Exercise 1 (3+2+3 points)

Construct DFAs that recognize the following languages. Drawing the state diagrams is sufficient. The alphabet is $\Sigma = \{0, 1\}$.

(a) $L_1 = \{ w \mid |w| \geq 2 \text{ and } w \text{ contains an even number of zeros} \}$.

(b) $L_2 = \{ w \mid w \text{ contains exactly two ones} \}$.

(c) $L_3 = \{ w \mid w \text{ has an odd number of zeros and ends with 1} \}$.

Exercise 2 (2+3 points)

Let $L, L_1, L_2$ be regular languages. Show that both $L := \Sigma^* \setminus L$ and $L_1 \cap L_2$ are regular as well by constructing the corresponding DFAs.

Remark: No need for drawing state diagrams. Show how a DFA for the language in question can be constructed presuming the existence of DFA for $L, L_1, L_2$.

Exercise 3 (2+5 points)

Consider the following NFA.

(a) Give a formal description of the NFA by giving the alphabet, state set, transition function, start state and the set of accept states.

(b) Construct a DFA which is equivalent to the above NFA by drawing the corresponding state diagram.