Exercise 1: Drawing DFAs and NFAs

Consider the following three languages over the alphabet \{0, 1\}.

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

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

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

First draw a DFA for each of the languages $L_1$, $L_2$ and $L_3$. Then, for each of the following languages, provide an NFA that recognizes the given language.

(a) $L_1^*$
(b) $L_3 \circ L_2$
(c) $L_2 \cup L_3$

Exercise 2: Regular Languages

Let $L, L_1, L_2$ be regular languages. Show that both $\overline{L} := \Sigma^* \setminus L$ 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 DFAs for $L, L_1, L_2$. 
Exercise 3: NFA to DFA

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.

(c) Explain what language the automaton recognizes.