

Relationship



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Left Recursion, Left factoring & Ambiguity

have

No Relation
with each other

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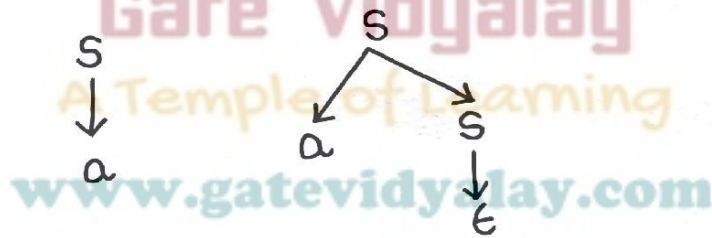
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Ambiguous Grammar with Left Factoring

Consider the grammar -

$$S \rightarrow as/a/\epsilon$$

Two parse trees exist for the string $w = a$



Unambiguous Grammar with Left factoring

Consider the grammar-

$$S \rightarrow aA / aB$$

$$A \rightarrow a$$

$$B \rightarrow b$$

$$L(G) = \{aa/ab\}$$

Unique parse trees exist for both the strings

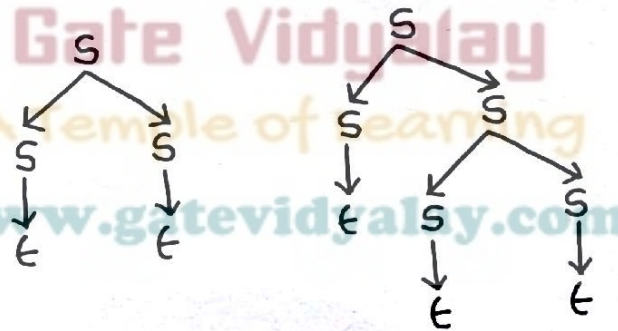
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Ambiguous Grammar with Left Recursion

Consider the grammar -

$$S \rightarrow SS / \epsilon$$

Infinite parse trees exist for the string $w = \epsilon$

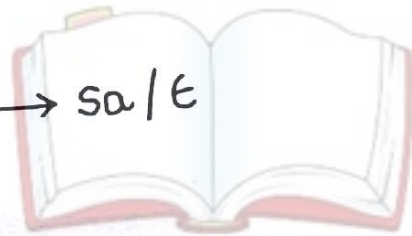


and so on.

Unambiguous Grammar with Left Recursion

Consider the grammar-

$S \rightarrow Sa / \epsilon$



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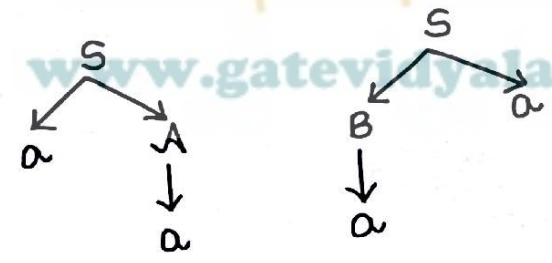
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Ambiguous Grammar without Left Recursion & without Left Factoring

Consider the grammar -

$$\begin{aligned} S &\rightarrow aA/Ba \\ A &\rightarrow a \\ B &\rightarrow a \end{aligned}$$

Two parse trees for $w = aa$



Unambiguous Grammar with both left recursion
and left factoring

Consider the grammar-

$$S \rightarrow sa/\epsilon/bB/b\emptyset$$

$$B \rightarrow b$$

$$\emptyset \rightarrow d$$

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