CMPE 222
Spring 2018

How to prove that a language L is not regular using pumping lemma

We use pumping lemma ***only*** to prove that a given language is nonregular. We do this by using **proof by contradiction.** Here are the steps:

1. Assume that L is regular.

2. If L is regular then, according to pumping lemma:

   $\exists\ p \in \mathbb{Z}^+$ such that, $\forall\ s \in L$, if $|s| \geq p$ then s can be **pumped**. Remember that if a string s can be **pumped** it means that s can be divided into three segments, i.e. s = xyz such that:

   - $|y| > 0$
   - $|xy| \leq p$
   - $\forall\ i \geq 0$, $xy^iz \in L$. (See that this is equivalent to xy^*z)

3. Find a string s which is longer than p.

4. Show that no matter how you segment s such that $|y| > 0$ and $|xy| \leq p$, it is not the case that $\forall\ i \geq 0$, $xy^iz \in L$.
(If it turns out that s can be indeed pumped, then this particular s is an unlucky choice. In this case, look for another string s).

5. s (which you have shown that it can not be pumped) is a counterexample. I.e. although $s \geq p$, it can not pumped. Thus, our assumption that L is regular is not true. Therefore L is nonregular.

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