Step v : (Conversion of the string containing terminals and non-terminals to the string of non-terminal. on the RHS) Consider any production of the form

$$\text{NT} \rightarrow \text{T}_1 \ \text{T}_2 \ldots \text{T}_n \text{NT}_1 \ldots \text{NT}_{n,}$$

where $n \geq 1$ For the part $\text{T}_1 \ \text{T}_2 \ldots \text{T}_n$, follow Step III

Check the resultant string by Step II. If not in CNF, follow Step IV.

By this process, the generated new grammar is in CNF.

Example 6.37 Comvert the following grammar into CNF.

$$S \rightarrow bA/aB$$
$$A \rightarrow bAA/aS/a$$
$$B \rightarrow aBB/DS/a$$

Selation: The productions $S \rightarrow bA, S \rightarrow aB, A \rightarrow bAA, A \rightarrow aS, B \rightarrow aBB, B \rightarrow bS$ are not in CNF. So, we have to coavert these into CNF. Let us replace terminal 'a' by a non-temminal c_a and terminal 'b' by a noa-teminal C_b. Hence, two new productions will be added to the granimar

$$C_a \rightarrow a \text{ and } C_b \rightarrow b$$

By replacing a and b by new non-terminals and including the two productions, the modified grammar will be

$$S \rightarrow \text{C}_b\text{A}/\text{C}_a\text{B}$$
$$A \rightarrow \text{C}_b\text{AA}/\text{C}_a\text{S}/a$$
$$B \rightarrow \text{C}_a\text{BB}/\text{C}_b\text{S}/a$$
$$\text{C}_a \rightarrow a$$
$$\text{C}_b \rightarrow b$$

In the modified grammar, all the productions are not in CNF. The productions $A \rightarrow C_b$ AA and $B \rightarrow C_a$ BB are not in CNF, becanse they contain more than two noa-terminals at the RHS. Let us replace AA by a new non-terminal D and BB by another new non-terminal E. Hence, two new productions will be added to the grammar D $\rightarrow$ AA and E $\rightarrow$ BB. So, the new modified grammar will be

$$S \rightarrow \text{C}_b\text{A}/\text{C}_a\text{B}$$
$$A \rightarrow \text{C}_b\text{D}/\text{C}_a\text{S}/a$$
$$B \rightarrow \text{C}_b\text{E}/\text{C}_a \text{ S}/a$$
$$\text{D} \rightarrow \text{AA}$$
$$\text{E} \rightarrow \text{BB}$$
$$\text{C}_a \rightarrow a$$
$$\text{C}_b \rightarrow b$$

Example 6.38 Comvert the following grammar into CRF.

$$S \rightarrow ABa$$
$$A \rightarrow \text{ aab}$$
$$B \rightarrow Ac$$