TDDB29
Övningsuppgifter i formella språk och automatateori

Sammanställt av Jonas Wallgren

2007

Här följer de problem (med (partiella) lösningar) som gicks igenom på lektionen och som inte finns i kursmaterialet.

Problems

2.4 For each of the following languages, construct a DFA that accepts the language.

- **a)** $L_1 = \{x \in \{0,1\}^* \mid x \text{ ends in } 00\}$
- **b)** $L_2 = \{x \in \{0,1\}^* \mid x = (01)^n, n \geq 0\}$
- **c)** $L_3 = \{x \in \{0,1\}^* \mid \text{every 0 is immediately followed by 1}\}$

2.6 b) Given the NFA in figure 1, construct an equivalent DFA.

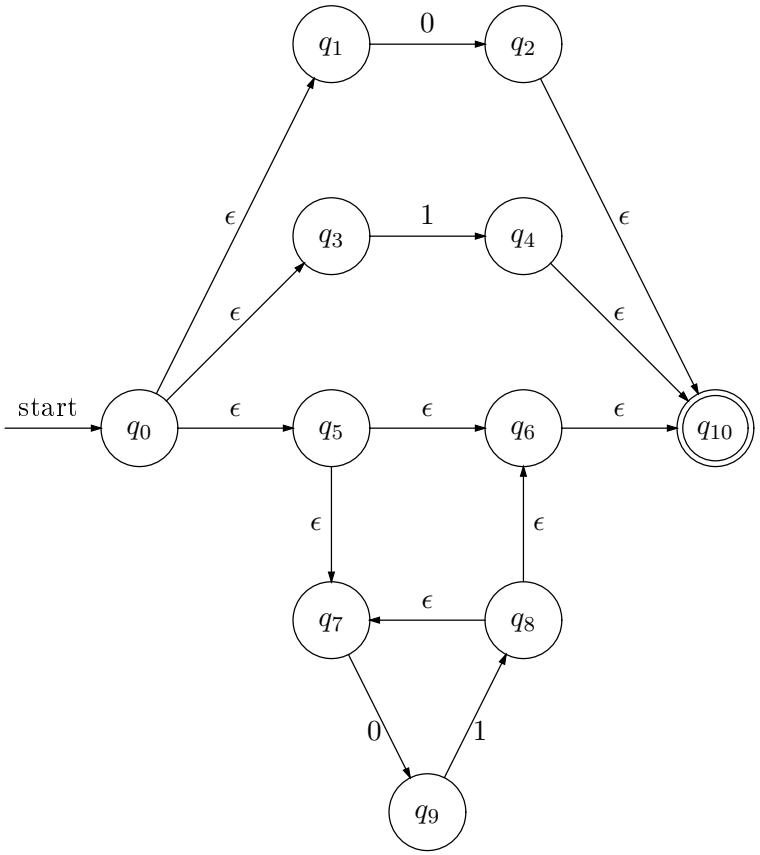

Figure 1: M_8

3.3 Construct an NFA which accepts the language defined by the regular expression $10 + (0 + 11)0^*1$.

6.1 Find CFG's for the following regular expressions:

a) $00(1 + 0)^*1$

b) $101(101)^*010(010)^*$

c) $(11 + 010)^*11(00 + 11)^*$

Solutions

2.4 a) An example of a DFA M_{15} such that $L(M_{15}) = L_1$ is given in figure 2.

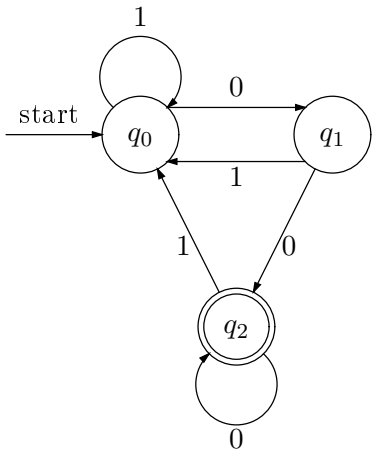

Figure 2: M_{15}

b) An example of a DFA M_{16} such that $L(M_{16}) = L_2$ is given in figure 3.

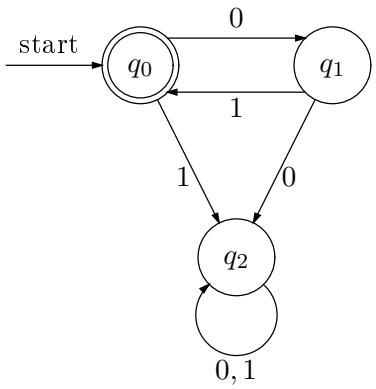

Figure 3: M_{16}

c) An example of a DFA M_{17} such that $L(M_{17}) = L_4$ is given in figure 4.

