Problems Solved:

6	7	8	9	10

Name:

Matrikel-Nr.:

Problem 6. Let L be the set of all strings $x \in \{a,b\}^*$ with $|x| \geq 3$ whose third symbol from the right is b. For example, *babaa* and *bbb* Elemente von L, but *bb* and *baba* are not.

1. Construct a NFSM N such that $L(N) = L$. (4 states are sufficient.)
2. Construct a DFSM D such that $L(D) = L$. (8 states are sufficient.)

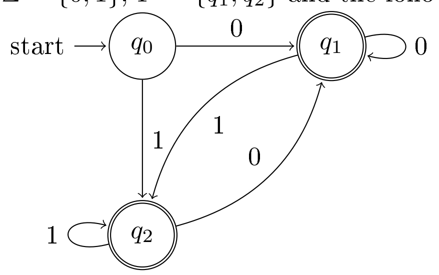
Problem 7. Construct a nondeterministic finite state machine for:

1. the language L_1 of all strings over $\{0,1\}$ that contain 001 as a substring.
2. the language L_2 of all strings over $\{0,1\}$ that contain the letters 0, 0, 1 in exactly that order. (Note that before, in between and after these three letters any number of other letters may occur).

Your two machines must not use more than 4 states. Moreover, they should only differ in their transition functions. Draw their transition graphs.

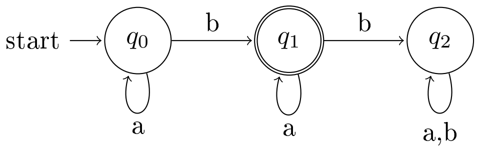
Problem 8. Let $N = (Q, \Sigma, \delta, S, F)$ be the NFSM given by $Q = \{q_0, q_1, q_2\}$, $\Sigma = \{0,1\}$, $S = \{q_0\}$, $F = \{q_1, q_2\}$, and the transition function $\delta : Q \times \Sigma \to P(\Sigma)$ where $\delta(q_0, 0) = \{q_0, q_1\}$, $\delta(q_0, 1) = \{q_0, q_2\}$, and $\delta(q, \sigma) = \emptyset$ for $q \in \{q_1, q_2\}$ and all $\sigma \in \Sigma$. Construct a DFSM D such that $L(N) = L(D)$. *H*int: Use the Subset Construction, cf. Section 2.2 in the lecture notes.

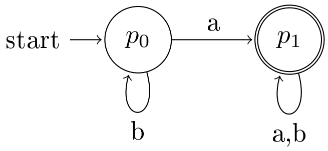
Problem 9. Let the DFSM $M = (Q, \Sigma, \delta, q_0, F)$ be given by $Q = \{q_0, q_1, q_2\}$, $\Sigma = \{0,1\}$, $F = \{q_1, q_2\}$ and the following transition function $\delta : Q \times \Sigma \to Q$:



Construct a minimal DFSM D such that $L(M) = L(D)$ using Algorithm MINIMIZE. (cf. Section 2.3 *Minimization of Finite State Machines*)

Problem 10. Let $M_1 = (Q_1, \Sigma, \delta_1, q_1, F_1)$ and $M_2 = (Q_2, \Sigma, \delta_2, q_2, F_2)$ be two DFSM over the alphabet Σ. Let $L(M_1)$ and $L(M_2)$ be the languages accepted by M_1 and M_2, respectively.
Construct a DFSM $M = (Q, \Sigma, \delta, q, F)$ whose language $L(M)$ is the intersection of $L(M_1)$ and $L(M_2)$. Write down Q, δ, q, and F explicitly.
Hint: M simulates the parallel execution of M_1 and M_2. For that to work, M "remembers" in its state the state M_1 as well as the state of M_2. This can be achieved by defining $Q = Q_1 \times Q_2$.
Demonstrate your construction with the following DFSMs.


start
q_0
q_1
q_2
b
b
a
a
a,b


start
p_0
p_1
a
b
a,b