Tutorial 12

COMP 335: Introduction to Theoretical Computer Science

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Outline

Contents of the section

Pumping Lemma for CFG

Definition

If L is a context free language, then there is a pumping number p (the pumping length) where, if s is any string in L of length at least p, then s may be divided into 5 pieces $s = uvxyz$ satisfying the conditions:

1. for each $i \geq 0$, $uv^i xy^i z \in L$
2. $|vy| > 0$
3. $|vxy| \leq p$

Contents of the section

Pumping Lemma for CFG

Question 1

Use pumping lemma to show that L is not a CFG:

$$L = \left\{ a^i b^j c^k | 0 \leq i \leq j \leq k \right\}$$

Contents of the section

Pumping Lemma for CFG

Question 2

Use pumping lemma to show that L is not a CFG:

$$L = \{ww | w \in \{0,1\}^*\}$$

Contents of the section

Pumping Lemma for CFG

Question 3

Use pumping lemma to show that L is not a CFG:

$$L = \{0^i 1 0^i 1 0^i | i > 1\}$$

Contents of the section

Pumping Lemma for CFG

Question 4

Use pumping lemma to show that L is not a CFG:

$$L = \{a^i b^j c^i d^j | i, j \geq 1\}$$

Contents of the section

Pumping Lemma for CFG

Question 5

Use pumping lemma to show that L is not a CFG:

$$L = \{w \in \{0,1\}^* : |w| \text{ is perfect square}\}$$