C V all symbols $(\Sigma \cup NT)^*$

CFG $= L = \{a^n b^n ; n \geq 0\}$ $G = (V, \Sigma, R, S)$

A derivation of G of w_n from w_0 may be any string in V^*

$V = \{S, a, b\}$ $\Sigma = \{a, b\}$
$R = \{S \to aSb ; S \to e\}$

$S \to aSb \to aaSbb \to aaaSbbb \to aaabbb$

CFG and PL

- Computer programs written in any language must satisfy some rigid criteria in order to be syntactically correct, and therefore amenable for mechanical interpretation.
- The syntax of most of the languages can be captured by CFG
- If a programming language is described by CFG, it will be easy for parsing.
- Parsing is the process of analyzing a program to find the syntax.

$G = (V, \Sigma, R, S)$
$V = \{+, *, (,), id, T, F, E\}$
$\Sigma = \{+, * (,), id\}$
$S = E$
$R \Rightarrow$ $E \to E + T$ $T \to T * F$ $F \to (E)$
$E \to T$ $T \to F$ $F \to id$

$w_n \to (id * id) + (id + id)$

Starting NT $\to E_{w_0}$

$E_{w_0} \to E + T$

$w_1 \to T + T$

$\to F + T$

$\to (E) + T$

$\to (T) + T$

$\to (T * F) + T$

$\to (F * F) + T$

$\to (id * F) + T$

$\to (id * id) + T$

$\to (id * id) + F$

$\to (id * id) + (E)$

$\to (id * id) + (E + T)$

$\to (id * id) + (T + T)$

$\to (id * id) + (F + T)$

$\to (id * id) + (F + F)$

$\to (id * id) + (id + F)$

$\to (id * id) + (id + id)$

RL and CFL

All RLs are CFL.

$M = (K, \Sigma, \delta, s, F)$ *and corresponds to a Regular language L*

$G(M) = (V, \Sigma, R, S)$

$V = K \cup \Sigma$

$S = s$

$R = \{ Q \to aP \mid \delta(Q, a) = P \} \cup \{ Q \to e \text{ if } Q \in F \}$

why context free

$E * E + E$

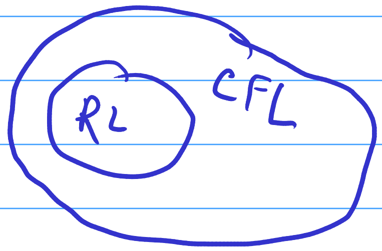
replace with RHS of rule $\to$ The surroundings of this 'E' have no part to play with rules for JUST replacement

Difference bet. BNF & CFG?

(They are fundamentally same)

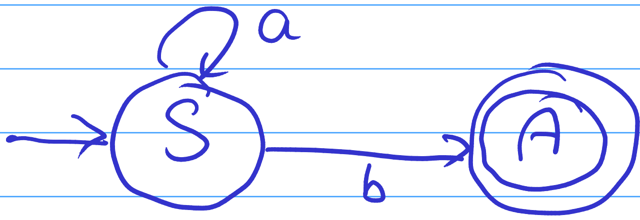
$a^n b^n$ where $n \geq 0$ is a CFL

If there exists a CFG for L $S \to Bb$



but $a^n b^n$ is not an RL

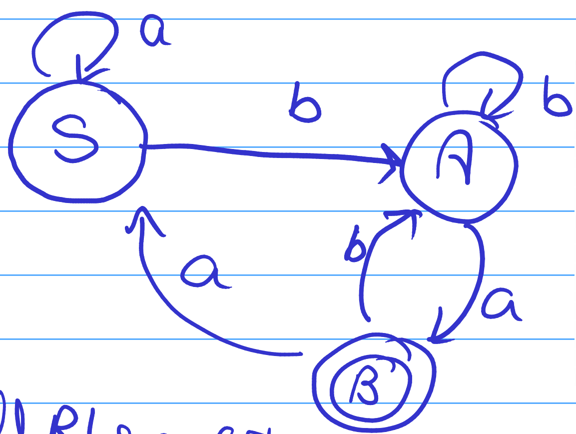
bab is a CFL & RL though



$a^* b$

$\delta(Q, a) = P$ $\quad Q \to aP$

$S \to aS$
$S \to bA$
$A \to e$



All RLs are CFL.

M= (K, Σ , δ, s, F) *and corresponds to a Regular language L*

G(M) = (V, Σ , R, S)

V= K U Σ

S= s

R= { Q→aP | δ (Q, a)=P } U { Q→e if Q ϵ F}

all RLs are CFLs but all CFLs are not RLs

$S \to aS$ $\quad A \to bA$ $\quad B \to bA$

$S \to \underbrace{bA}$ $\quad A \to aB$ $\quad B \to aS$ $\quad B \to e$

They are regular grammars { RHS has max 2 symbols (or lower) for this grammar

all Regular grammars are Context free grammars