Prework 1.4b: More Pumping Lemma Proofs

Write your preliminary solutions to each problem and submit a PDF on Canvas. The names in brackets indicate the subset responsible for presenting the problem.

1. [Meghan, Todd, Ben] We have shown that the language consisting of strings with the same number of 0's as 1's is nonregular. However, the following language is regular.

   $$A = \{w \mid w \text{ has the same number of 01 substrings as 10 substrings}\}$$

   Prove that A is regular by finding a regular expression that describes it.

2. [Allie, Joshua, Connor] A *palindrome* is a string that reads the same forwards as backwards. For example, 00011000 is a palindrome, but 101010 is not. Prove that the language

   $$A = \{w \mid w \text{ is not a palindrome}\}$$

   is not a regular language, where $\Sigma = \{0, 1\}$.

3. [Andrew, David, Micah] We proved that the language $A = \{0^n 1^n \mid n \geq 0\}$ is nonregular by pumping up. Redo this proof, but instead, pump down.

4. [Curtis, Grace, Ky, Levi] Prove that the following language is nonregular.

   $$A = \{\underbrace{1^n 0^* 1^n 0^* 1^n 0^* \cdots 1^n}_{k \text{ } 1^n\text{'s}} \mid k \geq 2,\ n \geq 0\}$$

   Hint: Consider $A \cap (1^*01^*)$.

BEGIN YOUR SOLUTIONS BELOW THIS LINE