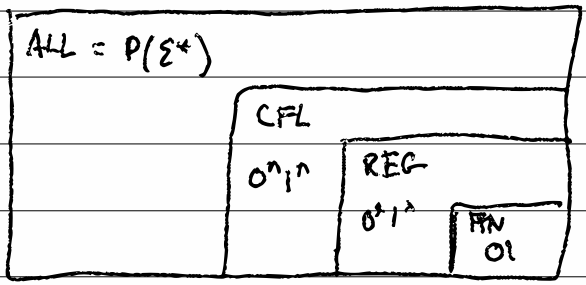
16-1/



$ALL \neq CFL \quad \Leftarrow \quad \exists x \in ALL.\ x \notin CFL.$

0. Choose some property P.
1. $\forall A \in CFL.\ P(A)$
2. $\exists x \in ALL.\ \neg P(A)$

$\Rightarrow \neg \quad x \notin CFL$

16-2 / Regular Pumping Property

$RPP(A) :=$

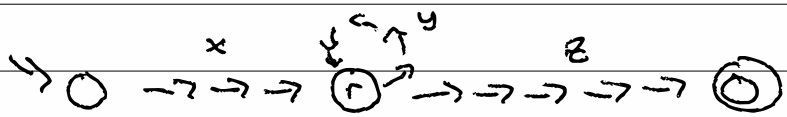
$\exists\, p \in \mathbb{N}.$ $\quad$ (that $p = |Q|$)

$\forall (s \in A \mid |s| \geq p)$

$\exists\, (x, y, z \in \Sigma^* \mid s = xyz \wedge |xy| < p \wedge |y| > 0)$

$\forall\, i \in \mathbb{N}.$

$xy^i z \in A$



16-3/ What is limited in a CFG?

in the way that states are in a DFA

$g \in CFG = (V, \Sigma, R, S)$

a finite set

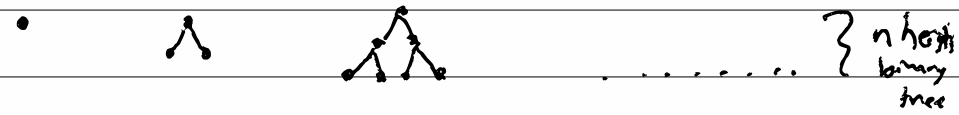
lets assume g is in Chomsky Normal Form

$S = v_0$

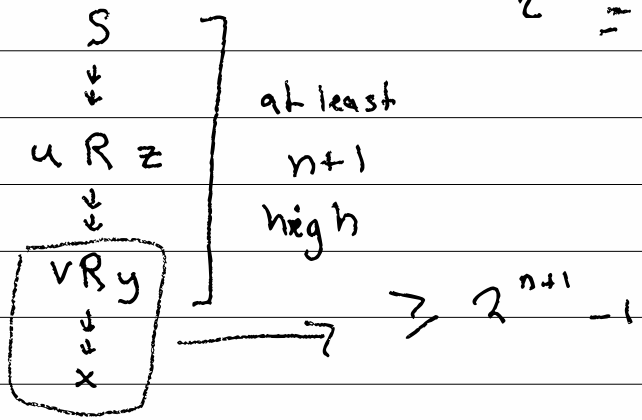
$V = \{v_0, \ldots, v_n\}$

- $S \Rightarrow \varepsilon$
- $A \Rightarrow BC$
- $A \Rightarrow a$

16-4 / $v_0 \Rightarrow v_1 v_1 \Rightarrow v_2 v_2 v_2 v_2 \Rightarrow \overbrace{v_n \cdots v_n}$



$2^n = 2^{|V|}$



$\geq 2^{n+1} - 1$

16-5/ Context-free pumping property CFPP(A) :=

$\exists p \in \mathbb{N}$ // $p = 2^{|V|+1}$

$\forall (s \in A \mid |s| \geq p)$

$\exists (u, v, x, y, z \mid s = uvxyz$

$\wedge |vy| > 0$

$\wedge |vxy| \leq p)$

$\forall i \in \mathbb{N}.$

$uv^i xy^i z \in A.$

$S \Rightarrow \varepsilon \mid 0S1$

000111

$uv^i xy^i z \in 0^n 1^n$ $u = 00$ $v = 0$ $x = \varepsilon$ $y = 1$ $z = 11$

$0^{3+i} 1^{2+i}$