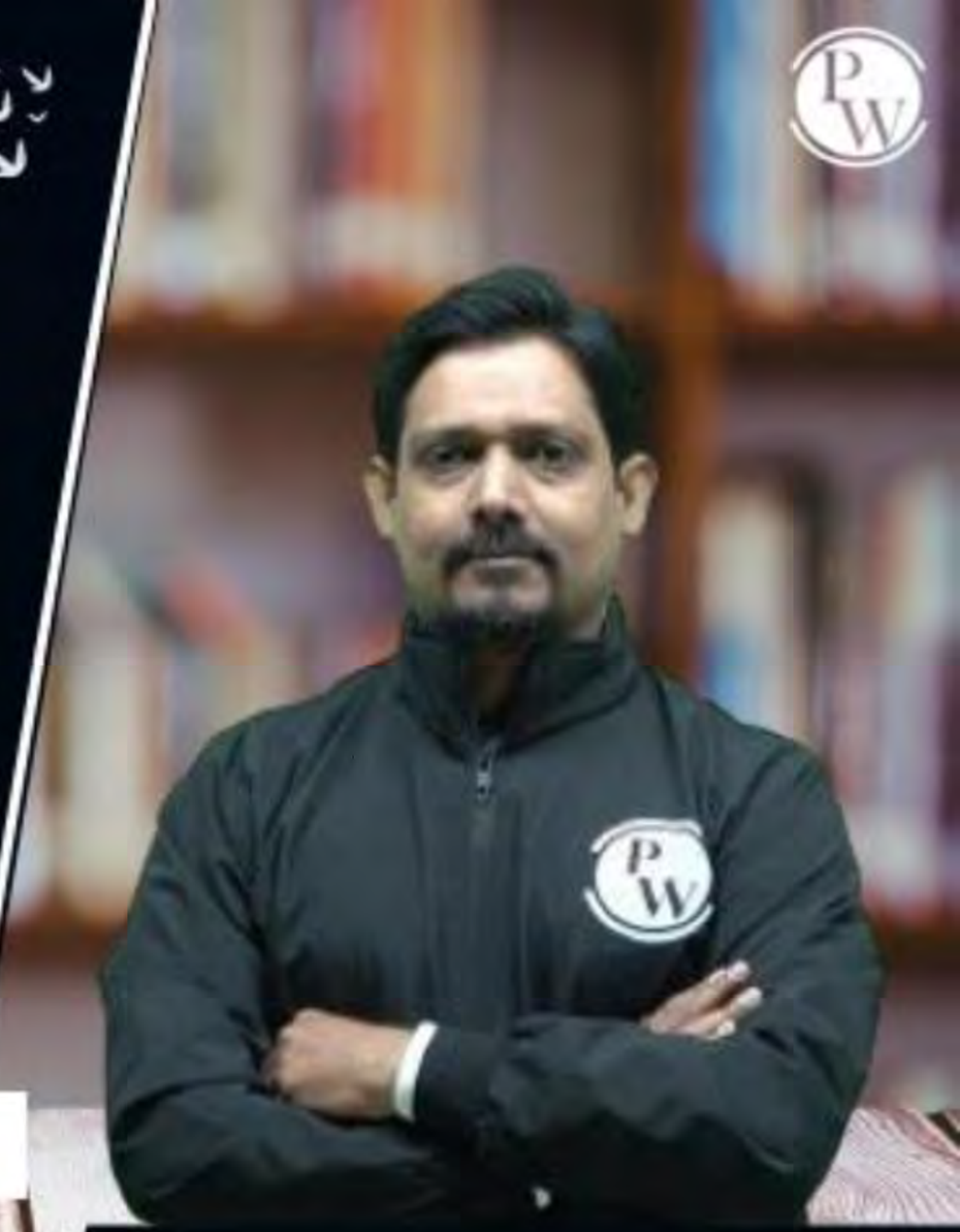
Computer Science & IT

Data Structure & Programming

Tree

Lecture No. 03



By- Abhishek Sir

Recap of Previous Lecture

Topic — Binary tree

Topic — Binary tree Height

Topic — Binary tree Theorem

Topic — Counting of unlabelled tree

Topic

Slide

Topics to be Covered

- Topic
- Topic
- Topic
- Topic
- Topic

Counting of labelled & unlabelled

Binary tree representation

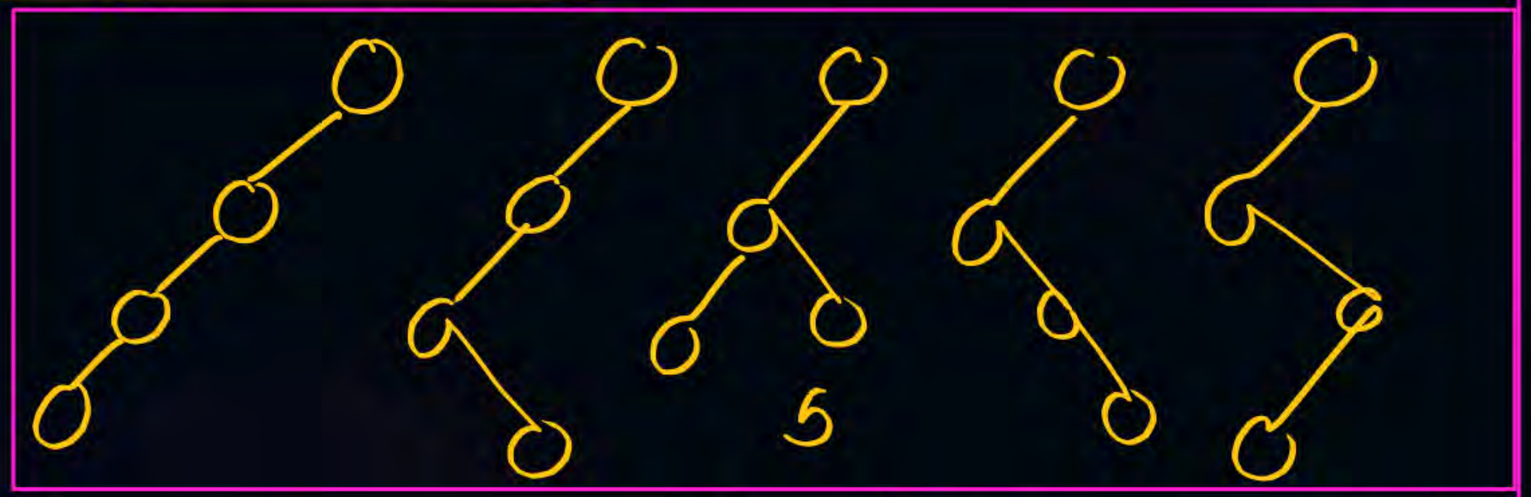
Traversal.

