CD: COMPILER DESIGN
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PREPARED FOR
Engineering Students
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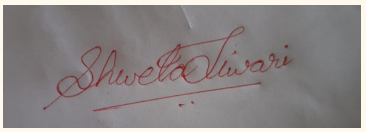

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CD: COMPILER DESIGN

TOPIC On : TOPIC On : Left

Factoring-Left Factoring Elimination

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By SHWETA TIWARI

Under On: Basic Parsing Techniques

TOPIC On : Left Factoring-Left

Factoring Elimination

Grammar With Common Prefixes-

If RHS of more than one production starts with the same symbol,

then such a grammar is called as

Grammar With Common Prefixes.

Example-

$$A \rightarrow \alpha\beta_1 / \alpha\beta_2 / \alpha\beta_3$$

(Grammar with common prefixes)

- This kind of grammar creates a problematic situation for Top down parsers.
- Top down parsers can not decide which production must be chosen to parse the string in hand.

To remove this confusion, we use left factoring.

Left Factoring-

Left factoring is a process by which the grammar with common prefixes is transformed to make it useful for Top down parsers.

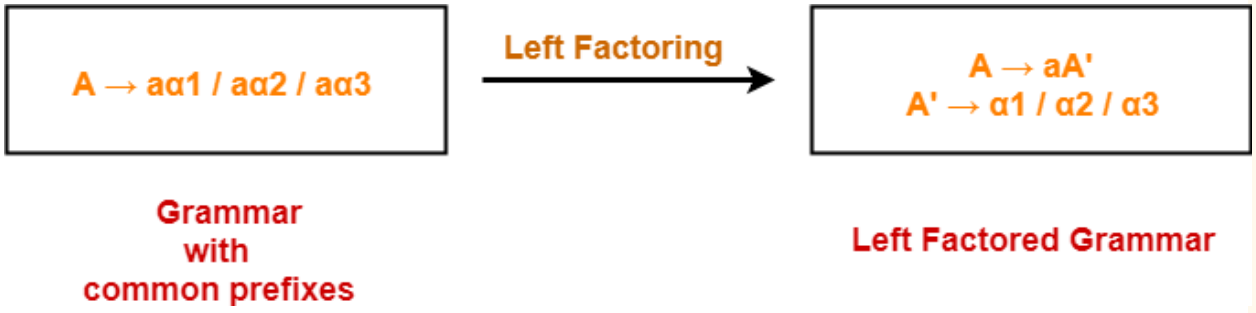
How?

In left factoring,

- We make one production for each common prefixes.
- The common prefix may be a terminal or a non-terminal or a combination of both.
- Rest of the derivation is added by new productions.

The grammar obtained after the process of left factoring is called **Left Factored Grammar**.

Example-



PRACTICE PROBLEMS BASED ON LEFT FACTORING-

Problem-01:

Do left factoring in the following grammar-

$$S \rightarrow iEtS / iEtSeS / a$$

$$E \rightarrow b$$

Solution-

The left factored grammar is-

$$S \rightarrow iEtSS' / a$$

$$S' \rightarrow eS / \in$$

$$E \rightarrow b$$

Problem-02:

Do left factoring in the following grammar-

$$A \rightarrow aAB / aBc / aAc$$

Solution-

Step-01:

$$A \rightarrow aA'$$

$$A' \rightarrow AB / Bc / Ac$$

Again, this is a grammar with common prefixes.

Step-02:

$$A \rightarrow aA'$$

$$A' \rightarrow AD / Bc$$

$$D \rightarrow B / c$$

This is left factored grammar.

Problem-03:

Do left factoring in the following grammar-

$$S \rightarrow bSSaaS / bSSaSb / bSb / a$$

Solution-

Step-01:

$$S \rightarrow bSS' / a$$

$$S' \rightarrow SaaS / SaSb / b$$

Again, this is a grammar with common prefixes.

Step-02:

$$S \rightarrow bSS' / a$$

$$S' \rightarrow SaA / b$$

$$A \rightarrow aS / Sb$$

This is left -factored grammar.

Problem-04:

Do left factoring in the following grammar-

$$S \rightarrow aSSbS / aSaSb / abb / b$$

Solution-

Step-01:

$$S \rightarrow aS' / b$$

$$S' \rightarrow SSbS / SaSb / bb$$

Again, this is a grammar with common prefixes.

Step-02:

$$S \rightarrow aS' / b$$

$$S' \rightarrow SA / bb$$

$$A \rightarrow SbS / aSb$$

This is left -factored grammar.

Problem-05:

Do left factoring in the following grammar-

$$S \rightarrow a / ab / abc / abcd$$

Solution-

Step-01:

$$S \rightarrow aS'$$

$$S' \rightarrow b / bc / bcd / \in$$

Again, this is a grammar with common prefixes.

Step-02:

$$S \rightarrow aS'$$

$$S' \rightarrow bA / \in$$

$$A \rightarrow c / cd / \in$$

Again, this is a grammar with common prefixes.

Step-03:

$$S \rightarrow aS'$$

$$S' \rightarrow bA / \in$$

$$A \rightarrow cB / \in$$

$$B \rightarrow d / \in$$

This is left factored grammar.

Problem-06:

Do left factoring in the following grammar-

$$S \rightarrow aAd / aB$$

$$A \rightarrow a / ab$$

$$B \rightarrow ccd / ddc$$

Solution-

The left factored grammar is-

$$S \rightarrow aS'$$

$$S' \rightarrow Ad / B$$

$$A \rightarrow aA'$$

$$A' \rightarrow b / \in$$

$$B \rightarrow ccd / ddc$$

To gain better understanding about Left Factoring,