Aufgabe 1 (Sipser, exercise 1.3)

The formal description of a DFA M is $(\{q_1, q_2, q_3, q_4, q_5\}, \{\mathtt{u}, \mathtt{d}\}, \delta, q_3, \{q_3\})$, where δ is given by the following table. Give the state diagram of this machine.

	u	d
q_1	q_1	q_2
q_2	q_1	q_3
q_3	q_2	q_4
q_4	q_3	q_5
q_5	q_4	q_5

Aufgabe 2 (Sipser, exercise 1.4, part a–f, part k–n)

Give state diagrams of DFAs recognizing the following languages. In all cases the alphabet is $\{0, 1\}$.

(a) $\{w \mid w$ begins with a 1 and ends with a 0$\}$.

(b) $\{w \mid w$ contains at least three 1s$\}$.

(c) $\{w \mid w$ contains the substring 0101, i.e., $w = x0101y$ for some x and $y\}$.

(d) $\{w \mid w$ has length at least 3 and its third symbol is a 0$\}$.

(e) $\{w \mid w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$.

(f) $\{w \mid w$ doesn't contain the substring 110$\}$.

(g) $\{\varepsilon, 0\}$.

(h) $\{w \mid w$ contains an even number of 0s, or exactly two 1s$\}$.

(i) The empty set.

(j) All strings except the empty string.

Aufgabe 3

Es sei $\Sigma = \{0, 1\}$ und A, B seien Sprachen über dem Alphabet Σ mit

$$A = \{w \,|\, w \text{ endet mit } 1\}$$

und

$$B = \{w \,|\, w \text{ beginnt mit } 1\}.$$

Beschreiben Sie, welche Sprachen sich mit den regulären Operationen $A \cup B$, $A \circ B$, A^* und B^* ergeben.