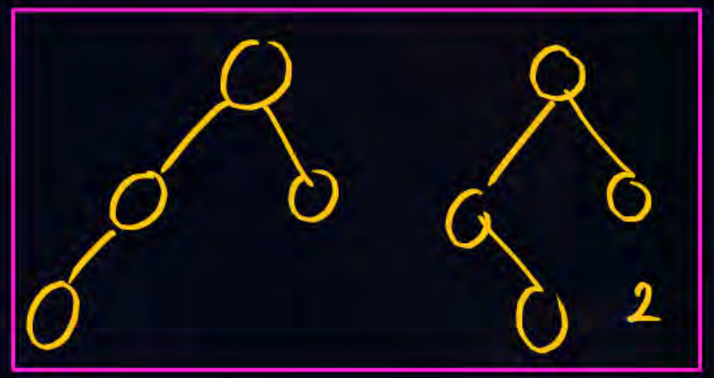
Slide

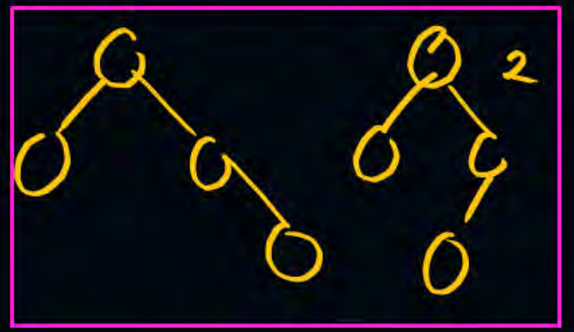
Topic : Tree

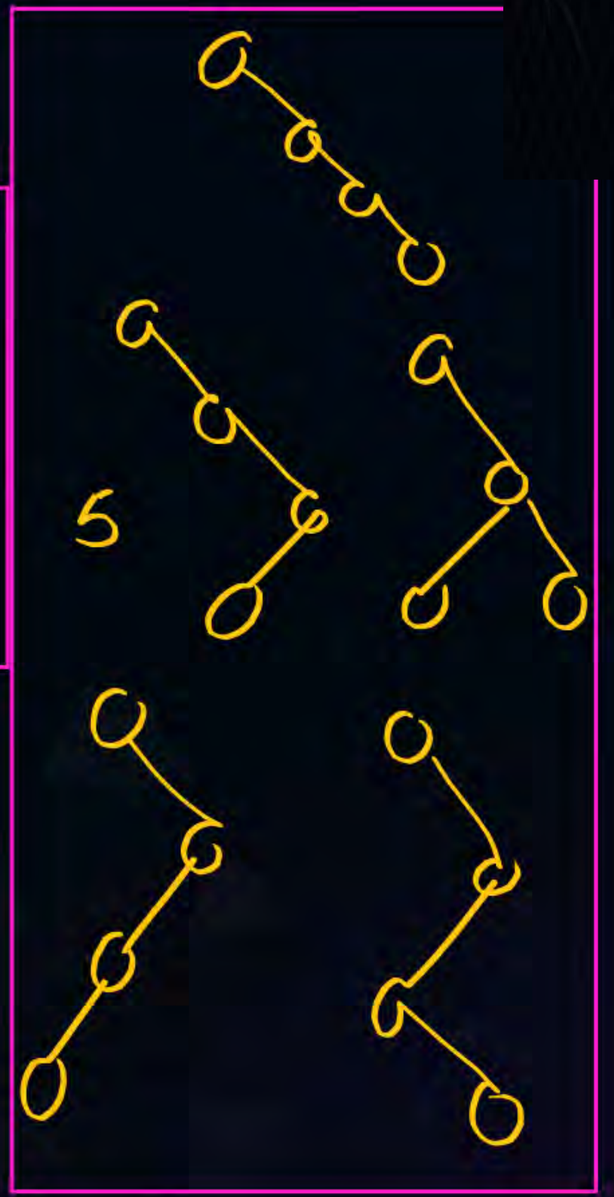
n = 4

L	R
3	0
2	1
1	2
0	3









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Topic : Tree

Catalan No $C_n = \frac{1}{n+1} {}^{2n}C_n$

1 — 1

2 — 2

3 - 5

4 - 15

5 - 42

6 - 132

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Topic : Tree

$n = 5$ → one is root Node

L	R	
4	0	14
3	1	5
2	2	4
1	3	5
0	4	14
		42

if $T(n)$ is No. of unlabelled trees

$$T(n) = \sum_{i=1}^{n} T(n-i)\,T(i-1)$$

Catalan No. Recurrence Relation

