

lecture 26:-

find CNF

Ex:-
 $A \rightarrow BAB \mid B \mid \lambda$
 $B \rightarrow \epsilon \mid \lambda$

Step 1:-
 $S_0 \rightarrow A$
 $A \rightarrow BAB \mid B \mid \lambda$
 $B \rightarrow \epsilon \mid \lambda$

Step 2:- Removing Null.

1) $A \rightarrow \lambda$
 2) $B \rightarrow \lambda$ ✓

$S_0 \rightarrow A$
 $A \rightarrow BAB \mid B \mid \lambda$ $AB \mid BA \mid A \mid \lambda$
 $B \rightarrow \epsilon \mid \lambda$ Substituting $B \rightarrow \lambda$

$S_0 \rightarrow A \mid \lambda$
 $A \rightarrow BAB \mid B \mid \lambda \mid A \mid B \mid A \mid A$ $BB \mid B \mid B \mid B$
 $B \rightarrow \epsilon$

$S_0 \rightarrow A \mid \lambda$
 $A \rightarrow BAB \mid B \mid A \mid B \mid A \mid A \mid BB$
 $B \rightarrow \epsilon$

Step 3:- Removing UNIT Production.

$A \rightarrow B$ $A \rightarrow a \mid bb$
 $B \rightarrow a \mid bb$

$S_0 \rightarrow A \mid \lambda$
 $A \rightarrow BAB \mid B \mid A \mid B \mid A \mid A \mid BB$
 $B \rightarrow \epsilon$

$A \rightarrow C \rightarrow B$
 $A \rightarrow C \rightarrow A$

$S_0 \rightarrow BAB \mid \epsilon \mid A \mid B \mid A \mid BB \mid \lambda$
 $A \rightarrow BAB \mid \epsilon \mid A \mid B \mid A \mid BB$
 $B \rightarrow \epsilon$

Step 4:- Replace terminals by non-terminals.

$S_0 \rightarrow BAB \mid \epsilon \mid A \mid B \mid A \mid BB \mid \lambda$
 $\lambda \rightarrow BAB \mid \epsilon \mid A \mid B \mid A \mid BB$

$A \rightarrow a$
 $A \rightarrow \epsilon$

$$\begin{aligned}
 S_0 &\rightarrow BAB / \overset{c}{\underset{c}{00}} / \overset{c}{\underset{c}{AB}} / BA / \overset{u}{BB} / \lambda \\
 A &\rightarrow BAB / \overset{c}{\underset{c}{00}} / \overset{c}{\underset{c}{AB}} / BA / BB \\
 B &\rightarrow \overset{c}{\underset{c}{00}} / \overset{c}{\underset{c}{c}} \\
 C &\rightarrow 0
 \end{aligned}$$

$$\begin{aligned}
 A &\rightarrow 00 \\
 A &\rightarrow aa
 \end{aligned}$$

$$\begin{aligned}
 S_0 &\rightarrow BAB / CC / \overset{c}{\underset{c}{AB}} / BA / BB / \lambda \\
 A &\rightarrow BAB / CC / \overset{c}{\underset{c}{AB}} / BA / BB \\
 B &\rightarrow CC \\
 C &\rightarrow 0
 \end{aligned}$$

Step 5: Take care of long rules.

$$\begin{aligned}
 S_0 &\rightarrow \overset{D}{\overline{BAB}} / CC / \overset{c}{\underset{c}{AB}} / BA / BB / \lambda \\
 A &\rightarrow \overset{D}{\overline{BAB}} / CC / \overset{c}{\underset{c}{AB}} / BA / BB \\
 B &\rightarrow CC \\
 C &\rightarrow 0 \\
 D &\rightarrow BA.
 \end{aligned}$$

$$\begin{aligned}
 S_0 &\rightarrow DB / CC / \overset{c}{\underset{c}{AB}} / BA / BB / \lambda \\
 A &\rightarrow DB / CC / \overset{c}{\underset{c}{AB}} / BA / BB \\
 B &\rightarrow CC \\
 C &\rightarrow 0 \\
 D &\rightarrow BA.
 \end{aligned}$$

