CS & IT ENGINEERING

Data Structure

Tree
Chapter- 5
Lec- 03

By- Pankaj Sharma sir

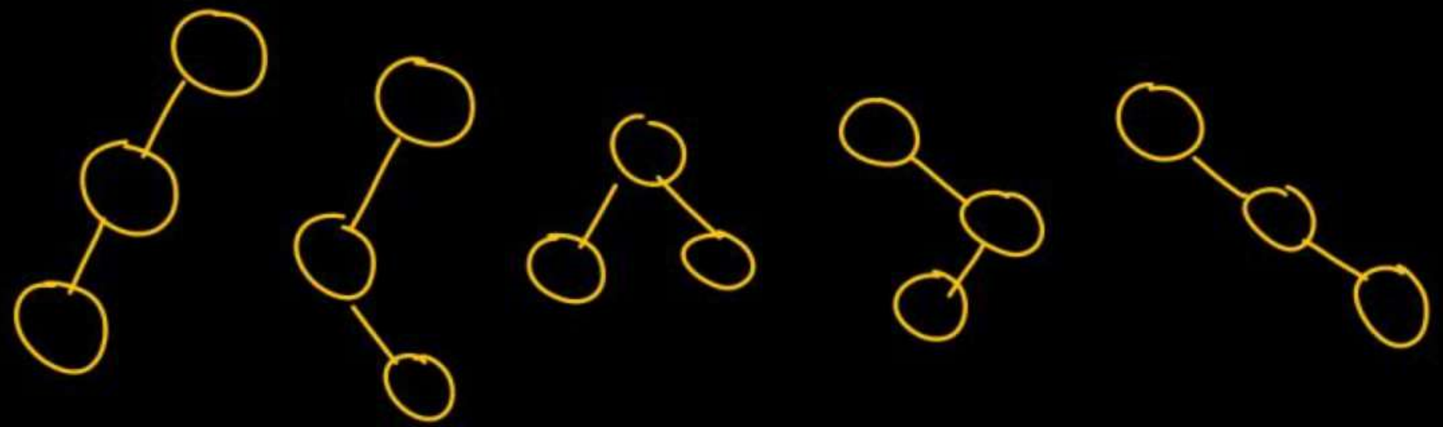
Tree-III

unlabeled binary trees with n nodes (structure/shape)

$n = 1$

$n = 2$

$n = 3$



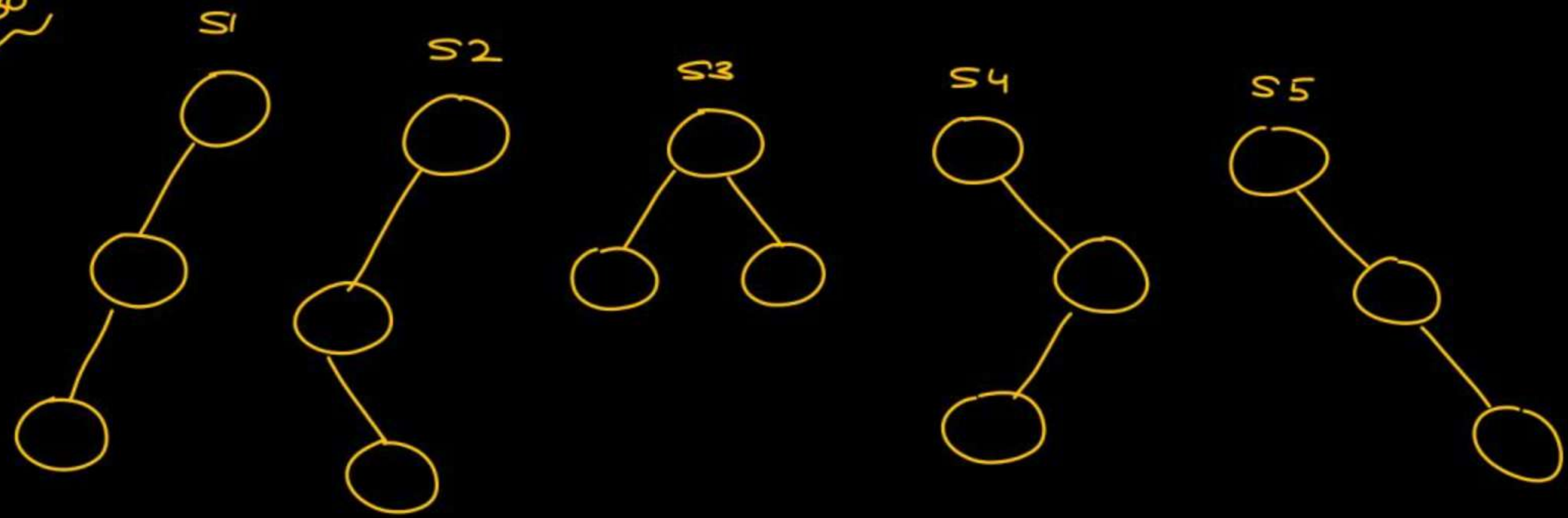
$$\#\text{ unlabeled binary trees with } n \text{ nodes} = \frac{{}^{2n}C_n}{n+1}$$

$n = 3$

$$\frac{{}^{6}C_3}{3+1} = \frac{{}^{6}C_3}{4} = \frac{6!}{4 \times 3! 3!} = \frac{\cancel{6} \times 5 \times \cancel{4} \times \cancel{3!}}{\cancel{4} \times \cancel{3!} \times \cancel{3!}} = 5$$

