1.46 Prove that the following languages are not regular. You may use the pumping lemma and the closure properties of the class of regular languages under union, intersection and complement.

b) \( L = \{0^m1^n | m \neq n \} \)

1.54 Consider the language \( F = \{a^ib^jc^k | i, j, k \geq 0 \text{ and if } i = 1, \text{ then } j = k \} \)

a) Show that \( F \) is not regular.

1.38 An all-NFA \( M \) is a 5-tuple \((Q, \Sigma, \delta, q_0, F)\) that accepts \( x \in \Sigma^* \) if every possible state that \( M \) could be in after reading input \( x \) is a state from \( F \). Note, in contrast, that an ordinary NFA accepts a string if some state among these possible states is an accept state. Prove that all-NFAs recognize the class of regular languages.

• TRUE or FALSE

1. If \( L_1 \cup L_2 \) is regular and \( L_1 \) is regular, then \( L_2 \) is regular.
2. If \( L_1 \) is regular and \( L_2 \subseteq L_1 \), then \( L_2 \) is regular.
3. If \( L_1 \) is regular and \( L_2 \) is not regular, then \( L_1 \cup L_2 \) is not regular.
4. If \( L_1 \) is regular and \( L_1 \cup L_2 \) is not regular, then \( L_2 \) is not regular.
5. If \( L_1 \) is regular and \( L_2 \) is not regular, then \( L_1 \cap L_2 \) is not regular.
6. If \( L_1 \) is not regular and \( L_2 \) is not regular, then \( L_1 \cup L_2 \) is not regular.

• Some questions from old exams