Pumping Lemma

Practice Problems

Using the Pumping Lemma, prove that the following languages are not regular:

1. $L = \{ a^k b^k \mid k \geq 0\}$
2. $L = \{a^k \mid k$ is a prime number$\}$
3. $L = \{a^n b^{n+1}\}$
4. $L = \{a^n b^{2n}\}$
5.   TRAILING-COUNT as any string s followed by a number of a's equal to the length of s.
6.   EVENPALINDROME = { all words in PALINDROME that have even length}
7.   ODDPALINDROME   = { all words in PALINDROME that have odd length}
8.   DOUBLESQUARE = { $a^n b^n$ where n is a square }
9. $L = \{ w \in \{a, b\}^* \mid w = w^R\}$
10. $L = \{ w \in \{a, b\} \mid w$ has an equal number of a's and b's$\}$
11. $L = \{ w\, w^R \mid w \in \{a, b\}^* \}$
12. $L = \{ 0^n \mid n$ is a power of 2 $\}$
13. $L = \{a^{2k} w \mid w \in \{a, b\}^*, |w| = k\}$
14. $L = \{a^k w \mid w \in \{a, b\}^*, |w| = k\}$
15. $L = \{a^n b^l \mid n \leq l\}$
16. $L = \{a^n b^l a^k \mid k = n + l\}$
17. $L = \{v a^{k+1} \mid v \in \{a, b\}^*, |v| = k\}$
18. $L = \{v a^{2k} \mid v \in \{a, b\}^*, |v| = k\}$
19. $L = \{ww \mid w \in \{a, b\}^*\}$
20. $L = \{ a^{n!} \mid n \geq 0\}$
21. $L = \{ a^n b^l \mid n \neq l\}$
22. $L = \{a^n b^l a^k \mid k > n + l\}$
23. $L = \{a^n b^l c^k \mid k \neq n + l\}$
24. $L = \{a^n b^l a^k \mid n = l$ or $l \neq k\}$
25. $L = \{a^n b a^{3n} \mid n \geq 0\}$
26. $L = \{a^n b^n c^n \mid n \geq 0\}$
27. $L = \{a^i b^n \mid i, n \geq 0, i = n$ or $i = 2n\}$
28. $L = \{0^k 1 0^k \mid k \geq 0 \}$
29. $L = \{0^n 1^m 2^n \mid n, m \geq 0 \}$