1. Solve Sipser 1.47 using the pumping lemma.

2. Solve Sipser 1.49, using the pumping lemma for part b.

3. Solve Sipser 1.53 using the pumping lemma.

4. Determine the equivalence classes of $\equiv_L$ for each of the following regular languages $L$ over the binary alphabet:
   
   a. $L = \{w : w$ begins with a 1 and ends with a 0$\}$
   
   b. $L = \{w : w$ contains at least three 1$s$\}
   
   c. $L = \{w : w$ does not contain 000 as a substring$\}$

5. Determine the equivalence classes of $\equiv_L$ for each of the following nonregular languages $L$ over the binary alphabet:
   
   a. $L = \{w : w$ is a palindrome$\}$
   
   b. $L = \{0^n1^n : n \geq 0\}$

6. Use the Myhill-Nerode theorem to prove that the following languages are non-regular:
   
   a. $L = \{0^n1^n2^n : n = 0, 1, 2, 3, \ldots \}$
   
   b. $L = \{www : w \in \{0, 1\}^*\}$
   
   c. $L = \{0^{2^n} : n = 0, 1, 2, 3, \ldots \}$

7. Construct the smallest possible DFA for each of the following languages, using the Myhill-Nerode theorem to prove that your DFA is indeed the smallest possible:
   
   a. $L = \{\epsilon\}$
   
   b. $L = \{w : w$ ends with 00$\}$
   
   c. the language $L$ of binary strings that contain a pair of 1$s$ separated by an even number of symbols.