_0', F')$ and the (simplified) diagram of the resulting deterministic FSA. Specify which of the strings below are accepted by both automata and which are rejected by both. Assume that the alphabet is $\{0,1\}$.

![Automaton Diagram]
a. \( \epsilon \)  \hspace{1cm} e. 1
b. 0  \hspace{1cm} f. 10
c. 01  \hspace{1cm} g. 111
d. 001  \hspace{1cm} h. 11000

4 Exercise 4

The following two languages are regular. For each of them, draw its corresponding deterministic FSA diagram and show that its obeys the Pumping Lemma for the indicated strings.

a. \( \{w : w \text{ contains the sub-string 10 exactly once}\} \).
   Pumping length = 4. Strings to be tested: 1110, 100000, 1100, 0010111.
b. \( \{w : w \text{ does not contain the sub-string 101}\} \).
   Pumping length = 3. Strings to be tested: 1100, 1001, 100, 10.