Week 2: DFA and NFA

1. Exercise 2.2.1

2. Suppose $\Sigma = \{a, b\}$. Build a DFA that accepts exactly the words containg bba as a subword. Build then a DFA that accepts exactly the words *not* containing bba as a subword.

3. If $L \subseteq \Sigma^*$ is regular then so is $L^R = \{rev(x) \mid x \in L\}$ (Hint: given a NFA for L build a NFA for L^R)

4. Suppose $\Sigma = \{a, b, c\}$. Build a DFA A_1 that accepts exactly the words containing ac as a subword. Build a DFA A_2 that accepts exactly the words containing ab as a subword. Using the product construction, build then a DFA for the words containing both ab and ac as subword, and one for the words containing ac but *not* ab as subword.

5. Build a DFA that recognizes exactly the word in $\{0, 1\}^*$ ending with the string 0100.

6. A ship attempts to transmit data to shore at random intervals. The receiver must continually listen and recognize when an actual transmission starts so that it can record the data that follows. Let us assume that the start of the transmission is signaled by the string 010010 and the end of transmission is signaled by the string 000111. Represent this behaviour with a DFA.

7. In a factory, we have the possible events a, b, c. A constraint L_1 is that if the event b occurs after the event a, then the event c should occur in between. Represent this constraint L_1 as a DFA A_1.

   Suppose that there is another constraint L_2 that if the event b occurs after the event c, then the event a should occur in between. Explain intuitively why, if we have both constraints L_1 and L_2 then the event b cannot occur after the event a. Represent the constraint L_2 as a DFA A_2. Do the product construction of A_1 and A_2 to have an automaton representing the conjunction of the constraint L_1 and L_2. Verify on this automaton that b cannot occur after a or c.