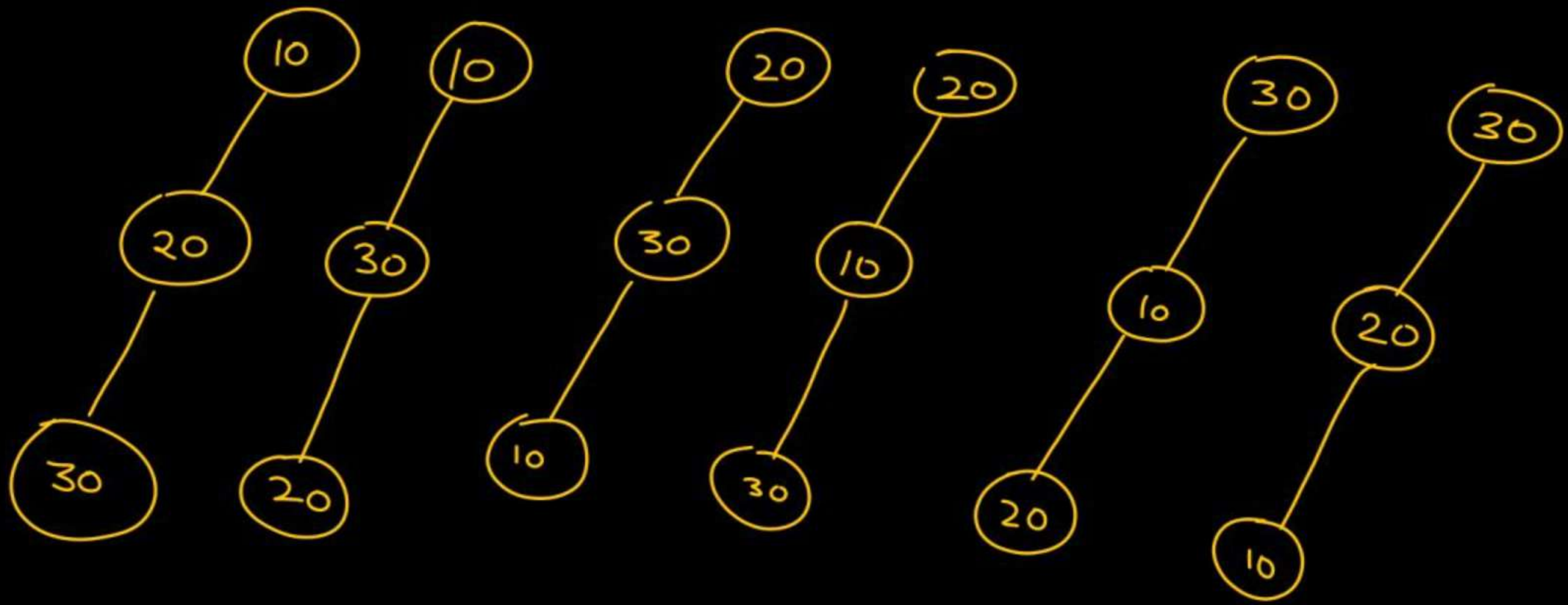
$n = 3 \Rightarrow 5$ binary tree structures are possible

10, 20, 30

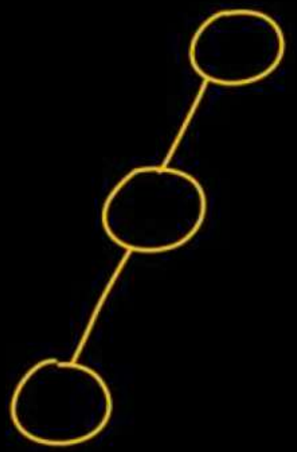


10, 20, 30

3!



