Informatik and Mathematical Modelling
DTU

16/9 04
Michael R. Hansen

02140 Languages and Parsing
Programming Exercise 4

The below programming exercises concern closure properties (intersection, union, complement) of DFAs and simple decision problems for DFAs (emptiness, subset). You shall use and supplement the programs available on the homepage of the course in connection with the lecture Monday, September 20.

1. Construct in SML a DFA accepting the language

$$\{w \in \{a,b,c\}^* \mid w \text{ begins with } ab \text{ and ends with } bc\}$$

2. Declare a function `complement` on DFAs such that

$$L(\texttt{complement}(A)) = \overline{L(A)}$$

3. Declare a function `union` on DFAs such that:

$$L(\texttt{union}(A_1, A_2)) = L(A_1) \cup L(A_2)$$

4. Construct in SML a DFA accepting the language:

$$\left\{ w \in \{a,b,c\}^* \mid \left(\begin{array}{l} w \text{ does not contain } abc \text{ as a substring, or} \\ w \text{ begins with } ab \text{ and ends with } bc \end{array} \right) \right\}$$

5. Declare a function `subset` to test whether the language of a DFA is a subset of the language of another, and declare a function `equal` to test whether two DFAs denote the same language.

6. Declare a function to test whether all strings in the language of a DFA have even length.

7. Declare a function `prefix` on DFAs such that

$$L(\texttt{prefix}(A)) = \{w \in \Sigma^* \mid \exists w_1 \in L(A), w_2 \in \Sigma^*.\ w_1 = w\,w_2\}$$

that is $L(\texttt{prefix}(A))$ is the prefix closure of $L(A)$.