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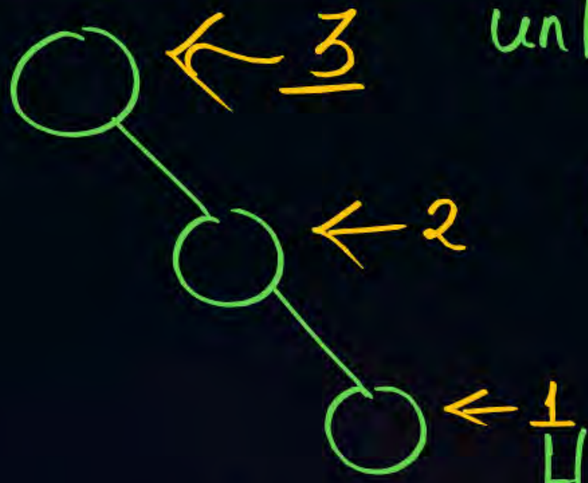
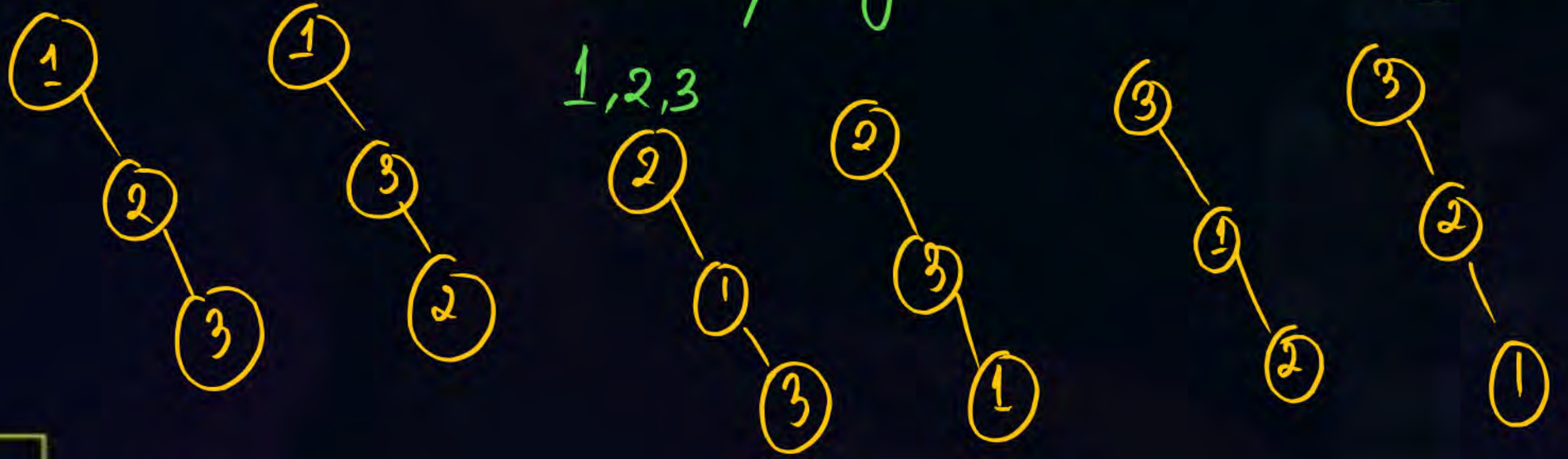
Topic : Tree



unlabelled binary tree

Key value, 1, 2, 3 = 3!

How many ways we can label the given tree by 1, 2, 3



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Topic : Tree

Key

No. of labelled tree with n distinct values

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

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Topic : Tree

Tree Representation

Binary Tree representation

1. Sequential Representation
2. Nested Representation
3. Tree Node representation