$n = 3$



S1

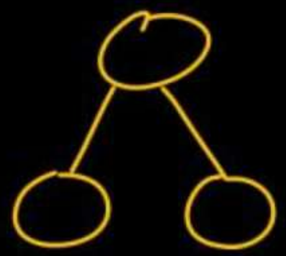
$\Downarrow$

$6(3!)$

S2

$\Downarrow$

$6(3!)$



S3

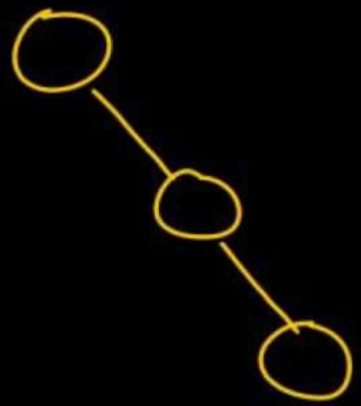
$\Downarrow$

$6(3!)$

S4

$\Downarrow$

$6(3!)$



S5

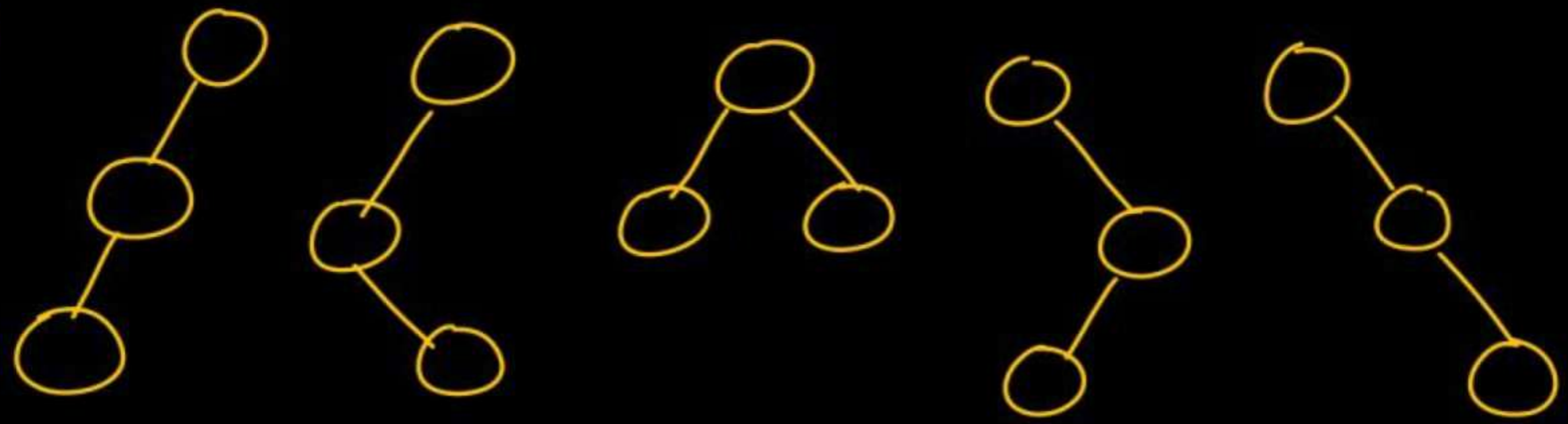
$\Downarrow$

$6(3!)$

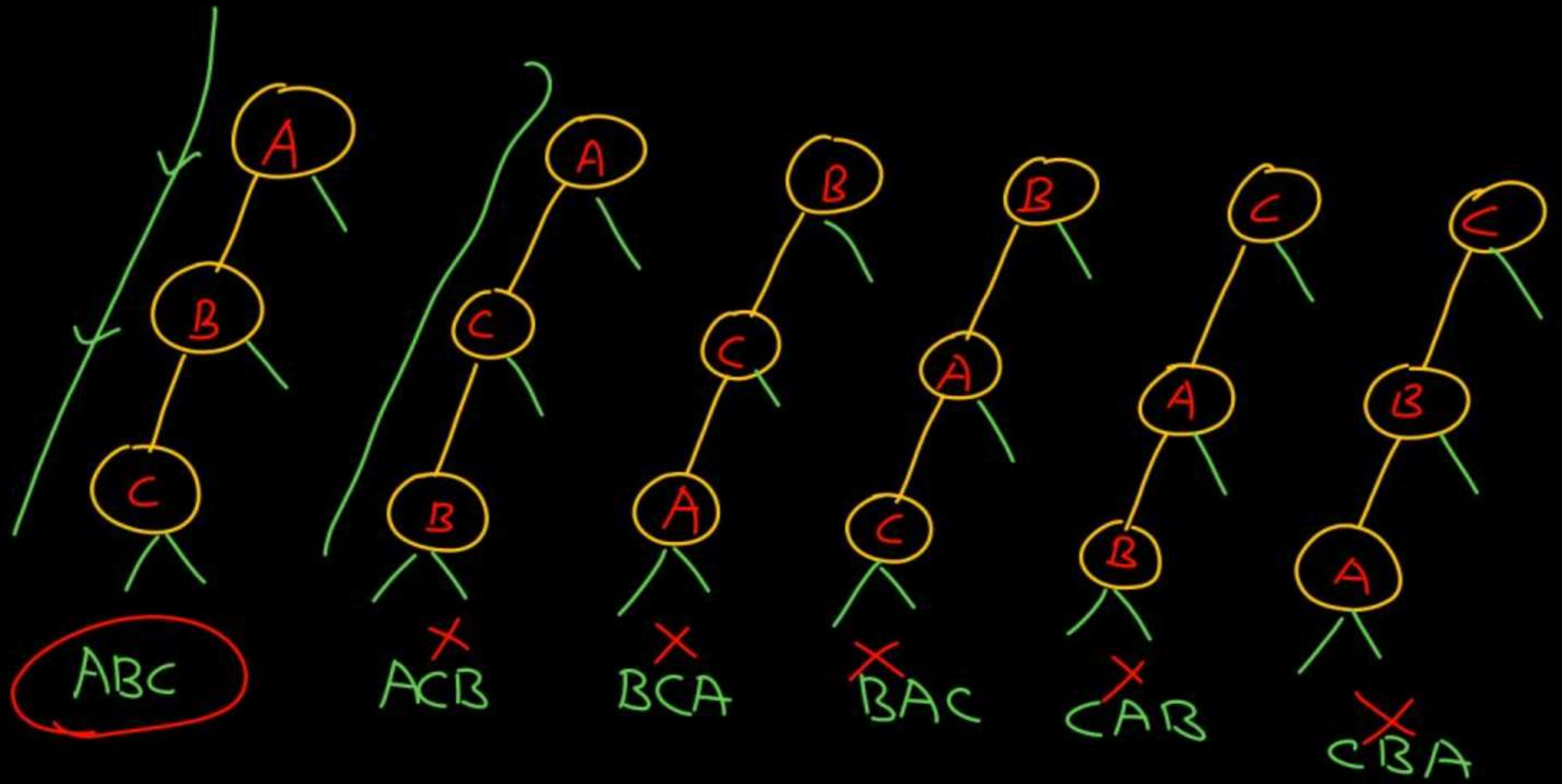
$$\#\text{labeled binary trees with } n \text{ nodes} = \frac{{}^{2n}C_n}{n+1} \times n!$$

