Derivation Tree

$S \to AB$
$A \to a$
$B \to b$
3P

A derivation Tree / Parse tree for a Context free Grammar G = (Vn, Sigma, P, S) is a tree stisfying the following conditions

1) Every vertex has a label which is a variable or terminal or null
2)The root has label S
3) The label of an internal vertex is a variable.
4)Next Page
5)Next Page

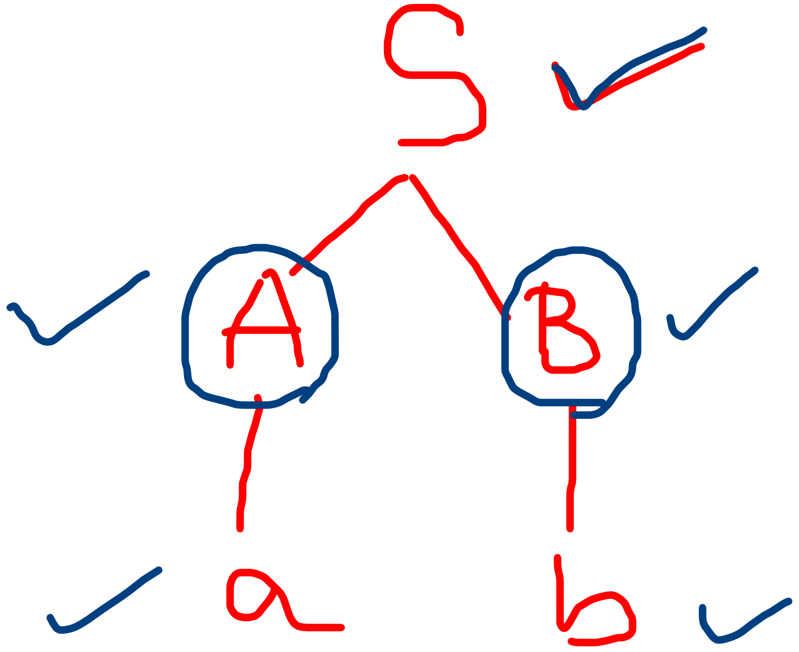
$A \to$ null

$A \to$ ✗

$\underbrace{S \quad A \quad B}_{V_N}$ $\quad \underbrace{a \quad b}_{\Sigma}$

Root = S

Internal Vertex = A, B



Derivtion Tree for deriving "ab"

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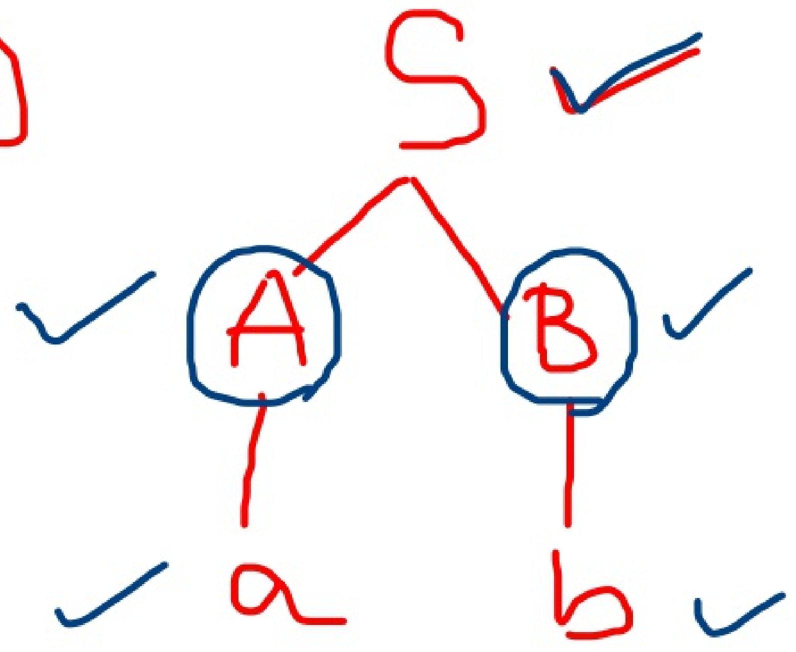


