Foundations of Computer Science  
Fall 2005  
Rowan University

Homework 7 (discussion): For November 14, 2005

1. Design a Mealy machine with input alphabet \{a, b\} and output alphabet \{0, 1\}. After each input symbol is read, the machine should output 0 if the input symbol was identical to the previous input symbol, and 1 if the input symbol was different. Output 1 for the first input symbol.

Example: \textit{abbaaaab} should produce 11010001.

2. Design a Moore machine to solve the problem in #1. Output 1 in the start state.

Example: \textit{abbaaaab} should produce 111010001.

3. Design a Mealy machine with input alphabet \{0, 1\} and output alphabet \{A, B, C\}. If the input ends in 10, output A; if the input ends in 11, output B; otherwise, output C.

Example: \textit{01011010} should produce \textit{CCACBACA}.

4. Design a Moore machine to solve the problem in #3. Output C in the start state.

Example: \textit{01011010} should produce \textit{CCCACBACA}.

5. Design a Regular Grammar for each of the following languages:

a) The set of all strings over \{a, b, c\} that begin with a b, end with an a, and contain at least one c. (For example, bccbaa is in the language, but bac is not in the language.)

b) The set of all strings over \{a, b, c\} that contain \textit{bbc} as a substring. (For example, \textit{abbcbb} is in the language, but \textit{ababc} is not in the language.)

c) The set of all strings over \{a, b, c\} that contain at least one \textit{a} and one \textit{c}. (For example, \textit{abca} is in the language, but \textit{ab} is not in the language.)

d) The set of all strings over \{a, b\} whose length is less than 3. (For example, \textit{ab} is in the language, but \textit{aba} is not in the language.)

e) The set of all strings over \{a, b, c\} that contain either \textit{aa} or \textit{abc} as a substring.

Several of these problems are based on Hopcroft & Ullman, Introduction to Automata Theory, Languages, and Computation, Addison-Wesley, 1979.