Regular languages

Pumping Lemma

abcaacab

abcaacaacaacab

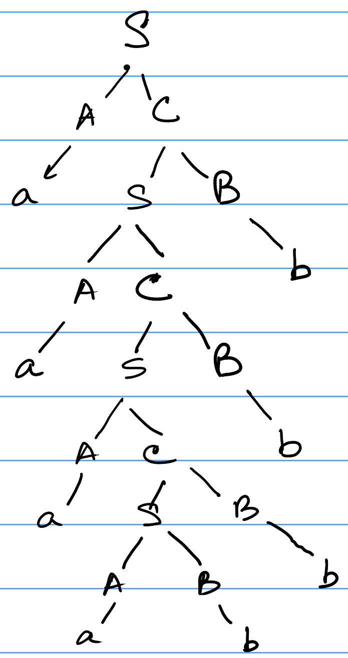
Does ∃ a CFL that always satisfies the above Pumping Lemma?

Ans. NO: $a^n b^n$

All regular languages are CFLs!

any CFG − {ε} → Chomsky Normal Form

$a^n b^n$ $\quad$ $a^4 b^4$ $\quad$ $S \to AC \mid AB$, $A \to a$, $B \to b$, $C \to SB$



$S \to AC \to aC \to aSB \to aACB \to aaSBB \to aaACBB$
$\to aaaCBB \to aaaSBBB \to aaaABBBB \to aaaaBBBB$
$\to aaaabBBB \to aaaabbBB \to aaaabbbB \to aaaabbbb$

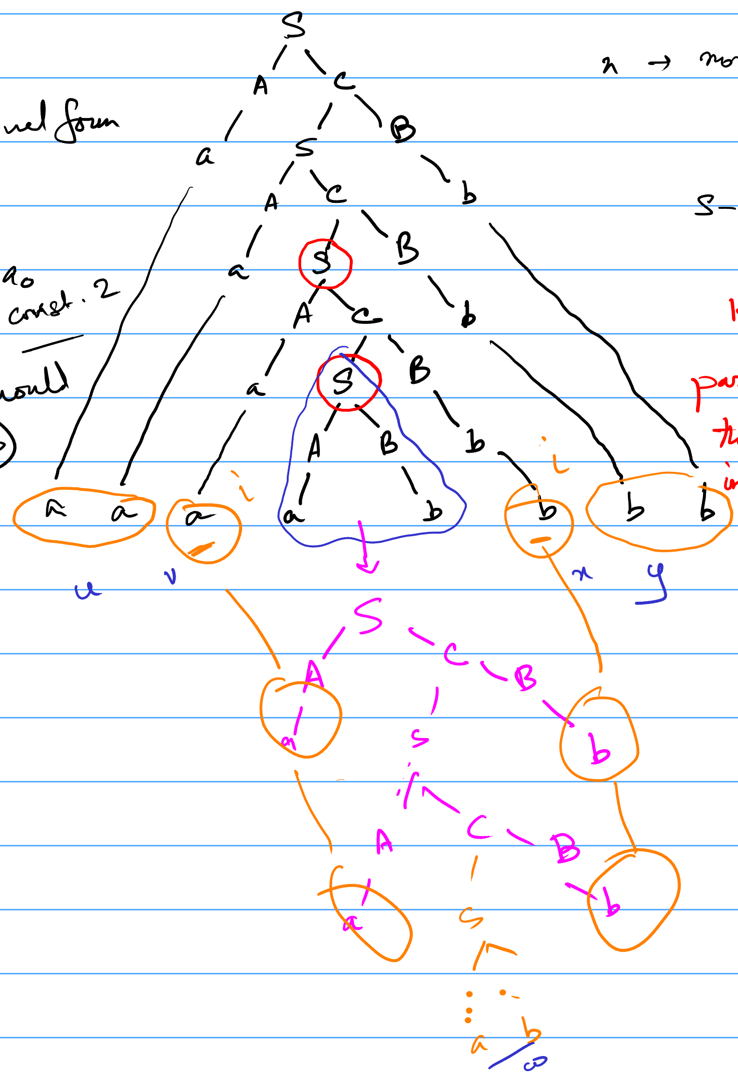
Chomsky Normal form

if end string is of length a_0 $\rightsquigarrow O(a_0) \rightarrow$ const. 2

lower bound should be $\omega(\log a_0)$

$x \rightarrow$ nonterminals

$S - AB - aB \rightarrow aBC - ab.$



Is this true? If a parse tree is large enough then a nonterminal occurs in a subtree of one of its own occurrences?

Pumping Lemma for CFLs: For every CFL A, there exists $k \geq 0$ s.t. every $z \in A$ of length at least k can be broken down into five substrings $z = uvwxy$ s.t. $vx \neq \epsilon$, $|vwx| \leq k$ and for all $i \geq 0$, $uv^iwx^iy \in A$.

Contrapositive?? If for A, $\forall k$ $\exists$ $z \in A$ of length $\geq k$ s.t. for all ways of breaking up z into $uvwxy$ where $vx \neq \epsilon$ and $|vwx| \leq k$, $\exists$ $i \geq 0$ s.t. $uv^iwx^iy \notin A$

then $\boxed{A \text{ is not a CFL}}$

$a^nb^na^n \rightarrow$ Can a nondeterministic automaton with a stack accept it?

" " " " a queue " ?