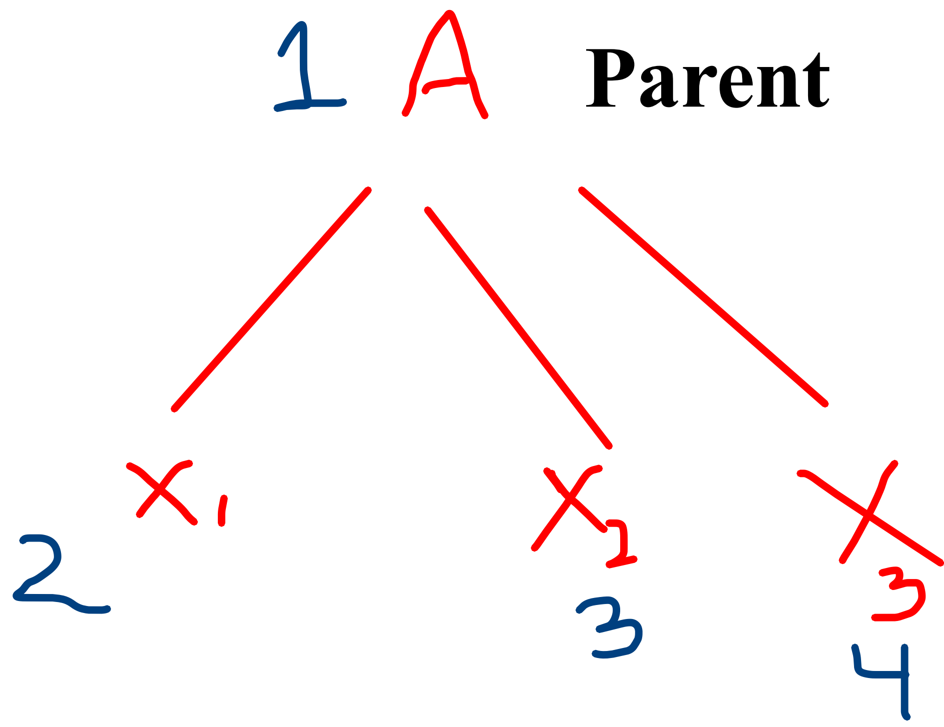
Derivtion Tree for deriving "ab"

4) If the vertices n1, n2,.....,nk written with labels X1, X2,......,Xk are the sons of vertex n with label A, then A->X1X2.....Xk is a production in P

5) A vertex n is a leaf if its label is a belongs to sigma or null.
n is the only son of its father if its label is null.

