CS 4510 Automata and Complexity 3/05/2022

Worksheet 5: Pumping Lemma for CFG

Worksheets are provided for your study purposes only. They are not graded.

We encourage you to discuss and collaborate on Piazza until the answer is uploaded. You can also discuss these questions during office hours.

1. Show that L is not context free.
   L = $\{0^n \quad |$ where n is prime.$\}$

2. Show that L is not context free.
   L = $\{w \quad |$ where $w \in \{0,1\}^*$, w is a palindrome with an equal # of 0's and 1's.$\}$

3. Show that L is not context free.
   L = $\{w \quad |$ where $w \in \{0,1\}^*$, w has length 2 *mod* 3, and
   the characters at position $\ulcorner \frac{n}{3} \urcorner$ and $\ulcorner \frac{2n}{3} \urcorner$ are 0's.$\}$

4. Show that L is not context free.
   L = $\{w\overline{w} \mid$ where $w \in \{0,1\}^*$, $\overline{w}$ is a complement of w.$\}$

   For example, if $w = 000011$, then $\overline{w} = 111100$.
   The choice of string s is very important to this question.
   Convince yourself that $s = 0^p1^p1^p0^p$ will not work.

5. Show that L is not context free.
   L = $\{0^i1^j \quad |$ where $i \geq 0$, $i^2 = j$.$\}$

6. Show that L is not context free.
   L = $\{0^i1^j2^k \quad |$ where $i, j, k \geq 0, i \times j = k$.$\}$

7. Show that L is not context free.
   L = $\{0^i1^j2^k3^r \quad |$ where $i, j, k \geq 0, i + j = k, i = r$ or $j = r$ or both.$\}$

8. Show that L is not context free.
   L = $\{ww^Rw \mid$ where $w \in \{0,1\}^*$.$\}$

   The choice of string s is very important to this question.
   Convince yourself that $s = 0^p0^p0^p$ and $s = 0^p110^p0^p1$ will not work.