1. (20%) Suppose that M is an NFA-Λ accepting $L \subseteq \Sigma^*$. Describe how to modify M to obtain an NFA-Λ recognizing $rev(L)=\{x^r | x \in L\}$.

   Note: Λ denotes a null string. Σ^* denotes the set of all strings over an alphabet Σ. x^r denotes the reverse of x.

2. (20%) Decide whether each statement below is true or false. If it is true, prove it. If not, give a counterexample. All parts refer to languages over the alphabet {0,1}.

   (a)、 If $L_1 \subseteq L_2$ and L_1 is not regular, then L_2 is not regular.

   (b)、 If L_1 is regular and L_2 is nonregular, then $L_1 \cup L_2$ is nonregular.

3. (20%) Find CFG generating the language $\{a^i b^j c^k | j \neq i + k\}$

4. (20%) Use the pumping lemma to show that the given language $L = \{x \in \{a,b,c\}^* | n_a(x) = \max\{n_b(x), n_c(x)\}\}$ is not a CFL.

   Note: $n_a(x)$, $n_b(x)$, and $n_c(x)$ denote the number of a's, of b's, and of c's in the string x.

5. (20%) Show that if L is a recursively enumerable language whose complement is recursively enumerable, then L is recursive.