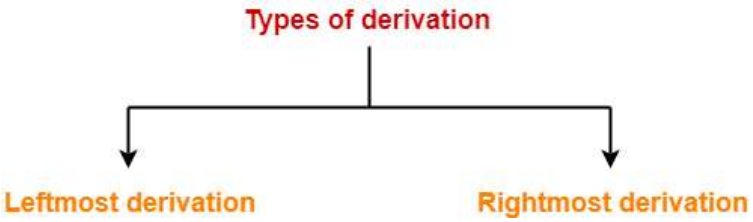
Parse Tree-

- The process of deriving a string is called as **derivation**.
- The geometrical representation of a derivation is called as a **parse tree** or **derivation tree.**



1. Leftmost Derivation-

- The process of deriving a string by expanding the leftmost non-terminal at each step is called as **leftmost derivation**.
- The geometrical representation of leftmost derivation is called as a **leftmost derivation tree**.

Example-

Consider the following grammar-

$$S \rightarrow aB / bA$$

$$S \rightarrow aS / bAA / a$$

$$B \rightarrow bS / aBB / b$$

(**Unambiguous Grammar**)

Let us consider a string w = aaabbabbba

Now, let us derive the string w using leftmost derivation.

Leftmost Derivation-

S → a**B**

→ aa**B**B (Using B → aBB)

→ aaa**B**BB (Using B → aBB)

→ aaab**B**B (Using B → b)

→ aaabb**B** (Using B → b)

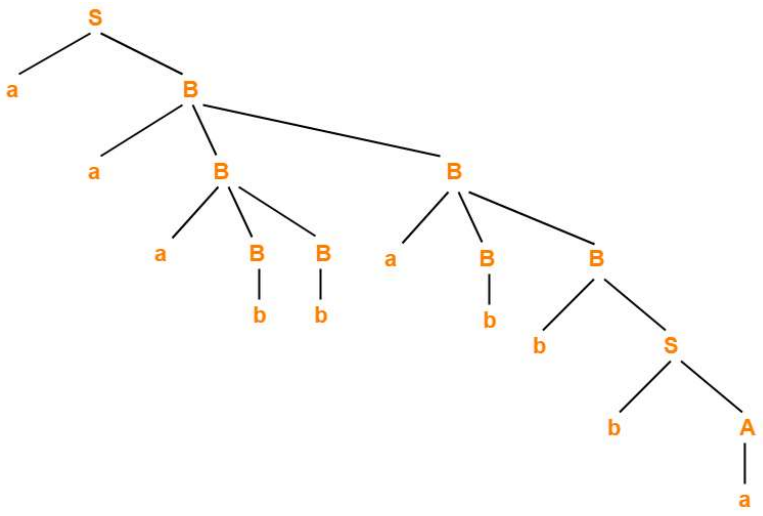
→ aaabba**B**B (Using B → aBB)

→ aaabbab**B** (Using B → b)

→ aaabbabb**S** (Using B → bS)

→ aaabbabbb**A** (Using S → bA)

→ aaabbabbba (Using A → a)



Leftmost Derivation Tree

2. Rightmost Derivation-

- The process of deriving a string by expanding the rightmost non-terminal at each step is called as **rightmost derivation**.
- The geometrical representation of rightmost derivation is called as a **rightmost derivation tree**.

Example-

Consider the following grammar-

S → aB / bA

S → aS / bAA / a

B → bS / aBB / b

(**Unambiguous Grammar**)

Let us consider a string w = aaabbabbba

Now, let us derive the string w using rightmost derivation.

Rightmost Derivation-

S → a**B**

→ aaB**B** (Using B → aBB)

→ aaBaB**B** (Using B → aBB)

→ aaBaBb**S** (Using B → bS)

→ aaBaBbb**A** (Using S → bA)

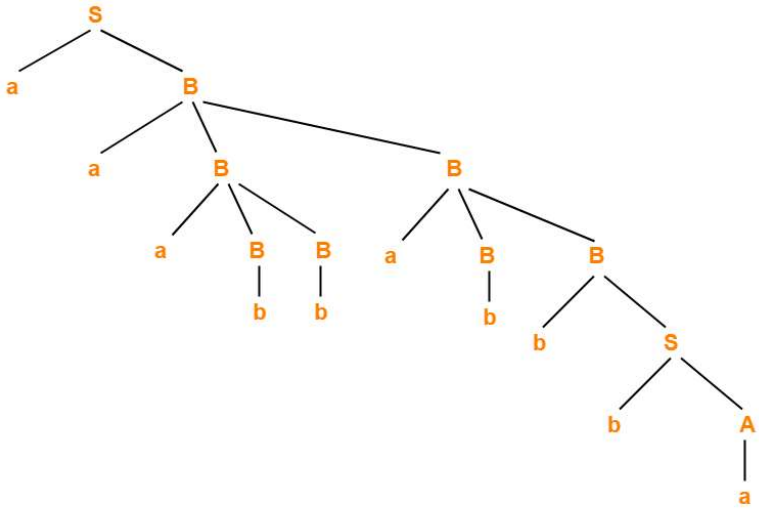
→ aaBa**B**bba (Using A → a)

→ aa**B**abbba (Using B → b)

→ aaaB**B**abbba (Using B → aBB)

→ aaa**B**babbba (Using B → b)

→ aaabbabbba (Using B → b)



Rightmost Derivation Tree

NOTES

- For unambiguous grammars, Leftmost derivation and Rightmost derivation represents the same parse tree.
- For ambiguous grammars, Leftmost derivation and Rightmost derivation represents different parse trees.

Here,

- The given grammar was unambiguous.
- That is why, leftmost derivation and rightmost derivation represents the same parse tree.

Leftmost Derivation Tree = Rightmost Derivation Tree

Also Read- Ambiguous Grammar

Properties Of Parse Tree-