CSCI 311/500 Models of Computation  
Self Test 2

1. Give an English description of the languages below, all defined on the alphabet \( \Sigma = \{a, b, c\} \). For each, indicate whether it is finite or infinite, and the smallest string accepted (or one of them if there are multiple).

(a) \( L_1 = \{w : |w| \leq 6\} \)
(b) \( L_2 = \{awb : w \in \{a, b, c\}^*\} \)
(c) \( L_3 = \{w : |w| \text{ mod } 3 = 0\} \)
(d) \( L_4 = \{a^i b^{2i} : i \geq 1\} \)
(e) \( L_5 = \{a(bc)^i a : 0 \leq i \leq 4\} \)
(f) \( L_1^2 \)

2. Give an English description of the language produced by the grammar: \( G = (\{S\}, \{a, b\}, S, P) \), where \( P \) is:

\[
S \rightarrow aS|bb
\]

3. Give an English description of the language produced by the grammar: \( G = (\{S, A, B\}, \{0, 1\}, S, P) \), where \( P \) is:

\[
\begin{align*}
S & \rightarrow AB|A \\
A & \rightarrow 0|00A \\
B & \rightarrow 11B|11
\end{align*}
\]

4. Using the grammar in the previous question, show a derivation of each of the following strings. If it cannot be derived, indicate that.

- 0001111
- 00111
- 11110