$n=3$

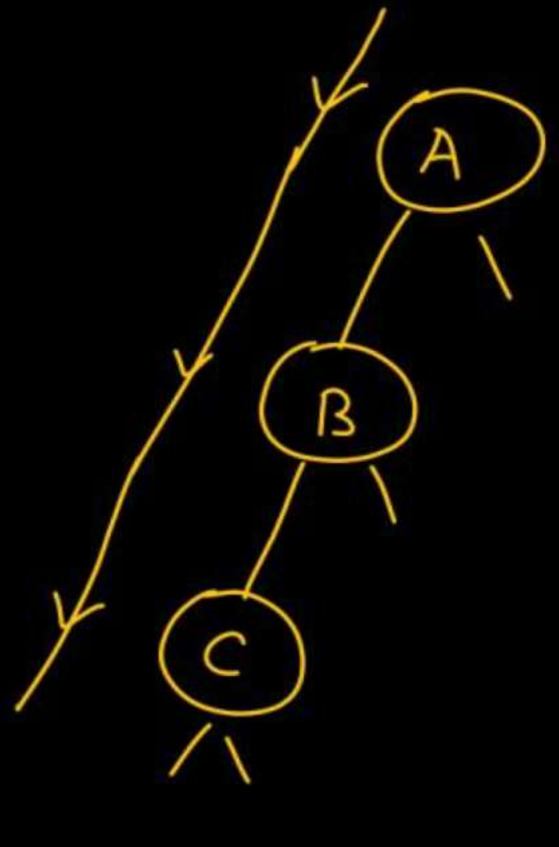
A BC

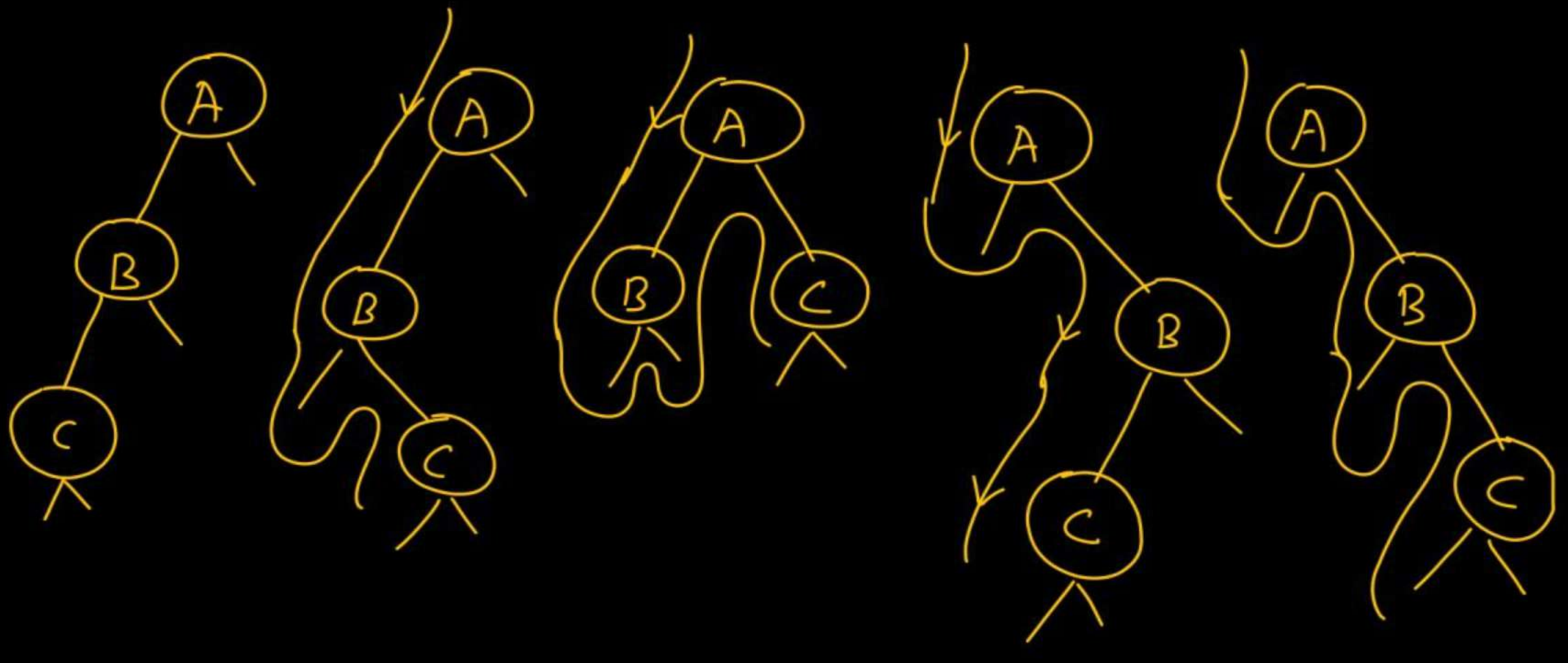


How many binary trees are possible with preorder : ABC


A
B
C
ABC
A
C
B
X
ACB
B
C
A
X
BCA
B
A
C
X
BAC
C
A
B
X
CAB
C
B
A
X
CBA

ABC




A
B
C
A
B
C
A
B
C
A
B
C
A
B
C

With a given preorder (length n), no. of binary trees possible

$$= \frac{2nC_n}{n+1}$$

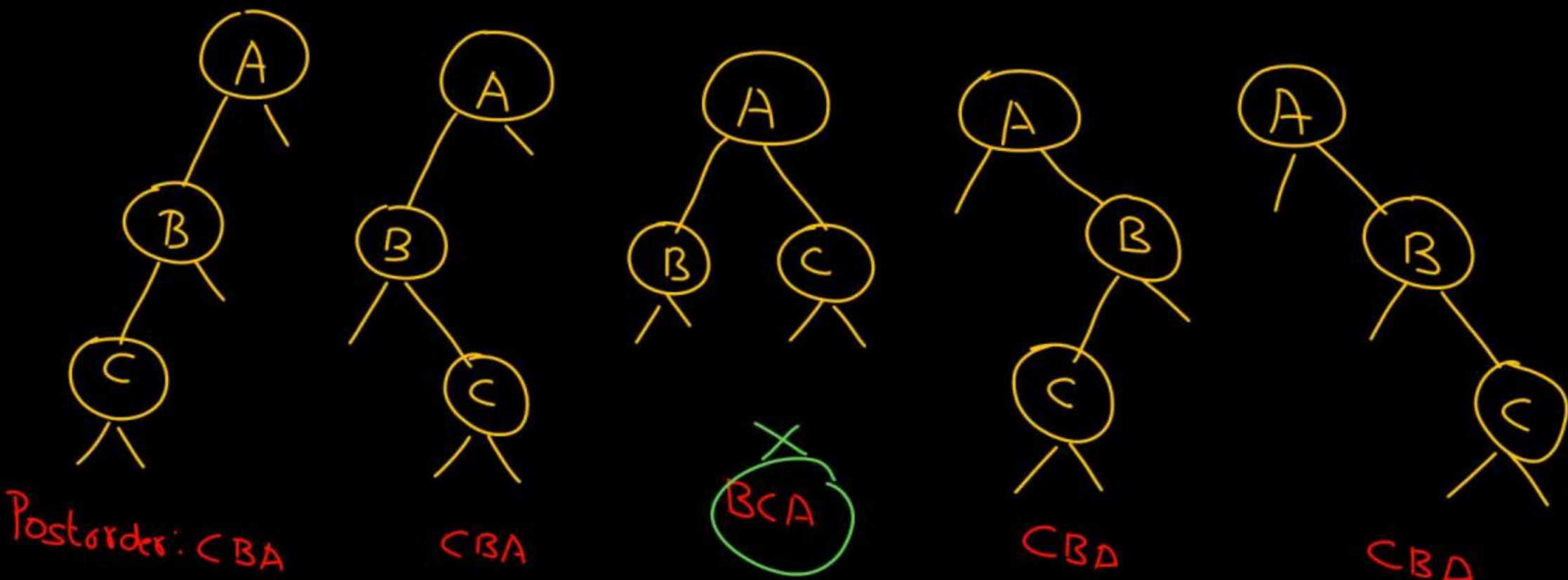
Given postorder, how many binary trees are possible (length n)

