1. Is the set of binary strings countable or uncountable? Justify your answer carefully.

2. Is the set of binary functions (decision problems) on binary strings countable or uncountable? Justify your answer carefully.

3. How many distinct binary strings are there of length $n$? On the other hand, what is the number of decision problems over binary strings of length $n$?

4. Construct DFAs for recognizing the following languages:

   (a) $\{ w \in \{0, 1\}^* | w$ contains the substring $010 \}$
   (b) $\{ w \in \{0, 1\}^* |$ the last symbol in $w$ is $0 \}$,
   (c) $\{ w \in \{0, 1\}^* |$ the second but last symbol in $w$ is $0 \}$,
   (d) $\{ w \in \{0, 1\}^* | w$ contains an even number of the symbol $0 \}$.

5. Show that, if $M$ is a DFA that recognizes language $B$, swapping the accept and nonaccept states in $M$ yields a new DFA that recognizes the complement of $B$. Conclude that the class of regular languages is closed under complement.

6. Minimize the following DFA using the algorithm presented in the lectures:

![Diagram of DFA](image-url)