Challenge 6 –Pumping Lemma

Suppose the set of languages defined by $L = \{x \in \{a, b\}^* \mid n_a(x) = f(n_b(x))\}$, where $n_a(x)$ and $n_b(x)$ identify the number of a and b symbols in x, respectively, and *f* represents a function.

(a) Give examples of *f* that make L a regular language;

(b) Give examples of *f* that make L a non-regular language;

(c) Show that if L can be accepted by an FA, the function *f* must be bounded (i.e., for some integer m, $f(n) \leq m$ for every n);

(d) Show that if $f(n) = n \bmod 2$, then L satisfies the pumping lemma for regular languages;

(e) Show that if $f(n) = n \bmod 2$, then L can be accepted by a DFA.