Regular Languages and Finite Automata

(a) Prove that if \( L \) is a regular language, its complement is also regular. [6 marks]

(b) For each of the following languages over the alphabet \( \{a, b\} \), state whether or not it is regular and justify your answer.

(i) \( \{w \mid w \text{ is not a palindrome}\} \)

(ii) \( \{a^k \mid k \text{ is a multiple of 3}\} \)

(iii) \( \{a^k \mid k \text{ is prime}\} \) [14 marks]