Problems Solved:

11	12	13	14	15

Name:

Matrikel-Nr.:

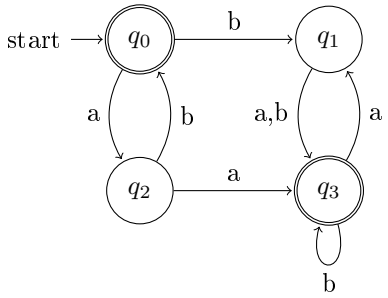
Problem 11. Answer the following questions.

(a) Is the language $L = \{0^m 1^n \mid m, n \in \mathbb{N}\}$ regular?

(b) Is the language $L = \{0^n 1^n \mid n \in \mathbb{N}\}$ regular?

(c) Is every subset of a regular language again a regular language?

Problem 12. Let M_1 be the DFSM with states $\{q_1, q_2, q_3, q_4\}$ whose transition graph is given below. Determine a regular expression r such that $L(r) = L(M_1)$. Show the *derivation* of the the final result by the technique based on Arden's Lemma (see lecture notes).



Problem 13. Let r be the following regular expression.

$$a \cdot a \cdot (b \cdot a)^* \cdot b \cdot b^*$$

Construct a nondeterministic finite state machine N such that $L(N) = L(r)$. Show the derivation of the result by following the technique presented in the proof of the theorem *Equivalence of Regular Expressions and Automata* (see lecture notes).

Problem 14. Let L be the language of properly nested strings over the alphabet $\Sigma = \{\texttt{[}, \texttt{]}, \texttt{o}\}$. A word w is *properly nested* if it contains as many opening as closing brackets and every prefix of w contains at least as many opening brackets `[` as closing `]`. (Example: `oo[][o[o]]` is properly nested, but `oo][` is not.) Show by means of the Pumping Lemma that L is not regular.

Problem 15. Write down explicitly a Turing machine M over $\Sigma = \{0\}$ which computes the function $d : \mathbb{N} \to \mathbb{N}$ given by $d(n) = 2n$.
Use unary representation: A number n is represented by the string 0^n consisting of n copies of the symbol 0.