$$= \frac{{}^{2n}C_n}{n+1}$$

**

With only 1 traversal order (Pre / Post / Inorder) of length n, no. of binary trees $= \frac{{}^{2n}C_n}{n+1}$

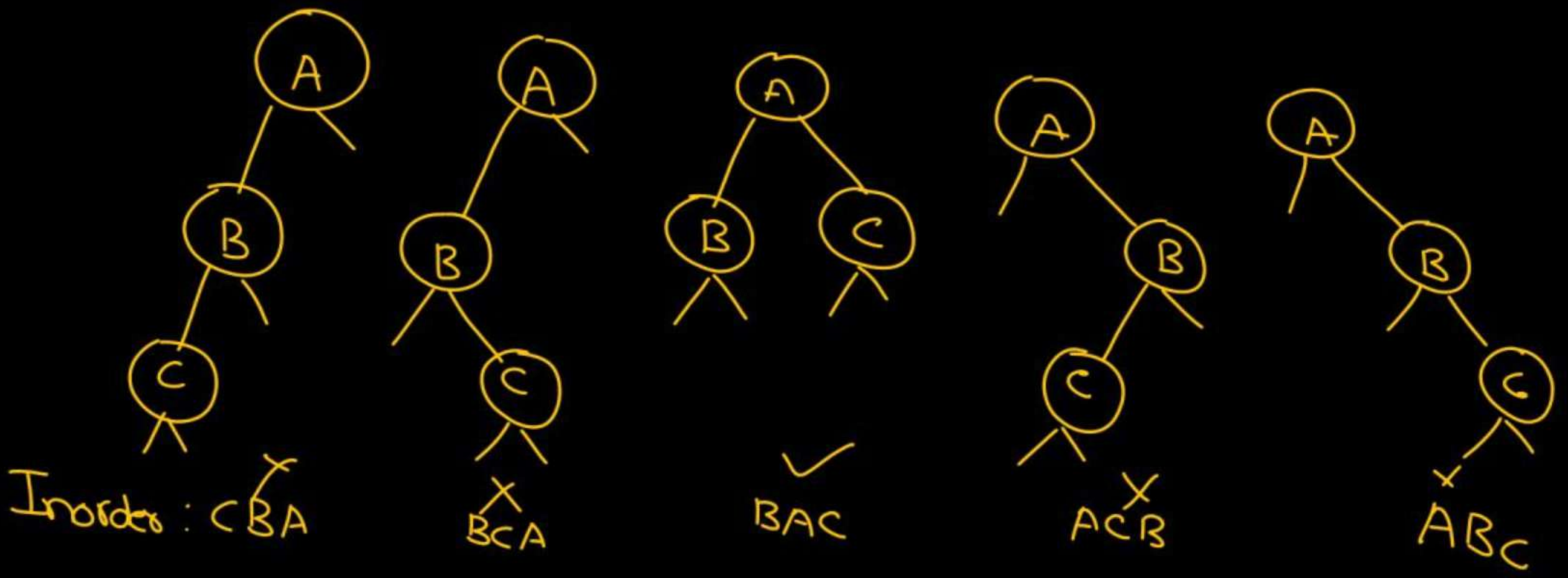
No. of binary trees possible with preorder : ABC
postorder : CBA.



With given preorder and postorder, how many binary trees are possible = Many

Given preorder : ABC

Inorder : BAC , how many binary trees are possible.



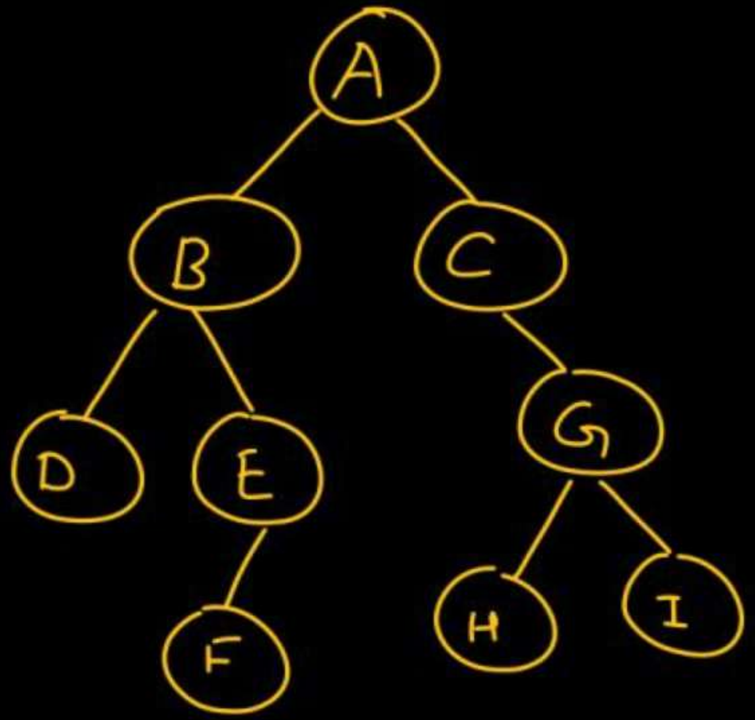
With a given preorder & inorder, no of binary trees possible = 1

