Homework 01

Purpose:
   The purpose of this homework assignment is to help you understand the concepts of FSM (both DFSM and NDFSM), and to practice the skills you learned in designing FSMs as well as the algorithms of FSM. This homework assignment will also help you review and practice the proof techniques you learned in discrete math, especially proof by induction. This is an essential skill for CS101, as we will soon move from induction on natural numbers to structural induction.

Tasks:
Problems from the texts are given in the form c.n where c is the chapter and n is the problem number. Thus problem 2.7 is problem 7 from Chapter 2.

1. (0 points) **Academic Honesty Declaration** (1 page)

2. (4 points) **Strings and Induction** (1 page)

   Read section 2.1.2 of Rich before doing this problem. Give a careful proof by induction on i that for all $i \geq 0$, and all strings $w \in \Sigma*$, $(w^R)^i = (w^i)^R$, where w^R is the reverse of string w. You may assume that w^k is defined inductively so that $w^0 = \epsilon$, while $w^{k+1} = ww^k$. You may also use Theorem 2.1 on the bottom of page 9 of Rich in your proof.

3. (2 points) **Set Operations** (1 page)

   Problem 2.8 (b, c, k, l) from Rich.

   If you decide a part is false, please give a counterexample. If you declare it to be true, prove it.

4. (4 point) **Deterministic FSM** (1 page)

   Problem 5.2 (g) from Rich

5. (4 points) **Nondeterministic FSM** (1 page)

   Problem 5.7 from Rich

Criteria:
   Your assignment will be graded based on the correctness and the completeness of your solutions. Please refer to the examples in the textbook for complete and clear induction proof.

Submission Guideline:
   Please edit your HW following the editing guideline, especially follow the instructions on the number of pages each question should occupy. The text in blue are instructions; they should be either removed, or replaced with proper contents and turned into black. Please submit your homework solutions online via gradescope.