1. Read Kozen Chapters 4 – 6.

2. Consider the following two deterministic finite automata with states \{1, 2\} and input alphabet \{a, b\}.

\[
\begin{array}{ccc}
 & a & b \\
\hline
\rightarrow & 1 & 2 \\
\rightarrow & 1 & 2 \\
2F & 1 & 1 \\
2F & 2 & 1 \\
\end{array}
\]

Give deterministic automata accepting (a) the intersection, and (b) the union of the two sets accepted by these automata.

3. The reverse of a string \(x\), denoted \(rev(x)\), is the string obtained by writing \(x\) backwards. For example, if \(x = abbaaab\) then \(rev(x) = baaabba\). If \(A\) is a subset of \(\Sigma^*\), the reverse of \(A\), denoted \(rev(A)\), is the subset of \(\Sigma^*\) consisting of all reverses of strings in \(A\):

\[
rev(A) = \{rev(x) \mid x \in A\}.
\]

For example, \(rev(\{a, ab, aab\}) = \{a, ba, baa\}\). Suppose you are given a finite automaton \(M\) accepting a set \(A\). Show how to construct an automaton \(M'\) accepting \(rev(A)\). (One possible approach: put pebbles on the final states of \(M\) and move them backwards along transition edges.)

(a) Describe \(M'\) formally (i.e. in terms of \(Q, \delta, \) etc.).

(b) Prove that \(M'\) accepts the set \(rev(A)\).

4. The following nondeterministic automaton accepts the set of strings in \(\{0, 1\}^*\) such that the third symbol from the right is a 1. Convert this automaton to an equivalent deterministic one using the subset construction. Don’t write down inaccessible states.