



1. Prove, using the Pumping Lemma, that $\{a^n b a^{2n} \mid n > 0\}$ is not regular.
2. Let $L = \{w a^{|w|} \mid w \in \{a,b,c\}^*\}$. In other words, L consists of words wa^n where w contains a's, b's, and c's and n is the length of w .
 - i. Use the Myhill-Nerode Theorem to prove that L is not regular.
 - ii. Use the Pumping Lemma to prove L is not regular.
3. Let $L = \{a^n \mid n \text{ is not a prime number}\}$.
 - i. Prove that L is not regular.
 - ii. Prove that L satisfies the Pumping Lemma.
4. Give an example of a regular language R and a non-regular language L such that $R + L$ is regular, and prove or justify that $R + L$ is regular.
5. Give an example of a regular language R and a non-regular language L such that $R + L$ is non-regular, and prove or justify that $R + L$ is non-regular.
6. Let L be a regular language over $\Sigma = \{a,b\}$. Define $L' = \{x \mid \text{there exists } y \in \Sigma^* \text{ such that } xy \in L\}$. Is L' regular? Either prove it is or give an example to show it may not always be.