With a given postorder & inorder, no. of binary trees possible = 1

With a given postorder & preorder, many binary trees are possible.

preorder : ABC

Inorder : CAB



Pre: ABDEFCGHI

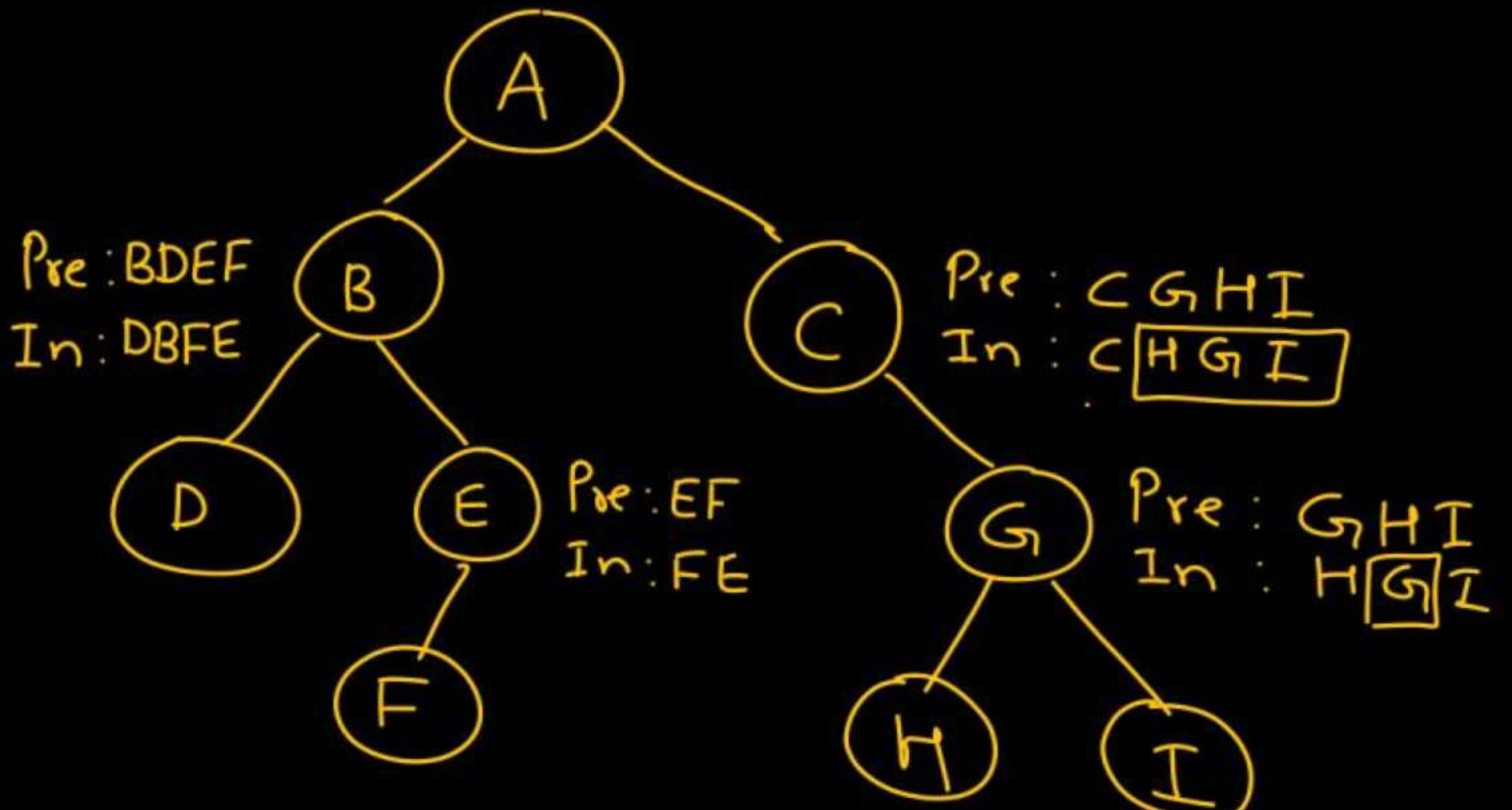
In: DBFEACHGI

Root LT RT

Pre : A B D E F C G H I

In : D B F E A C H G I

