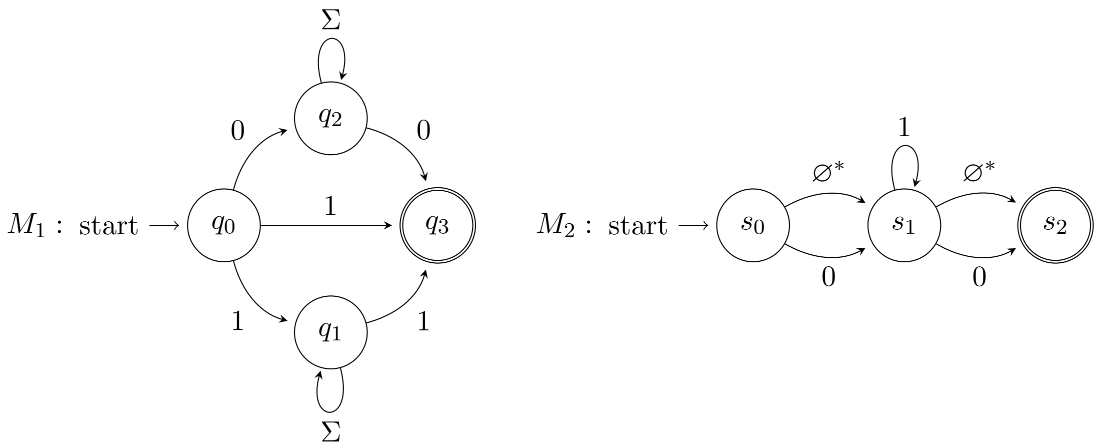
Automata, Computability and Complexity

Spring Semester 2023
Prof. Dr. Peter Zaspel

Assignment Sheet 3. Submit on **12:00 (noon) Feb. 27, 2023**.

Excercise 1. (Generalized non-deterministic finite automata)

Fix an alphabet $\Sigma = \{0,1\}$. Describe the languages accepted by the GNFAs M_1 and M_2 below.



(4 Points)

Excercise 2. (Regular expressions of Finite Automata)

Given the languages, derive the regular expressions denoting them. Alphabet for all: $\Sigma = \{a,\ b,\ c\}$

a) Language $\{w \in \Sigma^* |\ w$ ends in two identical letters$\}$

b) Language $\{w \in \Sigma^* |\ w$ contains exactly 2 c's$\}$

(4 Points)

Excercise 3. (Finite Automata of regular expressions)

Construct an NFA N recognizing the language $L(R)$ over alphabet $\Sigma = \{0,\ 1\}$ described by $R = (0 \cup 1)^*101$. Let the number of states be 4.

(4 Points)

Excercise 4. (Regular languages and their automata)

Consider the language L over the alphabet $\Sigma = \{0,1,2,3\}$ where

$$L = \{w \in \Sigma^* :\ \text{sum of digits of } w = 4k+1 \text{ for some } k \in \mathbb{N}\}.$$

For instance, the word $32013 \in L$ as $3+2+0+1+3 = 9 = 4 \cdot 2 + 1$ but $3210 \notin L$ since $3+2+1+0 = 6 = 4 \cdot 1 + 2$. Design a deterministic finite automaton that accepts L.

(4 Points)