

Aufgabe 1 (Sipser, exercise 1.9, part a)

In der Vorlesung wurde gezeigt, daß die Klasse der regulären Sprachen unter der Operation der Konkatenation abgeschlossen ist. Verwenden Sie die für die Herleitung benutzte Konstruktion, um das Zustandsdiagramm eines nichtdeterministischen endlichen Automaten anzugeben, der die Konkatenation der Sprachen

- (a) $\{w \mid \text{die Länge von } w \text{ ist höchstens } 5\}$ und
- (b) $\{w \mid \text{jede ungerade Position von } w \text{ ist eine } 1\}$

erkennt. Das Alphabet ist jeweils $\{0, 1\}$.

Aufgabe 2 (Sipser, exercise 1.7, part e, h)

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 $0^*1^*0^+$ with three states.
- (b) The language 0^* with one state.

Aufgabe 3 (Sipser, exercise 1.20)

Give regular expressions generating the following languages. In all parts the alphabet is $\{0, 1\}$.

- (a) $\{w \mid w \text{ begins with a } 1 \text{ and ends with a } 0\}$
- (b) $\{w \mid w \text{ contains at least three } 1\text{s}\}$
- (c) $\{w \mid w \text{ contains the substring } 0101, \text{ i.e., } w = x0101y \text{ for some } x \text{ and } y\}$
- (d) $\{w \mid w \text{ has length at least } 3 \text{ and its third symbol is a } 0\}$
- (e) $\{w \mid w \text{ starts with } 0 \text{ and has odd length, or starts with } 1 \text{ and has even length}\}$
- (f) $\{w \mid w \text{ doesn't contain the substring } 110\}$
- (g) $\{w \mid \text{the length of } w \text{ is at most } 5\}$

- (h) $\{w \mid w \text{ is any string except } 11 \text{ and } 111\}$
- (i) $\{w \mid \text{every odd position of } w \text{ is a } 1\}$
- (j) $\{w \mid w \text{ contains at least two } 0\text{s and at most one } 1\}$
- (k) $\{\varepsilon, 0\}$
- (l) $\{w \mid w \text{ contains an even number of } 0\text{s, or contains exactly two } 1\text{s}\}$
- (m) The empty set.
- (n) All strings except the empty string.