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

Greibach Normal Form

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

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid A_1 A_4$ ⟶ $A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Left Recursion

Step 5: Remove Left Recursion

Greibach Normal Form

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

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid A_1 A_4$ → $A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Left Recursion

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)

$A_1 \rightarrow A_2 A_3 \mid A_4 A_4$

$A_4 \rightarrow b \mid A_1 A_4$ ⟶ $A_4 \rightarrow b \mid b A_3 A_4 \mid A_4 A_4 A_4$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Left Recursion

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

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

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

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

Now the grammar is:

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

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

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

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Step 5: Remove Left Recursion

Introduce a New Variable to remove the Left Recursion

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

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

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

Now the grammar is:

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

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

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

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

Now the grammar is:

$A_1 \rightarrow A_2A_3 \mid A_4A_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow A_4A_4 \mid A_4A_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow bA_3 \mid$

$b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

Now the grammar is:

$A_1 \rightarrow A_2A_3 \mid A_4A_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow A_4A_4 \mid A_4A_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow bA_3 \mid bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4$

$b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

Now the grammar is:

$A_1 \rightarrow A_2A_3 \mid A_4A_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow A_4A_4 \mid A_4A_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow bA_3 \mid bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4 \mid$

$bA_4Z \mid bA_3A_4A_4Z \mid bZA_4Z \mid bA_3A_4ZA_4Z$

$A_2 \rightarrow b$

$b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

Now the grammar is:

$A_1 \rightarrow A_2A_3 \mid A_4A_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow A_4A_4 \mid A_4A_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

$A_1 \rightarrow bA_3 \mid bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4$

$A_4 \rightarrow b \mid bA_3A_4 \mid bZ \mid bA_3A_4Z$

$Z \rightarrow bA_4 \mid bA_3A_4A_4 \mid bZA_4 \mid bA_3A_4ZA_4 \mid$

$bA_4Z \mid bA_3A_4A_4Z \mid bZA_4Z \mid bA_3A_4ZA_4Z$

$A_2 \rightarrow b$

$A_3 \rightarrow a$

Questions????