Lecture 26:- How to Convert CFG to CNF.

$S \to CSC \mid B$

$C \to 00 \mid \lambda$

$B \to 01B \mid 1.$

Step 1:-

$S_0 \to S$

$S \to CSC \mid B$

$C \to 00 \mid \lambda$

$B \to 01B \mid 1.$

Step 2:-

$S_0 \to S$

$C \to \lambda.$

$S \to CSC \mid B \mid SC \mid CS \mid S$

$C \to 00 \cancel{\mid \lambda}$

$B \to 01B \mid 1.$

Step 3:-

$B \to a$

$A \to B.\ a$

$A \to B \to C$

$A \to \cancel{A}$

$S_0 \to \overset{CSC \mid 01B \mid 1 \mid SC \mid CS}{\underline{S}}$

$S \to CSC \mid \overset{01B \mid 1.}{\underline{B}} \mid SC \mid CS \mid \cancel{S}.$

$C \to 00 \cancel{\mid \lambda}$

$B \to 01B \mid 1.$

$S_0 \to CSC \mid 01B \mid 1. \mid SC \mid CS$

$S \to CSC \mid 01B \mid 1 \mid SC \mid CS$

$C \to 00$

$B \to 01B \mid 1.$

Step 4:-

$$S_0 \to CSC \mid 01B \mid 1 \mid SC \mid CS$$
$$S \to CSC \mid 01B \mid 1 \mid SC \mid CS$$
$$C \to \overset{Z}{0}\overset{Z}{0}$$
$$B \to \overset{Z}{0}\overset{Y}{1}B \mid 1 .$$

$$Z \to 0 .$$
$$Y \to 1 .$$

$$S_0 \to CSC \mid ZYB \mid 1 \mid SC \mid CS$$
$$S \to CSC \mid ZYB \mid 1 \mid SC \mid CS$$
$$C \to ZZ$$
$$B \to ZYB \mid 1 .$$

$$Z \to 0 .$$
$$Y \to 1 .$$

Step 5:-

$$S_0 \to \overbrace{CS}^{D}C \mid \overbrace{ZY}^{E}B \mid 1 \mid SC \mid CS$$
$$S \to \overbrace{CS}^{D}C \mid \underbrace{ZY}_{E}B \mid 1 \mid SC \mid CS$$
$$C \to ZZ$$
$$B \to \underbrace{ZY}_{E}B \mid 1 .$$

$$Z \to 0 .$$
$$Y \to 1 .$$
$$D \to CS .$$
$$E \to ZY$$

$S_0 \rightarrow DC \mid EB \mid 1 \mid SC \mid CS$

$S \rightarrow DC \mid EB \mid 1 \mid SC \mid CS$

$C \rightarrow ZZ$

$B \rightarrow EB \mid 1.$

$Z \rightarrow 0.$

$Y \rightarrow 1.$

$D \rightarrow CS.$

$E \rightarrow ZY$

Ex 2:- $A \rightarrow BAB \mid B \mid \lambda.$

$B \rightarrow 00 \mid \lambda.$

Step 1:

$S_0 \rightarrow A$

$A \rightarrow BAB \mid B \mid \lambda.$

$B \rightarrow 00 \mid \lambda.$

Step 2:-

$S_0 \rightarrow A$

$A \rightarrow BAB \mid B \mid \lambda. \mid AB \mid BA \mid A \mid \cancel{\lambda} \mid \cancel{\lambda}$

$B \rightarrow 00 \; \cancel{\lambda}.$

$A \rightarrow \lambda$ ✓. $B \rightarrow \lambda$

$S_0 \rightarrow A \mid \lambda$

$A \rightarrow BAB \mid B \mid \cancel{\lambda}. \mid AB \mid BA \mid A \quad \mid BB \mid \cancel{B} \mid \cancel{B} \mid \cancel{\lambda}.$ ✓. $A \rightarrow \lambda.$

$B \rightarrow 00$

Step 3:-

$BAB \mid 00 \mid AB \mid BA \mid BB$

$S_0 \rightarrow A \mid \lambda$

$A \rightarrow BAB \mid B \ldots$ 00

$S_0 \rightarrow A.$

$A \rightarrow B$

$A \rightarrow A$

$A \rightarrow A$

$A \rightarrow BAB \mid \overset{00}{B} \mid AB \mid BA \mid \cancel{A} \mid BB \mid$

