1. Convert the following DFA to a regular expression.

2. Let

\[ L = \{ s \mid s \text{ is a string of base 2 digits representing a number that is divisible by } 3 \} \]

Prove that \( L \) is regular.

3. Prove that the class of regular languages is closed under set subtraction. I.e., if \( R_1 \) and \( R_2 \) are regular languages, then \( R_1 - R_2 \) is regular.

Hint: See Theorem 1.25 in Sipser.

4. For any string \( w = w_1w_2...w_n \), the reverse of \( w \), written \( w^R \) is the string

\[ w^R = w_nw_{n-1}...w_1 \]

For any language \( A \), let \( A^R = \{ w^R \mid w \in A \} \). Show that if \( A \) is regular, then \( A^R \) is also regular.

5. Let

\[ L = \{ a^n \mid n \text{ is a prime number} \} \]

Use the pumping lemma to prove the \( L \) is not regular.