1. For each of the following operations, is the class of decidable languages closed under the operation? Prove each claim.
   (a) Intersection
   (b) Complement
   (c) Concatenation
   (d) Kleene star

2. Let $L = \{D \mid D \text{ is a DFA accepting at least one odd-length string}\}$.
   (a) Prove that $L$ is recognizable.
   (b) Given that $\overline{L}$ is recognizable (you need not prove this), prove that $L$ is decidable.

3. Let $L = \{D \mid D \text{ is a DFA that accepts no strings}\}$. We’ll break the process of proving that $L$ is decidable into the steps below.
   (a) Let $D$ be a DFA with exactly $n$ states. Prove that if $D$ does not accept any string of length $\leq n$ then $L(D) = \emptyset$.
   (b) Use (a) to prove that $L$ is decidable.

4. (Sipser 3.13) A Turing machine with stay put instead of left (TMSP) is similar to an ordinary Turing machine, but the transition function has the form
   \[ \delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{R, S\}. \]
   At each point, the machine can move its head right or let it stay in the same position. Prove that TMSPs recognize exactly the class of regular languages.