Pumping Lemma
In Class Examples and Extra Problems

Use the pumping lemma to show that the following languages are not regular.

1. Let $\Sigma = \{a, b\}$. $L = \{w \in \Sigma^* \ : \ n_a(w) < n_b(w)\}$
2. $L = \{(ab)^n a^k \ : \ n > k, k \geq 0\}$
3. $L = \{a^n \ : \ n \text{ is a perfect square}\}$
4. $L = \{a^n b^k c^{n+k} \ n \geq 0, k \geq 0\}$
5. $L = \{a^n b^l a^k \ : k \leq n + l\}$
6. $L = \{ww \ : w \in \{a, b\}^*\}$
7. $L = \{w\overline{w} \ : w \in \{0, 1\}^*\}$
8. $L = \{a^n b^l \ : \ n \leq l\}$
9. $L = \{a^n b^l a^k \ : \ n = l \text{ or } l \neq k\}$