Topic : Tree

Binary Tree Sequential Representation (CBT - Complete Binary tree)

An array is used to store Binary tree

With each Node of a tree an Index value is Associated (Not modifiable) Such that if array A is used to store the binary tree then the value at Node with index i goes to position A[i]

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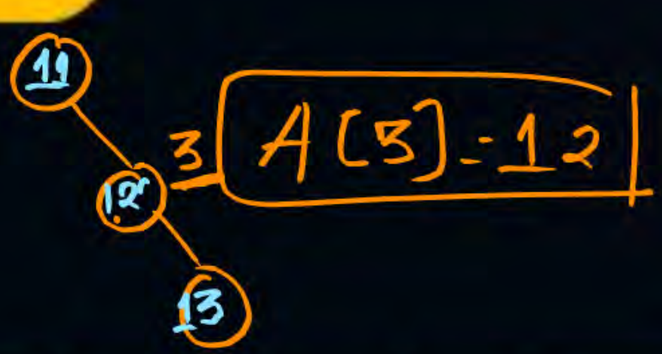
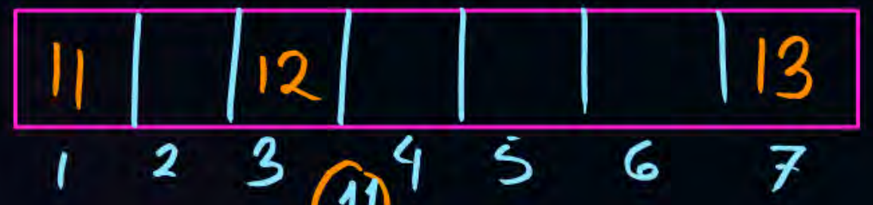
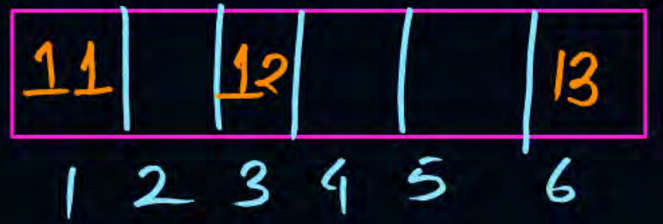
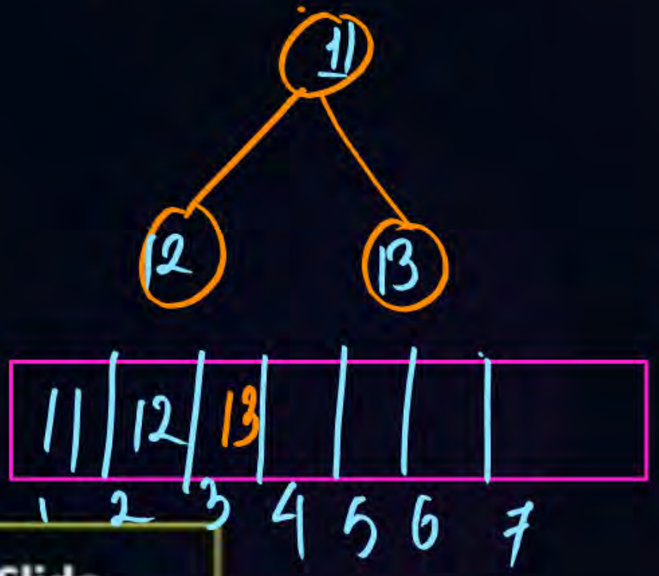
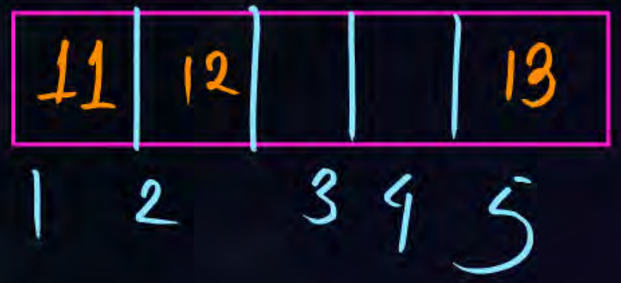
Topic : Tree