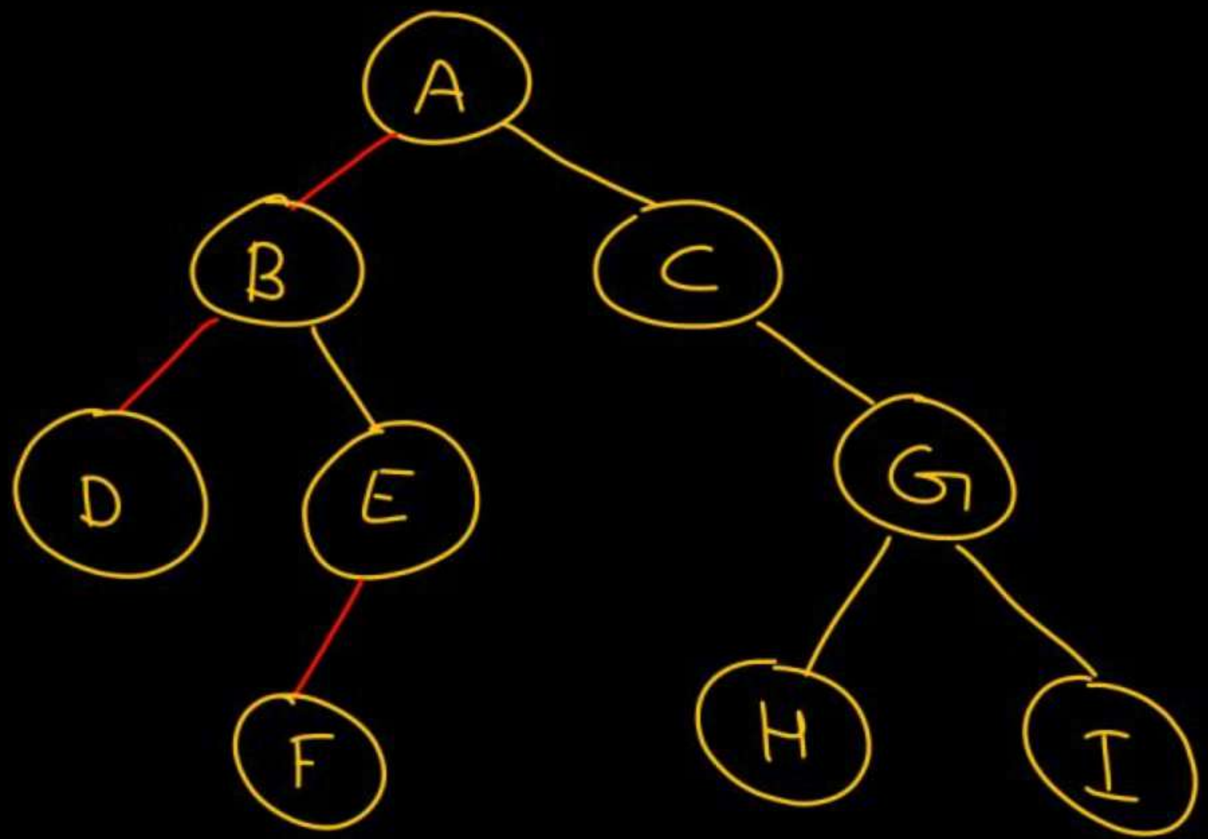
LT RT



Pre : A B D E F C G H I

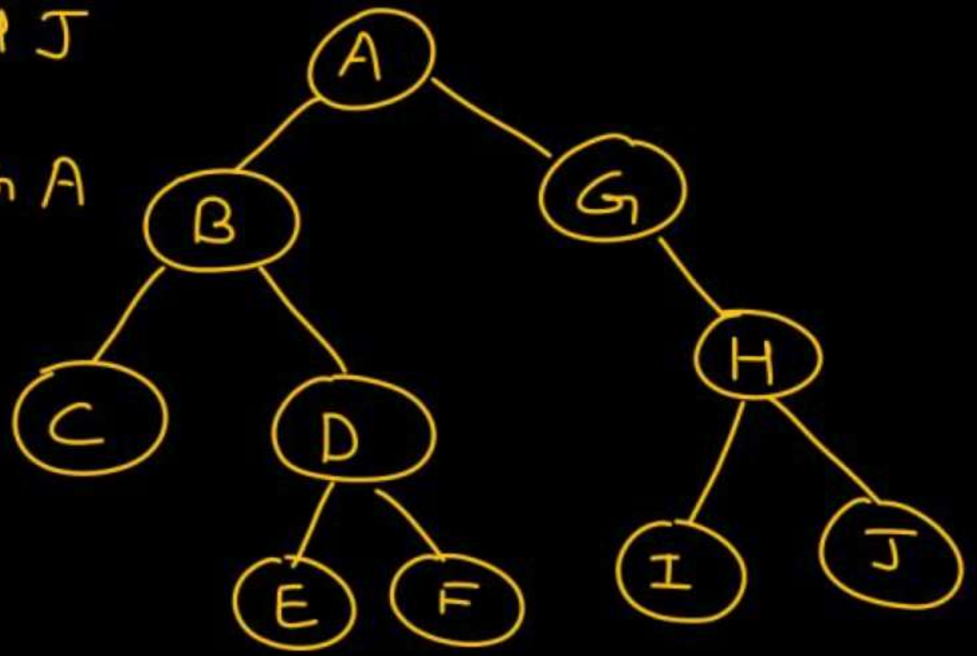
In : D B F E A C H G I

Short-trick



In : C B E D F A G I H J

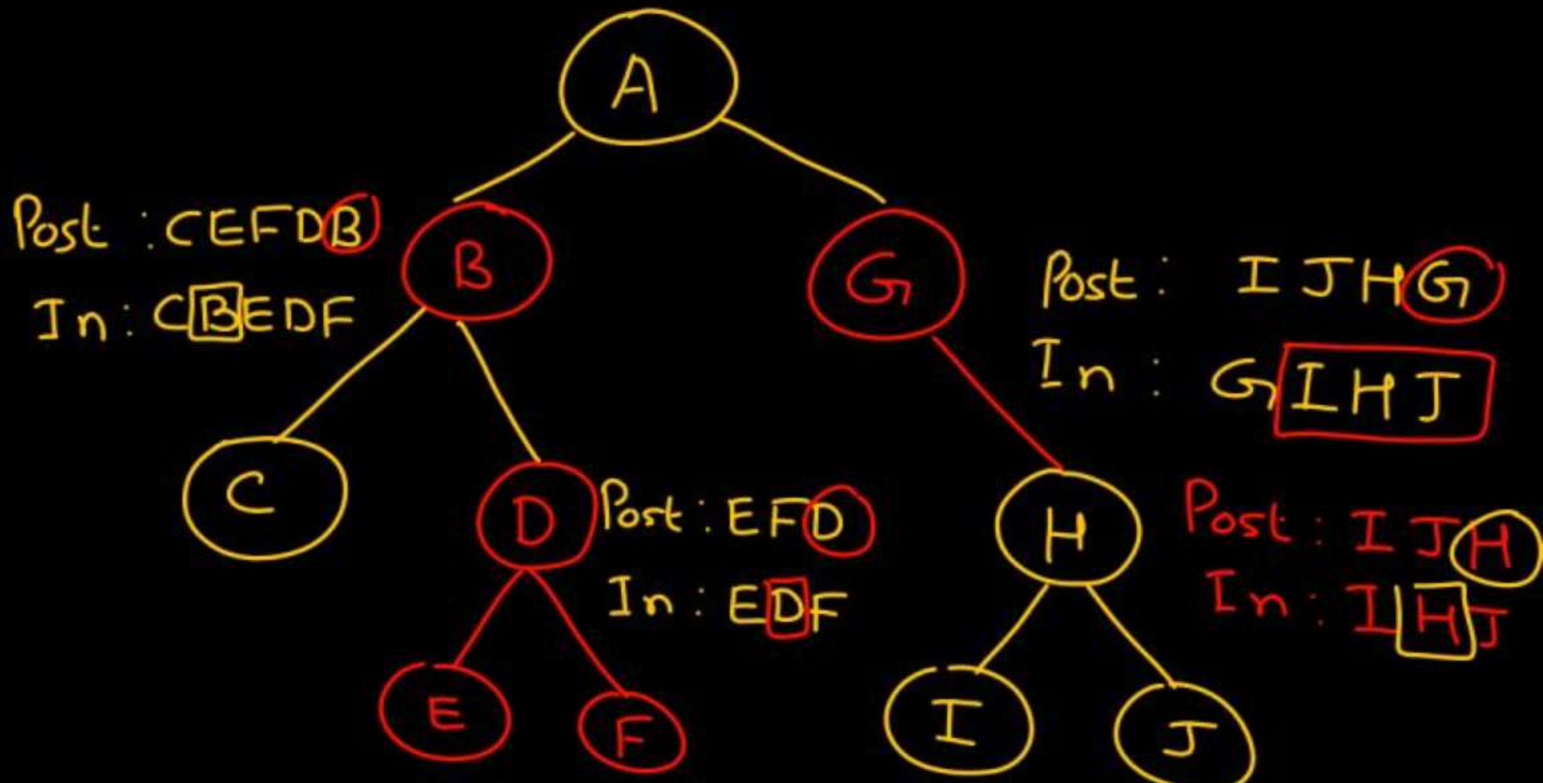
Post : C E F D B I J H G A



In : C B E D F A G I H J

