Automata Exercises

Tasks for 17.11.2015

Task 1 Convert the following regular expressions to NFA's, using the closure properties results:

(a) $a(abb)^* \cup \ b$,

(b) $a^+ \cup (ab)^+$,

(c) $(a \cup b^+)a^+b^+$.

Task 2 For each of the following regular languages, give two strings that are members and two strings that are *not* members—a total of four strings for each part. Assume the alphabet $\Sigma = \{a, b\}$ in all parts.

(a) a^*b^*,

(b) $a(ba)^*b$,

(c) $a^* \cup b^*$.

(d) $(aaa)^*$

(e) $\Sigma^*a\Sigma^*b\Sigma^*a\Sigma^*$.

(f) $(\varepsilon \cup a)b$

Task 3 Give an NFA that recognizes the language $(01 \cup 001 \cup 010)^*$. Convert this NFA to an equivalent DFA. Give only the portion of the DFA that is reachable from the start state.

Task 4 Give state diagrams of NFAs with the specified number of states recognizing each of the following languages. In all parts the alphabet is $\{0, 1\}$.

(a) The language $\{0\}$ with two states.

(b) The language 0^* with one state.

(c) The language $\{w \mid w \text{ ends with a } 00\}$ with three states,

(d) The language $1^*(001^+)^*$ with three states.

Task 5 Convert the NFAs from Task 4 (c) and Task 4 (d) to DFAs. Give only the portion of the DFAs that is reachable from the start state.

Task 6 Let $\Sigma = \{0, 1\}$ and let

$$D = \{w \in \{0,1\}^* \mid \#_{01}(w) = \#_{10}(w)\}.$$

Thus $101 \in D$ because 101 contains a single 10 and a single 01, but $1010 \notin D$ because $\#_{01}(1010) = 1$ but $\#_{10}(1010) = 2$.

Show that D is a regular language.