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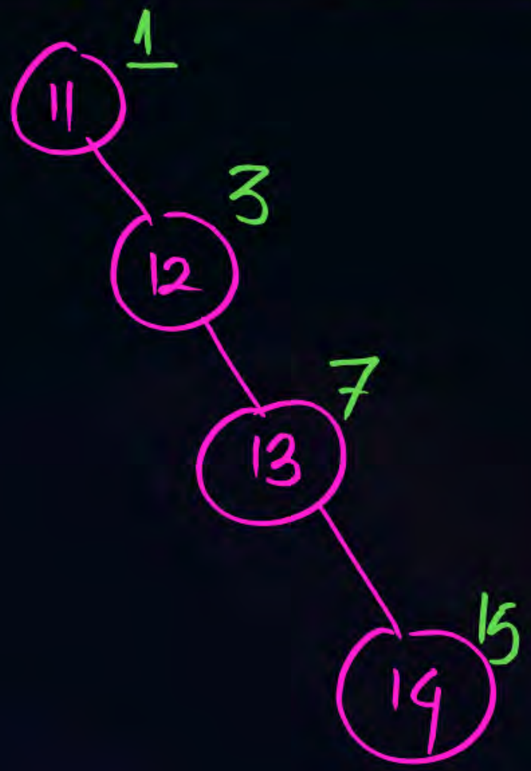

Maximum. $2^n - 1 = 2^4 - 1 = 15$

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Topic : Tree

if a Node at index i and $(i \neq 1)$ → root does Not have parent

Index of left child : $2i$

Index of right child : $2i+1$

Index of parent : $\lfloor i/2 \rfloor$

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Topic : Tree

A is at Index 1

then Index of I is

90

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Topic : Tree

if n Node to be stored the minimum Size of array required

Minimum : n (CBT)

