Tutorial 6

COMP 355: Introduction to Theoretical Computer Science

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Outline

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Pumping Lemma

Definition

If L is a regular language, then there is a number p (the pumping length) where, if s is any string in L of length at least p, then s maybe divided into 3 pieces, $s = xyz$, satisfying the following conditions:

1. for each $i \geq 0$, $xy^iz \in L$
2. $|y| > 0$
3. $xy \leq p$

Contents of the section

Pumping Lemma

Question 1

Prove $L = \{ww | w \in \Sigma^*\}$ is not regular.

Pumping Lemma

Question 2

Is the language $L = \{w_1 w_2 | w_1, w_2 \in \{a, b\}^*, |w_1| = |w_2|\}$ regular?

Pumping Lemma

Question 3

Prove $L = \left\{0^i 1^j | i > j \geq 0\right\}$ is not regular.

Pumping Lemma

Question 4

Consider the language $L = \{a^i b^j c^k | i, j, k \geq 0 \text{ and if } i = 1 \text{ then } j = k\}$

1. Show that L is not regular.
2. Show that L acts like a regular language in the pumping lemmma. In otehr words, give a pumping length p, and demonstrated that L satisfies the 3 conditions of the pumping lemma for this value of p.
3. Explain why part (1) and (2) do not contradict the pumping lemma.

Pumping Lemma

Question 5

Prove $L = \left\{1^{n^2} | n \geq 0\right\}$ is not regular.