

L-5 CFG to GNF Conversion (Removal of Left Recursion)-1

Greibach Normal Form

(Conversion of CFG to GNF - Removal of Left Recursion)

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$

$$\boxed{A_4 \rightarrow b \mid A_1 A_4} \longrightarrow A_4 \rightarrow b \mid b A_3 A_4 \mid \boxed{A_4 A_4 A_4}$$

$$A_2 \rightarrow b$$

$$A_3 \rightarrow a$$

Left Recursion

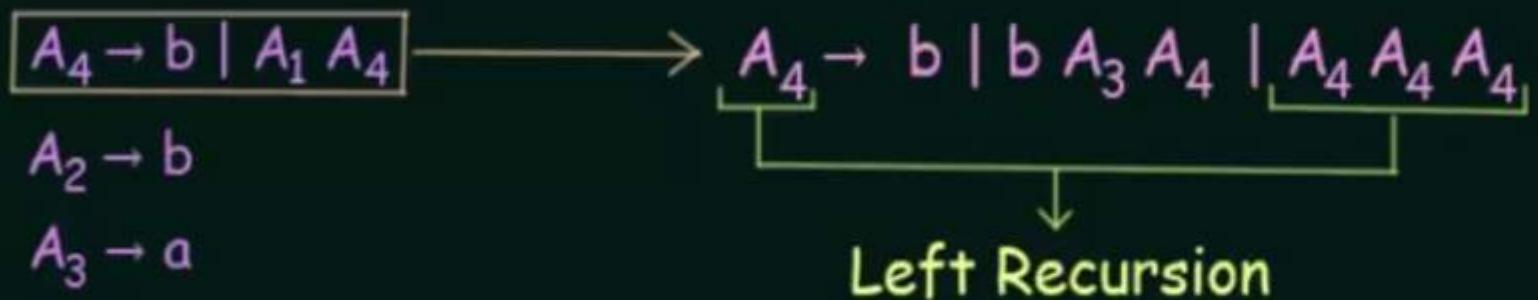


Step 5: Remove Left Recursion

Greibach Normal Form

(Conversion of CFG to GNF - Removal of Left Recursion)

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$



Step 5: Remove Left Recursion

Introduce a New Variable to remove the Left Recursion

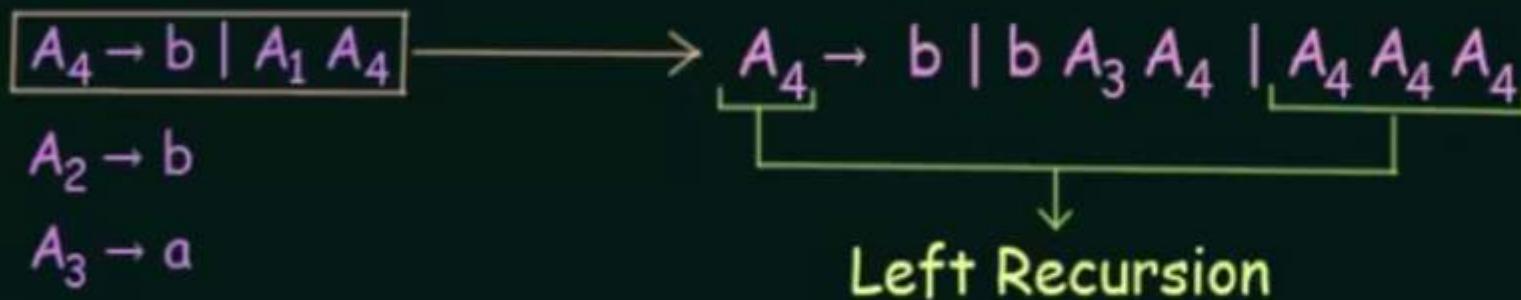
$$A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$$

Z 

Greibach Normal Form

(Conversion of CFG to GNF - Removal of Left Recursion)

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$



Step 5: Remove Left Recursion

Introduce a New Variable to remove the Left Recursion

$$A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$$

$$Z \rightarrow A_4 A_4 Z \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid b Z \mid b A_3 A_4 Z$$



Step 5: Remove Left Recursion

Introduce a New Variable to remove the Left Recursion

$$A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$$

$$Z \rightarrow A_4 A_4 Z \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid b Z \mid b A_3 A_4 Z$$

Now the grammar is:

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid b Z \mid b A_3 A_4 Z$$

$$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$$

$$A_2 \rightarrow b$$

$$A_3 \rightarrow a \quad \text{→}$$

Step 5: Remove Left Recursion

Introduce a New Variable to remove the Left Recursion

$$A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$$

$$Z \rightarrow A_4 A_4 Z \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid b Z \mid b A_3 A_4 Z$$

Now the grammar is:

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid b Z \mid b A_3 A_4 Z$$

$$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$$

$$A_2 \rightarrow b$$

$$A_3 \rightarrow a \quad \text{→}$$

$b | bA_3A_4 \mid bZ \mid bA_3A_4Z$

Now the grammar is:

$$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$$

$$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$$

$$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$$

$$A_2 \rightarrow b$$

$$A_3 \rightarrow a$$

$$A_1 \rightarrow b A_3 \mid$$

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

Now the grammar is:

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow b A_3 \{ b A_4 \mid b A_3 A_4 A_4 \} bZ A_4 \mid b A_3 A_4 Z A_4$



$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$
 $A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

Now the grammar is:

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow b A_3 \mid b A_4 \mid b A_3 A_4 A_4 \mid bZ A_4 \mid b A_3 A_4 Z A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

$Z \rightarrow b A_4 \mid b A_3 A_4 A_4 \mid bZ A_4 \mid b A_3 A_4 Z A_4 \mid$

$b A_4 Z \mid b A_3 A_4 A_4 Z \mid bZ A_4 Z \mid b A_3 A_4 Z A_4 Z$

$A_2 \rightarrow b$



$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

Now the grammar is:

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

$Z \rightarrow A_4 A_4 \mid A_4 A_4 Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow b A_3 \mid b A_4 \mid b A_3 A_4 A_4 \mid bZ A_4 \mid b A_3 A_4 Z A_4$

$A_4 \rightarrow b \mid b A_3 A_4 \mid bZ \mid b A_3 A_4 Z$

$Z \rightarrow b A_4 \mid b A_3 A_4 A_4 \mid bZ A_4 \mid b A_3 A_4 Z A_4 \mid$

$b A_4 Z \mid b A_3 A_4 A_4 Z \mid bZ A_4 Z \mid b A_3 A_4 Z A_4 Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Questions???