Maximum Size of array required : $2^n - 1$

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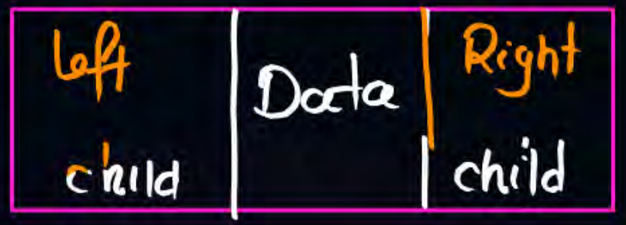
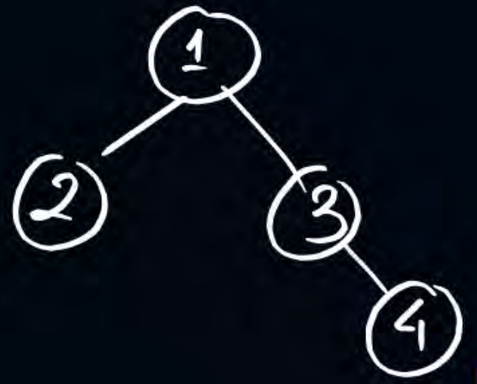
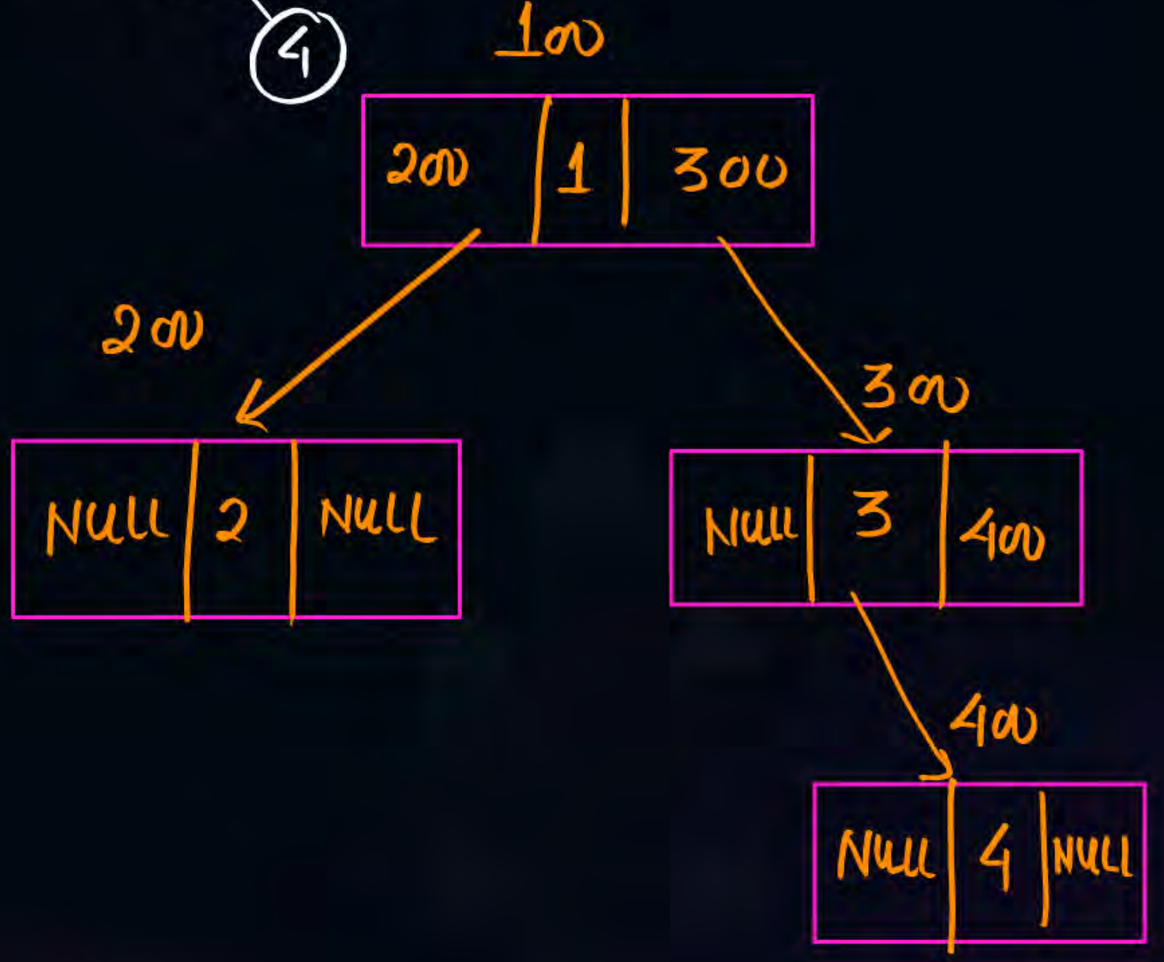
Topic : Tree

Binay Tree Node structure




```
typedef struct tnode{
        int data;
        struct tnode* left;
        struct tnode *right;
}Tnode;
```





