Derivations Tree:

It is useful to display derivations as trees. These pictures, called derivation (or generation or production or parse, syntax) trees.

Leaf: a vertex which has no sons, usually represent a terminal.

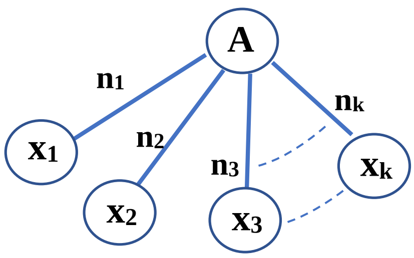
Interior vertex: a vertex with one or more sons usually belongs to a nonterminal.

Yield of the derivation tree: if we read the label of the leaves from left to right, we have a sentential form. We call this string the yield.

Definition:

Let G=(N, T, P, S) be a grammar, a tree is a derivation (parse) tree for G if :

1. Every vertex (node) has a label, which is a symbol of NUTU{ϵ}
2. The label of the root is S.
3. If a vertex n is interior and has label A, then A must be a symbol in N.
4. If a vertex n has label A and vertexes n_1, n_2, ……….. n_k are the sons of the vertex n, in order from the left, with labels x_1, x_2, x_3,……….. x_k respectively, then A → x_1, x_2, x_3,…….. x_k must be a production in P.
5. If a vertex n has the label ϵ , then the vertex n is a leaf and is the only son of its father.



Example /

Consider the grammar G=({S,A },{a,b},P,S), where P consist of

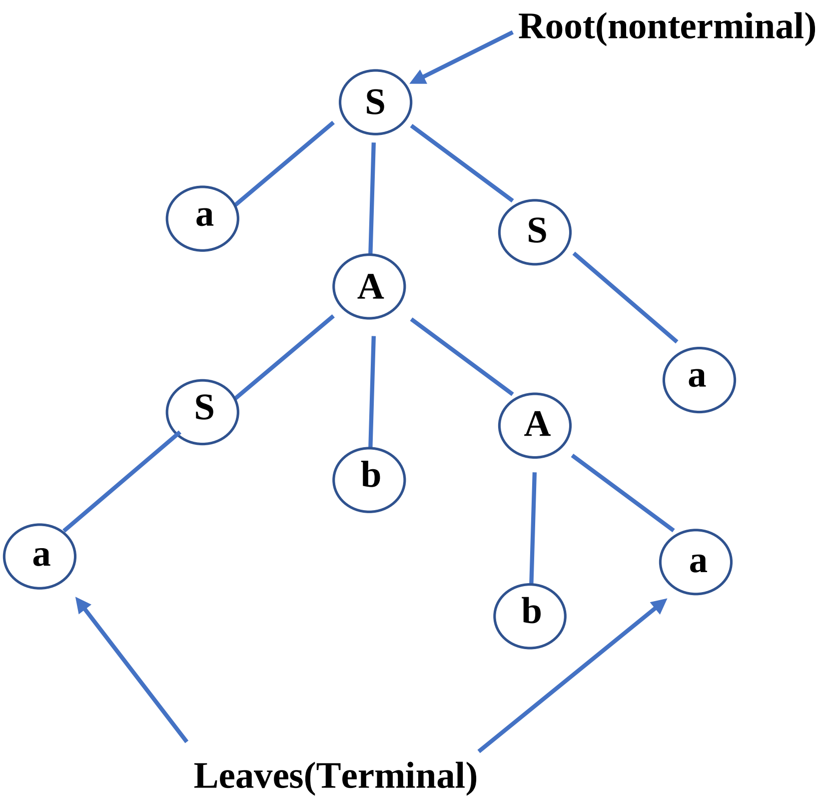
S→ aAS / a

A →SbA/SS/ba

Draw the derivation tree for the string (**aabbaa**)

Answer /

S → a**A**S → a**S**bAS → aab**A**S → aabba**S** → aabbaa



H.W/

Let G = ({ S, A, B }, { a, b }, P, S), where

P = { S→ AB, A→ aA / a, B→ bB / b }

Draw the derivation tree for the string :

1. W / W = ($a^2 b^3$)
2. W / W = ($a^3 b^2$)
3. (**aaabbb**)

Ambiguity

A grammar can lead to the generation of an identical string or sentence by two or more different derivations. Such a grammar is known as ambiguous grammar, otherwise, it is said to be unambiguous.

