1. Use the pumping lemma to show the following languages are not regular.
   a. \( L = \{w \in \{a,b\}^* \mid \text{no prefix of } w \text{ has more } b\text{'s than } a\text{'s, i.e. the start of the string.}\} \)
   b. \( L = \{a^n b^m c^{n+m} | n \geq 0, m \geq 0\} \)

2. Show that the following languages are not regular. You may should consider the reverse of L in your proof:
   a. \( L = \{a^{10^{n+m}} b^m a^m | n \geq 0, m \geq 0\} \)

3. Indicate whether each of the following languages is regular or not, and prove your answer. You can use the pumping lemma or closure properties to prove a language is non-regular. To prove a language is regular, you can use closure properties, give a regular expression for the language, or construct a DFA that accepts it.
   a. \( L = \{a^i b^j a^k | i + j + k > 5\} \)
   b. \( L = \{uww^Rv | u, v, w \in \{a, b\}^*\} w^R = \text{Reverse}(W) \)
   c. \( L = \{a^n | n \text{ is even}\} \)

4. Indicate whether each statement below is true or false and justify your answer.
   a. If \( L_1 \) & \( L_2 \) are not regular, then \( L_1 \cup L_2 \) is not regular.
   b. If \( L_1 \) is regular and \( L_2 \) is not regular, then \( L_1 \cup L_2 \) is not regular.