CSCI 311/500 Models of Computation
Homework 2

Due: Thursday, October 20th at Midnight

Please follow the guidelines for writing up homework.

1. Write regular expressions for each of the following languages
   (a) \( L = \{ w \in \{0,1\}^* : w \text{ contains } 000 \text{ or } 111 \} \)
   (b) \( L = \{ 0^i1^j : i \text{ is even and } j \text{ is odd} \} \)
   (c) All strings on \( \{a,b\}^* \) that begin or end with \( aa \) or \( bb \).
   (d) \( L = \{ a^i b a^j : i,j \geq 0, i + j \text{ is odd} \} \)

2. Write grammars for the following languages. Note that they are not regular, so the grammars will not be left linear or right linear.
   (a) \( L = \{ a^n b^{3n} : n \geq 0 \} \cup \{ a^3 b^n : n \geq 1 \} \)
   (b) \( L = \{ a^i b^i c^k : i < k \} \)

3. Use the pumping lemma to show \( L = \{ a^i b^j c^k : i < k \} \) is not regular.

4. Use the pumping lemma to show that \( L = \{ c^i b^j a^k : k > i \text{ or } k > j \} \)