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Topic : Tree

\# Consider the following Binary tree

(n_0) Leaf Node 2 Null pointer

Node with 1 children . 1 NULL

$(n_0 \times 2 + n_1 \times 1)$ $n_1 = 6$

$3 \times 2 + 6 \times 1 = 12$

If Index of 11 is x in Sequential representation and in tree node ~~Representation~~ No. Null pointer is y

then x+y is ____

Index 11 is 123

y is 12

x+y : 123+12 = 135

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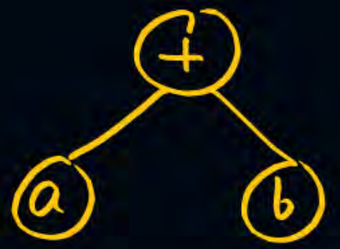
Topic : Tree

Traversal of Binary tree



1 Inorder	— left Root Right	a + b
2. preorder	— Root left Right	+ a b
3 postorder	left Right Root	a b +

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Topic : Tree

Inorder : a - c*d + b

preorde

Subtree repeat the process of traversal

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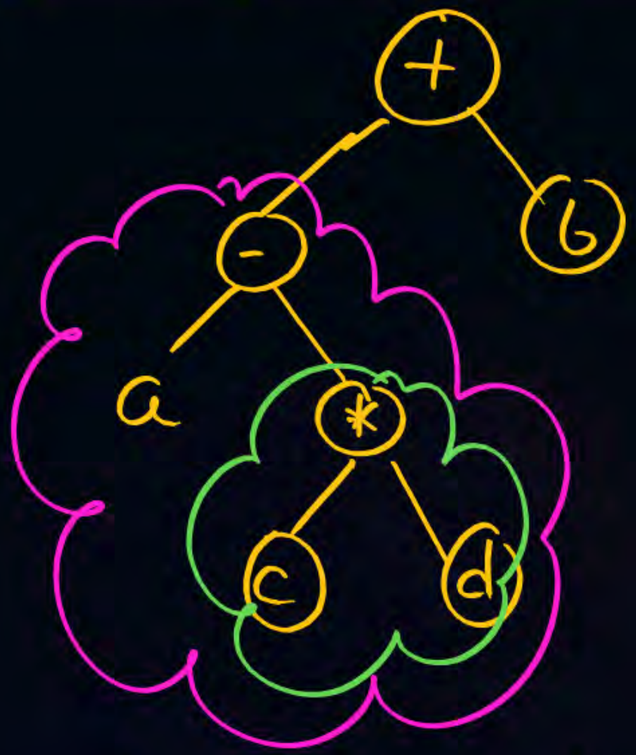
Topic : Tree



Subtree repeat the process of traversal

Root left Right

preorder :

+ − a * c d b

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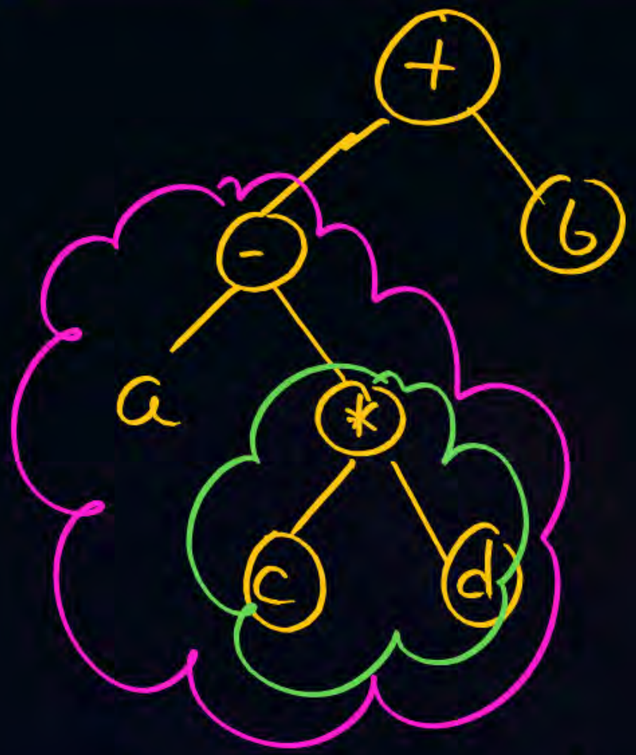
Topic : Tree