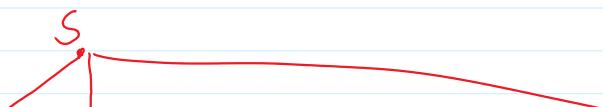
Total Language Tree:

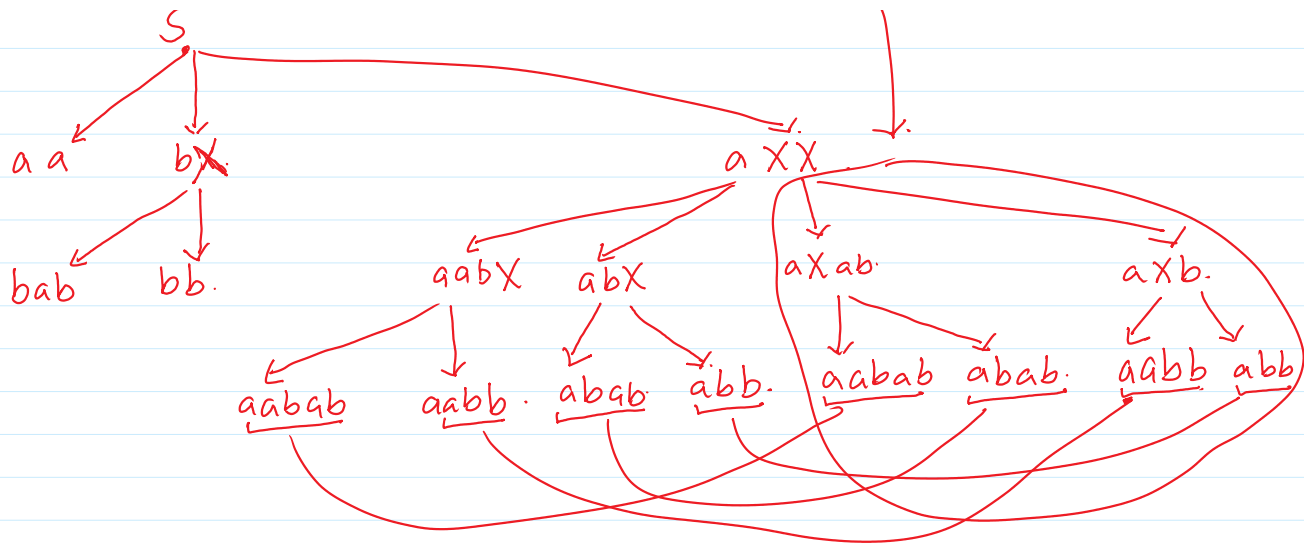
Representation of CFG.

Ex: $S \rightarrow aa / bX / aXX$

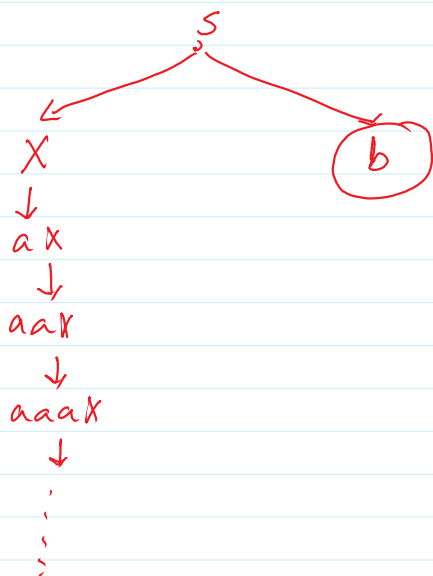
$X \rightarrow ab / b$

Redundant.