$$A \to X_1 X_2 X_3$$

Parent Sons

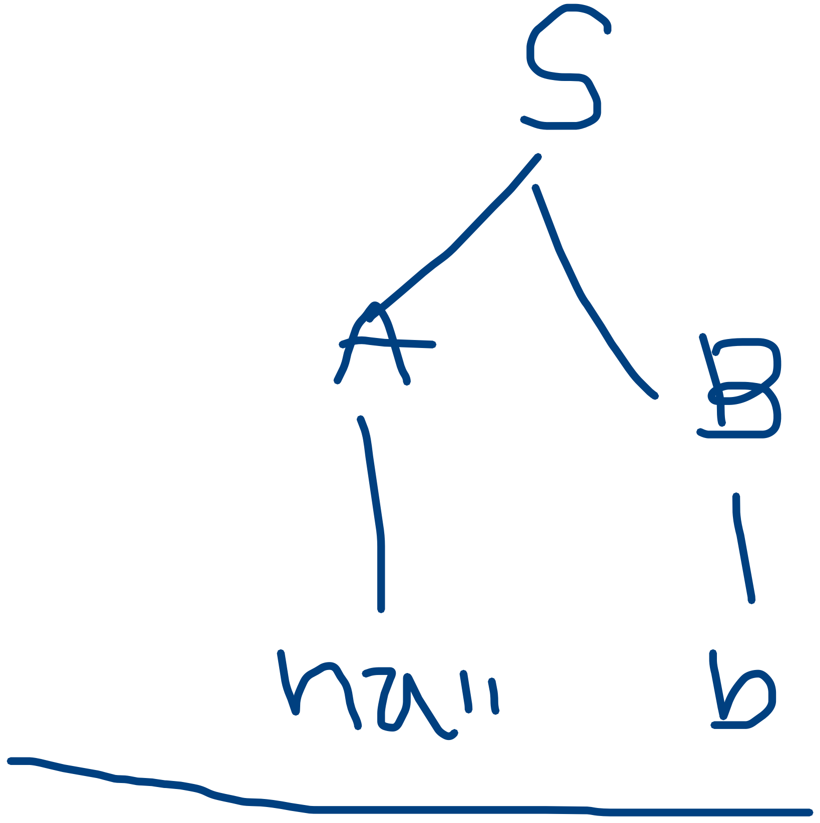


Sons

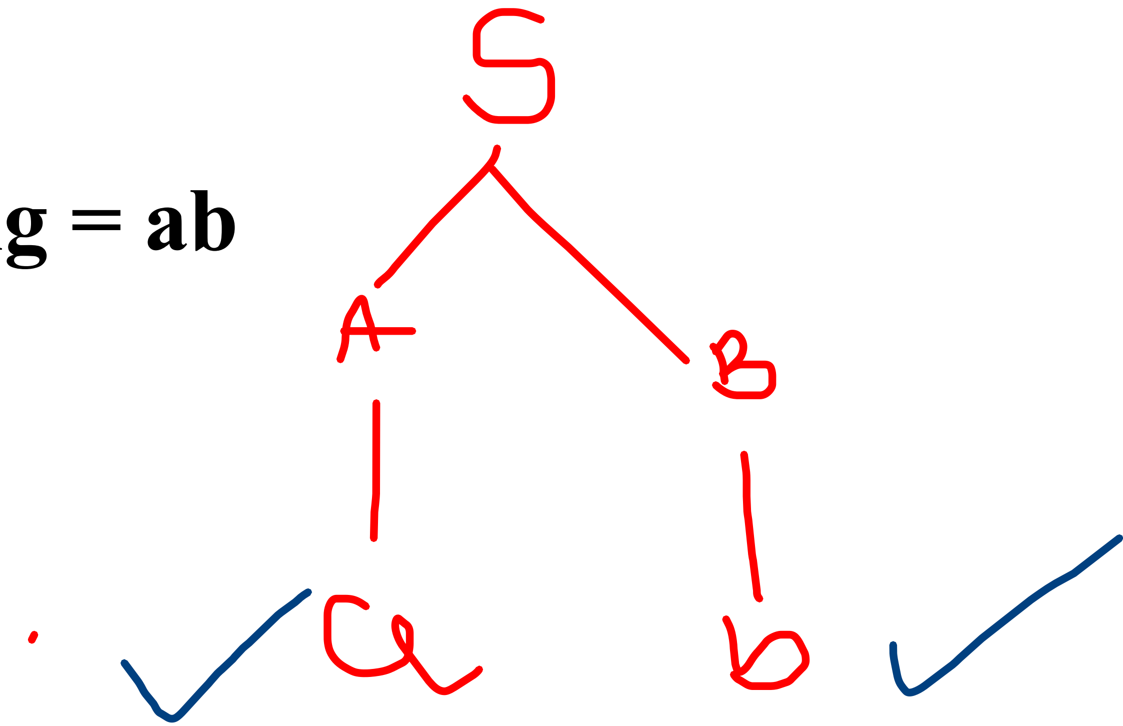
n=1,n1=2, n2=3,n3=4

5) A vertex n is a leaf if its label is a belongs to sigma or null. n is the only son of its father if its label is null.

String = b



String = ab



$a \in \Sigma$ or null

Context free grammar

A grammar of the form

A-> Alpha

is called Context free grammar.

Where, A is a variable
Alpha belongs to (Vn U Σ)*

$(V_n \cup \Sigma)^*$ null

BC   a b c

A-> BC Only Vn's
B->aBCDb Combinations of Vn and sigma
A->a Only single terminal symbol
C->abc Many sigma's
A->null null *
A->B Only single Vn

$A \rightarrow \alpha$

$\alpha = (V_n \cup \Sigma)^*$

All derivations are in the above form

Left hand side contains only one variable

α =Right hand side of the derivation

$(0 \cup 1)^*$

$(0+1)^*$

S-> aAS | a

A-> SbA | SS | ba

a a b b a a

Both=Start,end

Use right most derivation to derive the string "aabbaa"

Check Starting and ending symbol always, pattern of the string should not be disturbed

S->a A S (S->a A S)

-> a A a (S->a)

->aSbAa (A->SbA)

->aSbbaa (A->ba)

->aabbaa (S->a)

In case of Multiple op= left to right order

A-> SbA | SS

Choose SbA first

S-> aAS | a
A-> SbA | SS | ba

Use right most derivation to derive the string "aabbaa"

Check Starting and ending symbol.

$$\frac{A}{abba}$$

Multiple op= left to right order

a a b b a a

Both=Start,end

$S \rightarrow aAS$
$\rightarrow aAa$
$\rightarrow aSbAa$
$\rightarrow aSbbaa$
$\rightarrow aabbaa$

S->0B | 1A
A->0 | 0S | 1AA
B->1 | 1S | 0BB

0 0 1 1 0 1 0 1

Derive the string "00110101"
using right most derivation

S->0B (S->0B)
-> 00BB (B->0BB)
->00B1 (B->1)
->001S1 (B->1S)
->0011A1 (S->1A)
->00110S1 (A->0B)
->001101A1(S->1A)
->00110101 (A->0)

S->0B | 1A

A->0 | 0S | 1AA

B->1 | 1S | 0BB

Derive the string "00110101" using right most derivation

0 0 1 1 0 1 0 1

$S \rightarrow 0B$

$\rightarrow 0\,0BB$

$\rightarrow 0\,0B1$

$\rightarrow 0\,0\,1S1$

$\rightarrow 0\,0\,1\,1A1$

$\rightarrow 0\,0\,1\,1\,0S1$

$\rightarrow 0\,0\,1\,1\,0\,1A1$

$\rightarrow 0\,0\,1\,1\,0\,1\,0\,1$

S

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