$B \rightarrow 00$

$S_0 \rightarrow BAB \mid 00 \mid AB \mid BA \mid BB \mid \lambda$

$A \rightarrow BAB \mid 00 \mid AB \mid BA \mid BB \mid$

$B \rightarrow 00$

Step 4:-

$S_0 \rightarrow BAB \mid \overset{D}{0}\overset{D}{0} \mid AB \mid BA \mid BB \mid \lambda$

$A \rightarrow BAB \mid \underbrace{00}_{DD} \mid AB \mid BA \mid BB \mid$

$B \rightarrow \underbrace{0}_{D}\underbrace{0}_{D}$

$D \rightarrow 0.$

$S_0 \rightarrow BAB \mid DD. \mid AB \mid BA \mid BB \mid \lambda$

$A \rightarrow BAB \mid DD \mid AB \mid BA \mid BB$

$B \rightarrow DD$

$D \rightarrow 0.$

Step 5:-

$S_0 \rightarrow \overset{E}{BA}B \mid DD. \mid AB \mid BA \mid BB \mid \lambda$

$A \rightarrow \overset{E}{BA}B \mid DD \mid AB \mid BA \mid BB$

$B \rightarrow DD$

$D \rightarrow 0.$

$E \rightarrow BA$

$S_0 \rightarrow EB \mid DD \mid AB \mid BA \mid BB \mid \lambda$

$A \rightarrow EB \mid DD \mid AB \mid BA \mid BB$

$B \rightarrow DD$

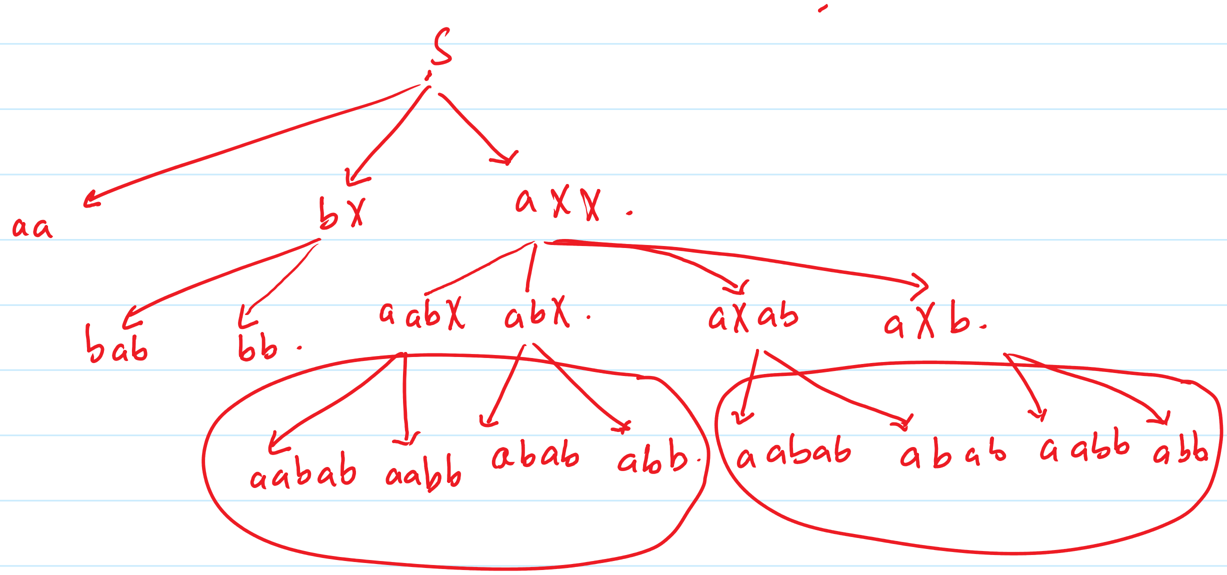
$D \rightarrow 0$.

$E \rightarrow BA$

Total Language Tree.

$S \rightarrow aa \mid bX \mid aXX$

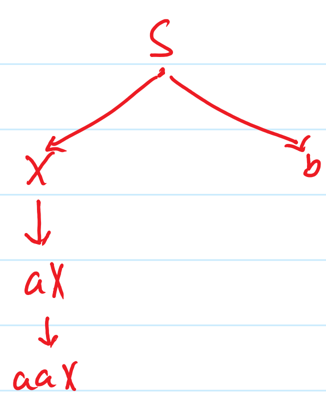
$X \rightarrow ab \mid b$.