Subtree repeat the process of traversal

postorder : left Right Root

a c d * - b +

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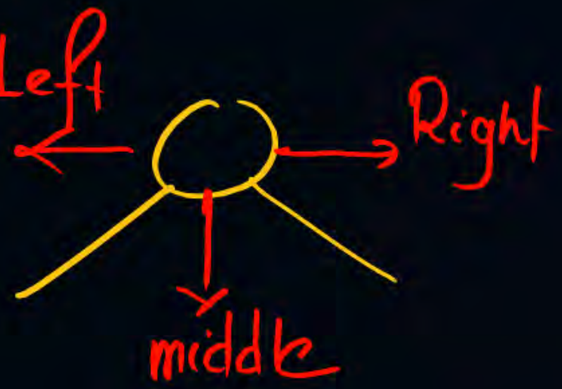
Topic : Tree



tracing

Inorder a − c * d + b

Whenever tracing touches middle point & we print the value it results in Inorder traversal

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Topic : Tree

Left point touch & print

+ - a * c d b

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Topic : Tree

a c d * − b +

Touching right point of Node & print then postorder Traversal

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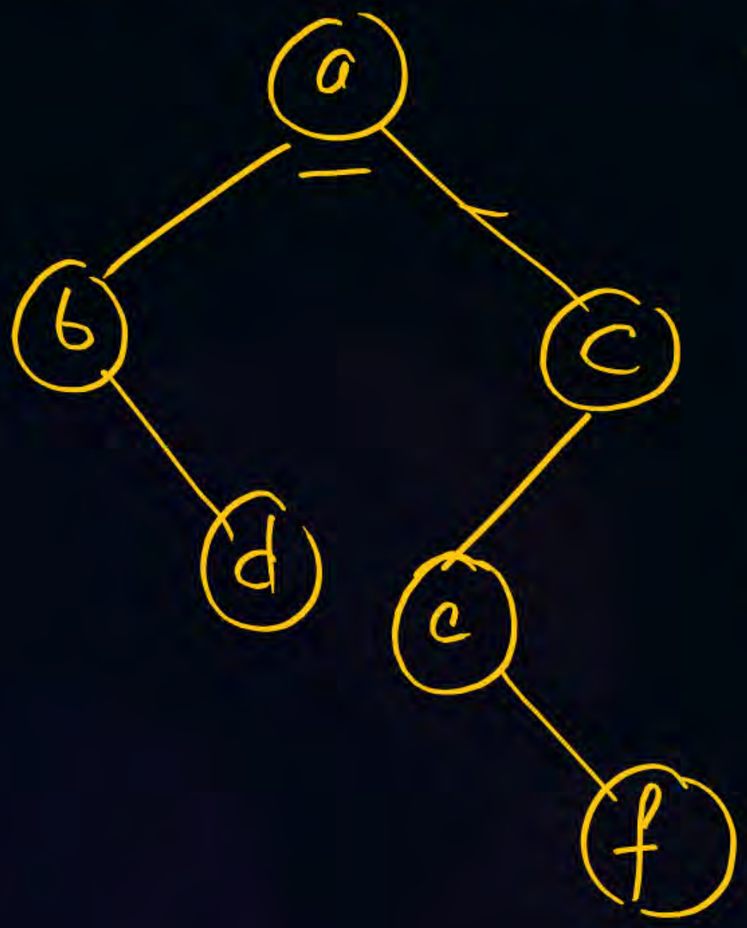
Topic : Tree



Inorder : b d a e f c

preorder : a b d c e f

postorder : d, b, f, e, c a

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Topic : Tree

Inorder : b d a e f c

preorder : a b d c e f

postorder : d b f e c a

Slide

Topic : Tree

```
void Inorder(Tnode*t){
    if(t){
        Inorder(t->left);
        printf("%d",t->data);
        Inorder(t->right);
    }
}
```

```
void preorder(Tnode*t){
    if(t){
        printf("%d",t->data);
        preorder(t->left);
        preorder(t->right);
    }
}
```

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Topic : Tree

```
void postorder(Tnode *t) {
    if (t) {
        postorder(t->left)
        postorder(t->right)
        printf("%d", t->data);
    }
}
```

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2 mins Summary

Topic — Counting of unlobelled trees

Topic — Tree Representation

Topic — Traversal

Topic

Topic

Slide

THANK - YOU

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