Ex:- $S \rightarrow X/b$ $X \rightarrow aX.$



$S \rightarrow b$

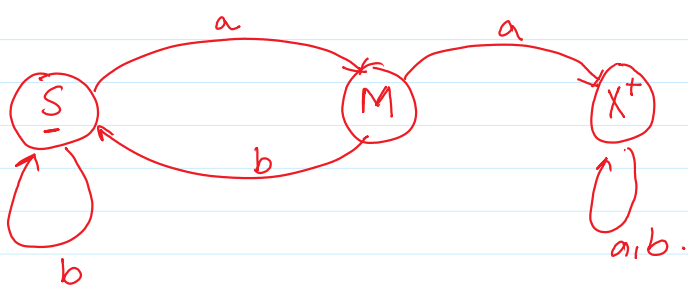
Semi word:-

terminal, terminal, ..., terminal, Non terminal-

$aaaX$, bX ,
 abX

CPG. to PA.

$S \rightarrow aM$
 $S \rightarrow bS$
 $M \rightarrow aX$
 $M \rightarrow bS$
 $X \rightarrow aX$



$$\begin{aligned} M &\rightarrow bS \\ X &\rightarrow aX \\ X &\rightarrow bX \\ X &\rightarrow \lambda \end{aligned}$$

$$\bigcup_b$$

$$U_{a,b}$$

Theorem: Regular CFG.
If every production in CFG is of the form.

- 1- Nonterminal \rightarrow Semi word.
- 2- Non terminal \rightarrow word.

Ex:- $S \rightarrow aaS | bbs | \lambda$ ✓

Ex:- $S \rightarrow aA | bB$ ✓
 $A \rightarrow aS | a$
 $B \rightarrow bS | b$

Point: If CFG is regular then we can convert it into TG.

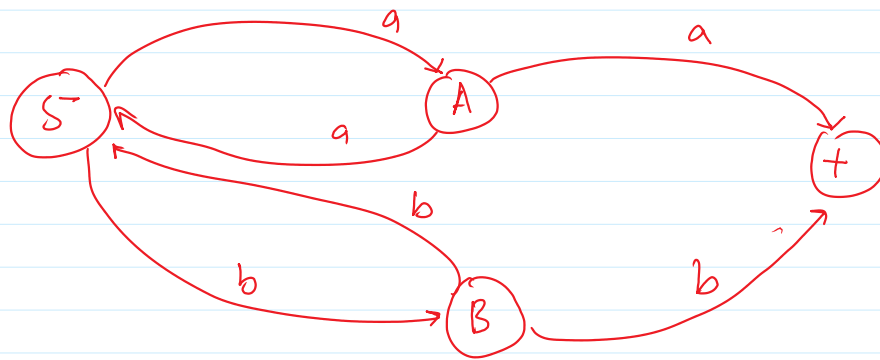
Ex:- $S \rightarrow aaS | bbs | \lambda$



Ex:- $S \rightarrow aA | bB$
 $A \rightarrow aS | a$
 $B \rightarrow bS | b$

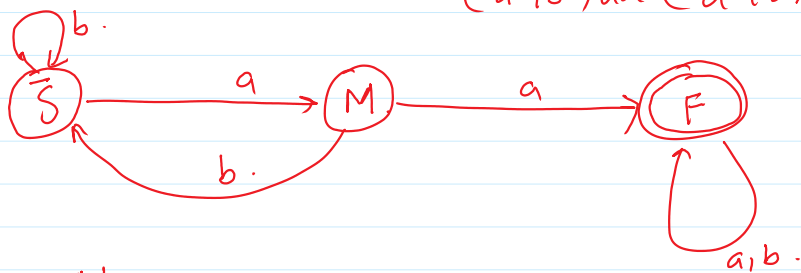
_____ a

$B \rightarrow ba/b.$



RA to CFG.

$(a+ba)^+aa(a+ba)^+.$



$S \rightarrow aM/bS.$

$M \rightarrow aF/bS.$

$F \rightarrow aF/bF/\lambda.$