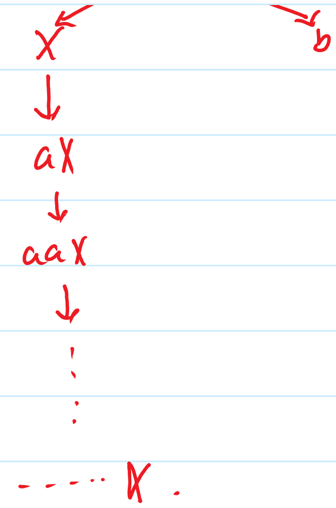


Ex

$S \rightarrow X \mid b$

$X \rightarrow aX$.





Practice :- $S \rightarrow aX \mid Xa \mid aXaXa$

$X \rightarrow ba \mid ab$.

Produce all possible words Using total language tree.

Semi Word :-

terminal, terminal, terminal - - - · Non terminal

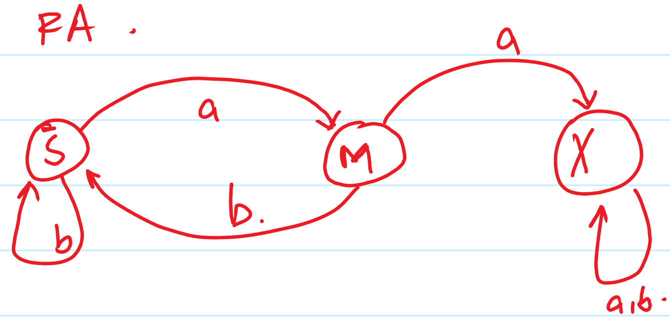
aX , abb X .

Converting A CFG to FA .

$S \rightarrow aM \mid bS$

$M \rightarrow aX \mid bS$

$X \rightarrow aX \mid bX \mid \Lambda$.



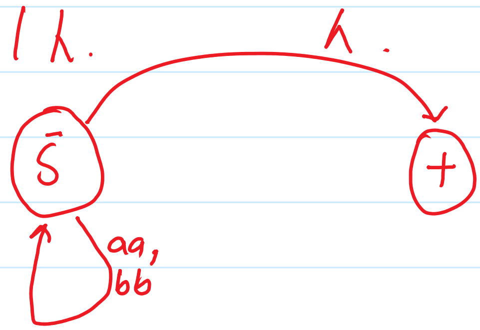
Regular Grammar:- A CFG is said to be regular if each production is in any one of these two forms

1- Non-terminal → Semi word.

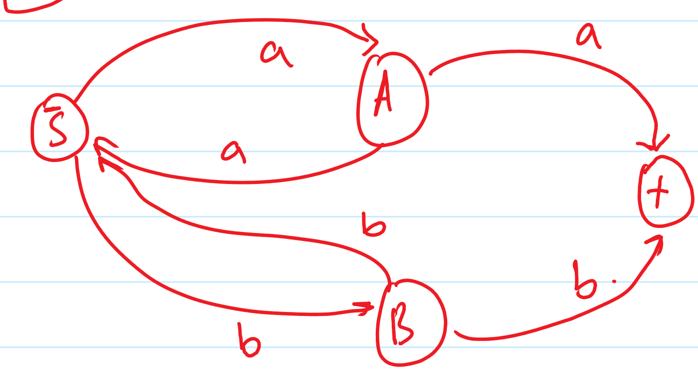
2- Non-terminal → word.

CFG to TG.

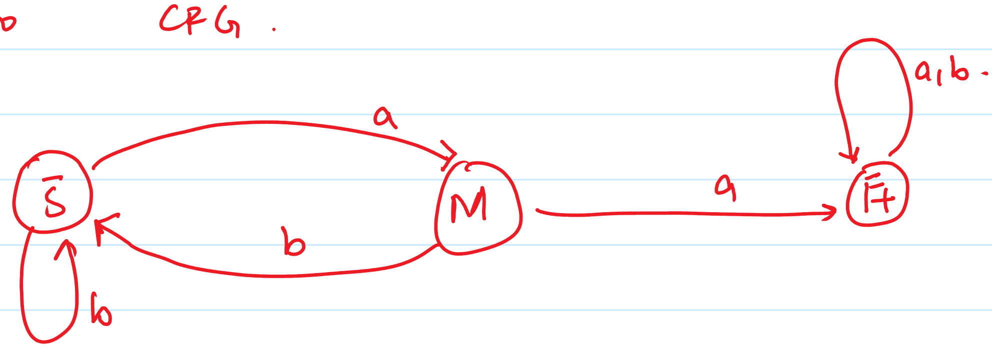
S → aaS | bbS | λ.



S → aA | bB
A → aS | a
B → bS | b.



FA to CFG.



S → aM | bS
M → aF | bS

$R \rightarrow aR \mid bR \mid \lambda.$