

CHOMSKY Normal Form

- It should follow all Simplification of CFG
- It should contain for all productions
 - * Either two Nonterminals
 - * Either terminal

Eg:

$$S \rightarrow ABC.$$

$$S \rightarrow C_1 C$$

$$C_1 \rightarrow AB$$

① Convert the following grammar in CNF

$$S \rightarrow aABb$$

$$A \rightarrow a$$

$$B \rightarrow b.$$

Checking for Simplification of Grammar

① Elimination of Null production

→ No null productions

② Elimination of Unit productions

→ No unit productions

③ Elimination of useless symbol

$S, A, B \rightarrow$ are generating

S, A, B are reachable

$$S \rightarrow XABY$$

$$S \rightarrow C_1C_2$$

$$C_1 \rightarrow XA$$

$$C_2 \rightarrow BY$$

$$X \rightarrow a$$

$$Y \rightarrow b$$

$$A \rightarrow a$$

$$B \rightarrow b$$

(2)

$$E \rightarrow E+T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid id$$

* No null production

Unit production

$$E \rightarrow T$$

$$T \rightarrow F$$

To remove $T \rightarrow F$

$$T \rightarrow (E)$$

$$T \rightarrow id$$

To remove $E \rightarrow T$

$$E \rightarrow (E)$$

$$E \rightarrow id$$

$$E \rightarrow T * F$$

Grammar is

$$E \rightarrow E+T \mid T * F \mid (E) \mid id$$

$$T \rightarrow T * F \mid (E) \mid id$$

$$F \rightarrow (E) \mid id$$

Generating

$$E, T, F \rightarrow \text{Generating } (E \rightarrow id; T \rightarrow id; F \rightarrow id)$$

E is the start symbol

\therefore E is reachable

$E \rightarrow E+T \Rightarrow T$ is reachable

$E \rightarrow T * F \Rightarrow F$ is reachable

Assigning

$$X \rightarrow +$$

$$Y \rightarrow *$$

$$Z \rightarrow ($$

$$A \rightarrow)$$

$$\cancel{B \rightarrow \text{...}}$$

$$\therefore \cancel{E \rightarrow E * F}$$

$$E \rightarrow EXT \mid TYF \mid ZEA \mid id$$

$$T \rightarrow TYF \mid ZEA \mid id$$

$$F \rightarrow ZEA \mid id$$

In chomsky Normal form

$$E \rightarrow C_1 T \mid C_2 F \mid C_3 A \mid id$$

$$T \rightarrow C_2 F \mid C_3 A \mid id$$

$$F \rightarrow C_3 A \mid id$$

$$C_1 \rightarrow EX$$

$$C_2 \rightarrow TY$$

$$C_3 \rightarrow ZE$$

$$X \rightarrow +$$

$$Y \rightarrow *$$

$$Z \rightarrow ($$

$$A \rightarrow)$$