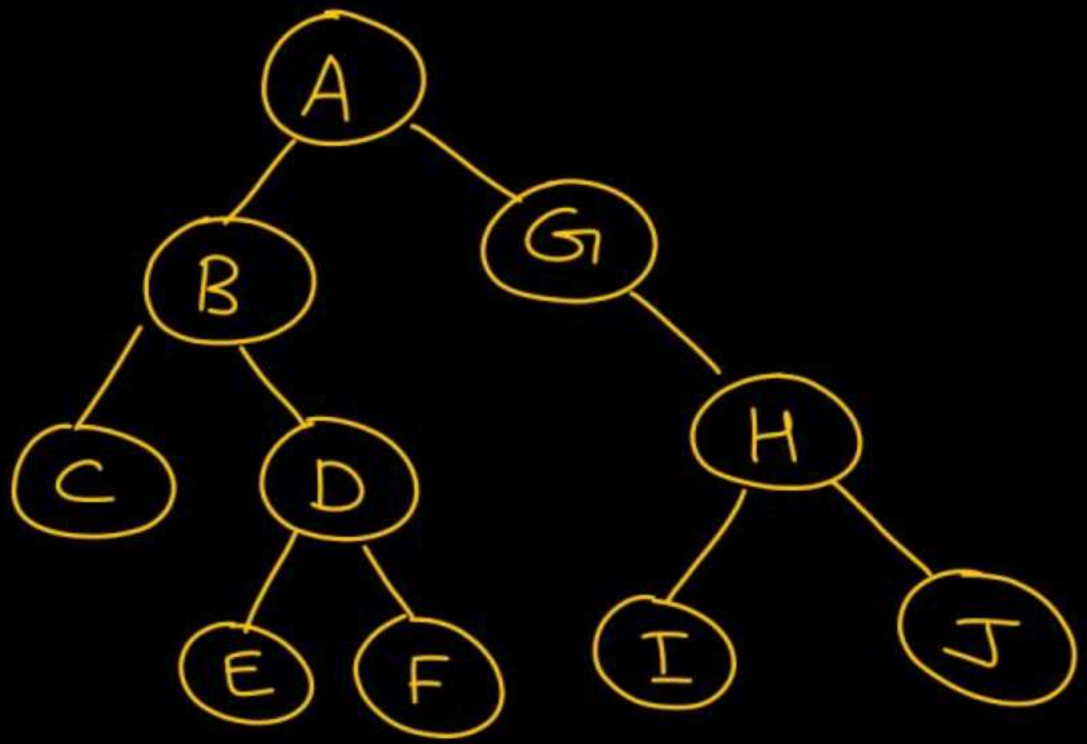
Post : C E F D B I J H G A

$L_T, R_T,$ Root



In : C B E D F A G I H J

Post : C E F D B I J H G A



Homework

binary trees possible with height 3 and only 1 leaf node.

binary trees possible with height 6 and only 1 leaf node.


THANK YOU GW
SOLDIERS !