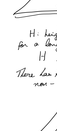
Pumping Lemma for CFL

A generator for a CFL has only finitely many variables.

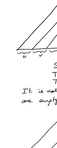


generate thing

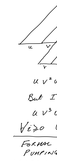
H: height of the parse tree for a long enough word

$H > \#$ of non terminals in the grammar.

There has to be a repeated non-terminal.



It is not possible that both u,v are empty



But I can do this again!

$u\,v^2\,w\,x^2\,y \in L$

$V \geq 0 \quad U\,V^i\,w\,x^i\,y \in L$

FORMAL STATEMENT of the PUMPING LEMMA for CFL

$\forall G \text{ CFL } L \quad \exists P > 0$

$\forall s \in L \quad |s| \geq P$

$\exists\, u,v,w,x,y \in \Sigma^* \text{ s.t.}$

- $s = uvwxy$
- $|vx| > 0 \leftarrow$
- $|vwx| \leq P$

$\forall i \geq 0 \quad u\,v^i\,w\,x^i\,y \in L$

CONTRAPOSITIVE

For some language L,

$\nexists\, P > 0 \quad \exists s \in L \quad |s| \geq P$

$\forall u,v,w,x,y \in \Sigma^*$

s.t. $s = uvwxy$

$|vx| > 0$

$|vwx| \leq P$

$\exists i \geq 0 \quad u\,v^i\,w\,x^i\,y \notin L$

then L is not context free.

Ex 1. $L = \{a^n b^n c^n \mid n \geq 0\}$

Demon Chooses P

I choose $a^P b^P c^P$

$\underbrace{aaaa