2.6) b The subset construction results in an DFA with reachable states $\{q_0, q_1, q_3, q_5, q_6, q_7, q_{10}\}$, $\{q_2, q_9, q_{10}\}$, $\{q_4, q_{10}\}$, $\emptyset$, $\{q_6, q_7, q_8, q_{10}\}$, $\{q_9\}$. The initial state is $\{q_0, q_1, q_3, q_5, q_6, q_7, q_{10}\}$. The final states are those containing q_{10}.

3.3 By decomposing the regular expression syntactically according to the recursive definition of regular expressions, an NFA can be constructed systematically in a bottom-up fashion

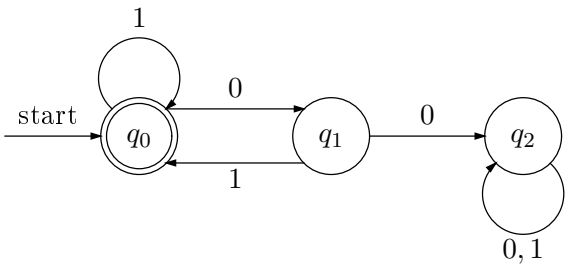

Figure 4: M_{17}

by successively joining NFA:s corresponding to subexpressions according to the regular operator (*, concatenation, +) in question. The resulting NFA is shown in figure 5.

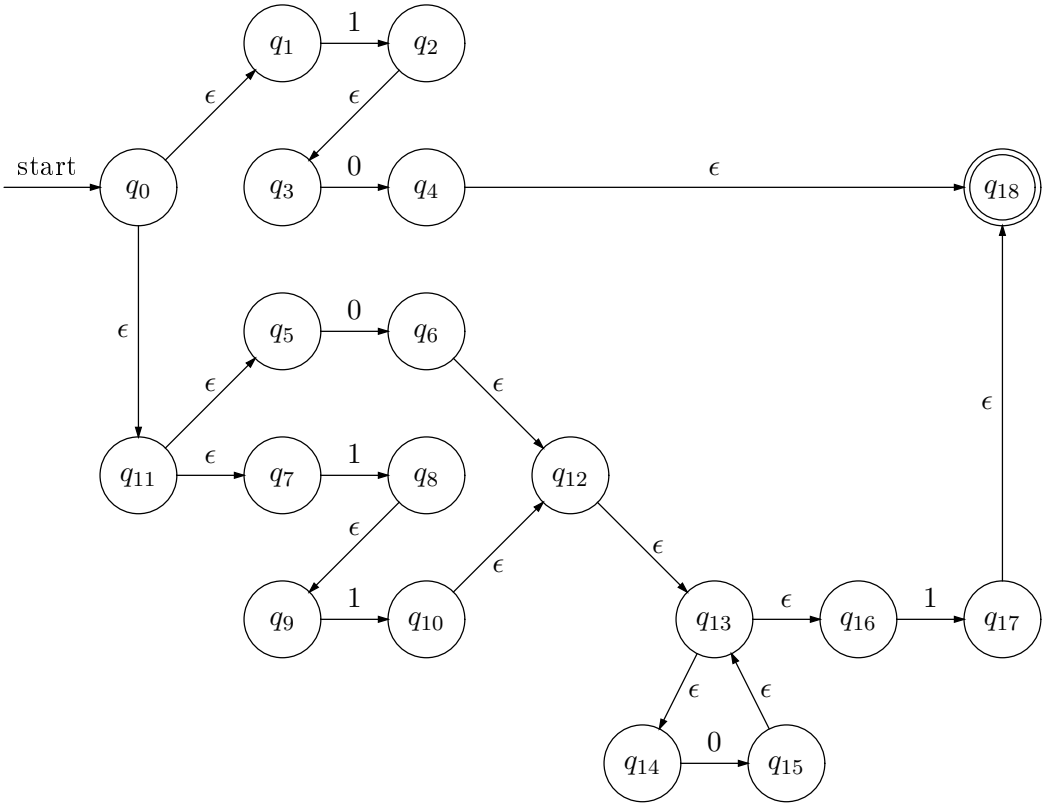

Figure 5: M_{23}

6.1

a) $S \to 00A1$
$A \to \epsilon \mid 0A \mid 1A$

b) $S \to 101A010B$
$A \to \epsilon \mid 101A$
$B \to \epsilon \mid 010B$

c) $S \to A11B$
$A \to \epsilon \mid 11A \mid 010A$
$B \to \epsilon \mid 00B \mid 11B$