Example1 /

Consider the grammar G=({S,A,B },{a,b},P,S), where

P ={ S → AB, B →ab / b, A→ aa / a }

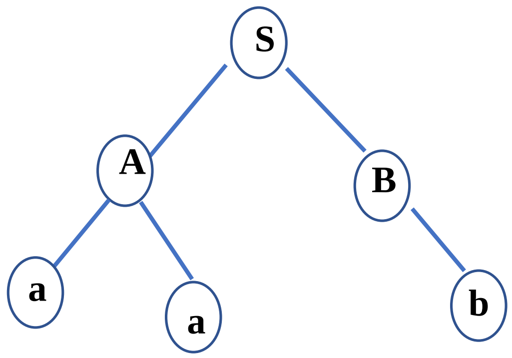
Is the Grammar G ambiguous for the string " aab " ?

Answer /

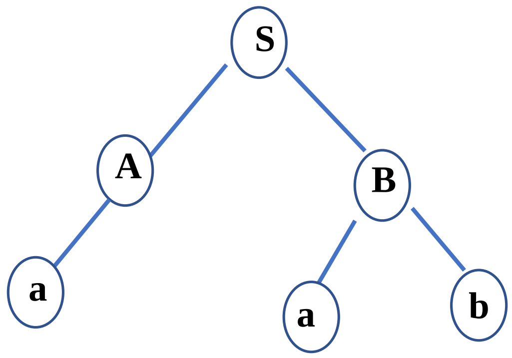
S → **A**B→ aa**B**→ aab ………(1)

S → **A**B → a**B** →aab ……......(2)

(1)



(2)



The grammar G is ambiguous

Example2 /

Let G=({S },{a,b,c},P,S), where P ={ S→ SbS / ScS/ a }

Is the Grammar G ambiguous for the string " abaca "?

Binary operation on language

Reverse operation العمليات المعكوسة

Suppose L is given language generated by G : (N , T , P , S) then the reversal grammar that generates $\mathbf{L^R}$ is grammar $\mathbf{G^R}$: (N , T , P^R , S)

where $L^R = \{ \propto^R / \propto \in L\}$ the set of production p^R is obtained from P as

$\{ \propto^R \rightarrow B^R / \propto \rightarrow B \in P \}$

Example /

Let G=({S,A,B },{a,b},P,S), where

P ={ S→ AB, B→ ab / b, A→ aa / a }

Then, we will get the string (**W= aaab**) as: **S →<u>A</u>B →aa<u>B</u> →aaab**

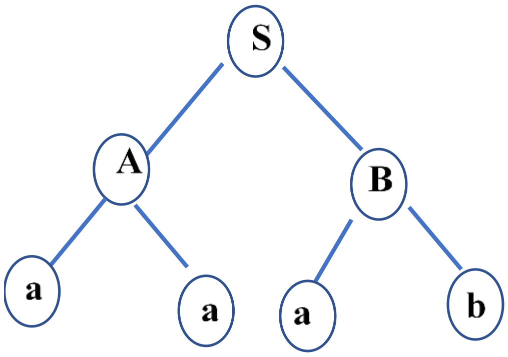
, thus will be in L(G).

If we use the grammar G^R=(N,T,P^R,S) where,

P^R ={ S → BA, B→ ba / b, A→ aa / a }

Then we will get ($\mathbf{W^R}$ **= baaa**) as : **S→ <u>B</u>A →ba<u>A</u>→ baaa**

W:



W^R: