First and Follow-

First and Follow sets are needed so that the parser can properly apply the needed production rule at the correct position.

First Function-

First(α) is a set of terminal symbols that begin in strings derived from α.

Example-

Consider the production rule-

$$A \rightarrow abc \ / \ def \ / \ ghi$$

Then, we have-

$$First(A) = \{ a , d , g \}$$

Rules For Calculating First Function-

Rule-01:

For a production rule $X \rightarrow \in$,

$$First(X) = \{ \in \}$$

Rule-02:

For any terminal symbol ‘a’,

$$First(a) = \{ a \}$$

Rule-03:

For a production rule $X \rightarrow Y_1Y_2Y_3$,

Calculating First(X)

If $\in \notin First(Y_1)$, then $First(X) = First(Y_1)$

If $\in \in First(Y_1)$, then $First(X) = \{ First(Y_1) - \in \} \cup First(Y_2Y_3)$

Calculating First(Y_2Y_3)

If $\in \notin First(Y_2)$, then $First(Y_2Y_3) = First(Y_2)$

If $\in \in First(Y_2)$, then $First(Y_2Y_3) = \{ First(Y_2) - \in \} \cup First(Y_3)$

Similarly, we can make expansion for any production rule $X \rightarrow Y_1Y_2Y_3.....Y_n$.

Follow Function-

Follow(α) is a set of terminal symbols that appear immediately to the right of α.

Rules For Calculating Follow Function-

Rule-01:

For the start symbol S, place $ in Follow(S).

Rule-02:

For any production rule $A \rightarrow \alpha B$,

$$\text{Follow}(B) = \text{Follow}(A)$$

Rule-03:

For any production rule $A \rightarrow \alpha B \beta$,

If $\in \notin \text{First}(\beta)$, then $\text{Follow}(B) = \text{First}(\beta)$

If $\in \in \text{First}(\beta)$, then $\text{Follow}(B) = \{ \text{First}(\beta) - \in \} \cup \text{Follow}(A)$

Important Notes-

Note-01:

$\in$ may appear in the first function of a non-terminal.

∈ will never appear in the follow function of a non-terminal.

Note-02:

Before calculating the first and follow functions, eliminate Left Recursion from the grammar, if present.

Note-03:

We calculate the follow function of a non-terminal by looking where it is present on the RHS of a production rule.