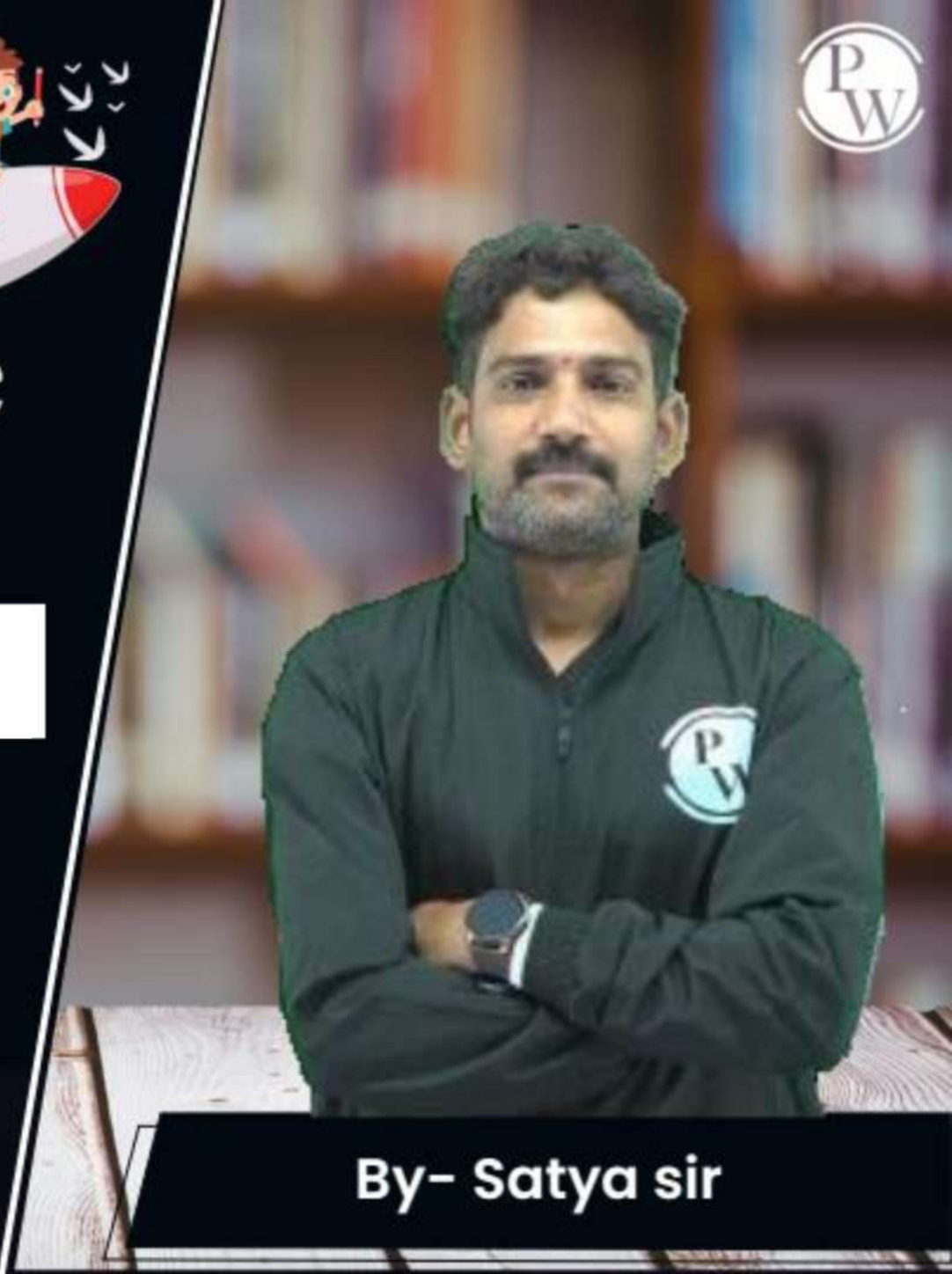
Data Science & Artificial Intelligence

Data Structure through Python

Super 1500+

Lecture No.- 05



By- Satya sir

Recap of Previous Lecture

Linked Lists

Topics to be Covered

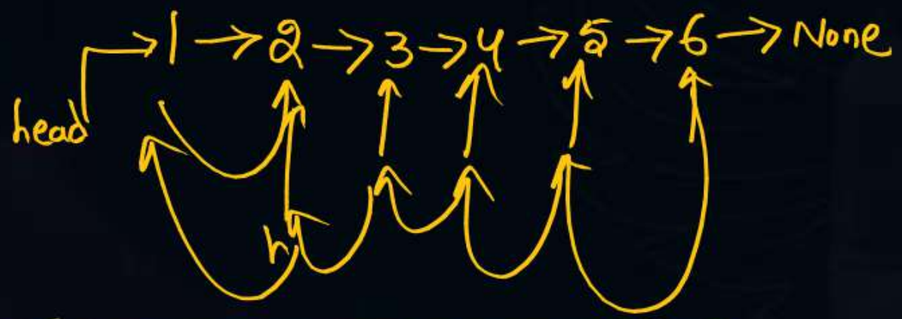
Trees

SUPER 1500+ - DSP- CLASS – 4 - Homework Question - 1

#Q. What does the following function print for a given Linked List with input 1,2,3,4,5,6?

```
void fun1(struct node* head) :
{
  if(head.next == NULL)
  return;
  printf("%d ", head.data);
  fun1(head.next);
  printf("%d ", head.data);
}
```

a) 1,2,3,4,5,6,6,5,4,3,2,1
b) 1,2,3,4,4,3,2,1
c) 1,2,3,4,5,5,4,3,2,1
d) 1,2,3,4,5,1,2,3,4,5



o/p: 1, 2, 3, 4, 5, 5, 4, 3, 2, 1

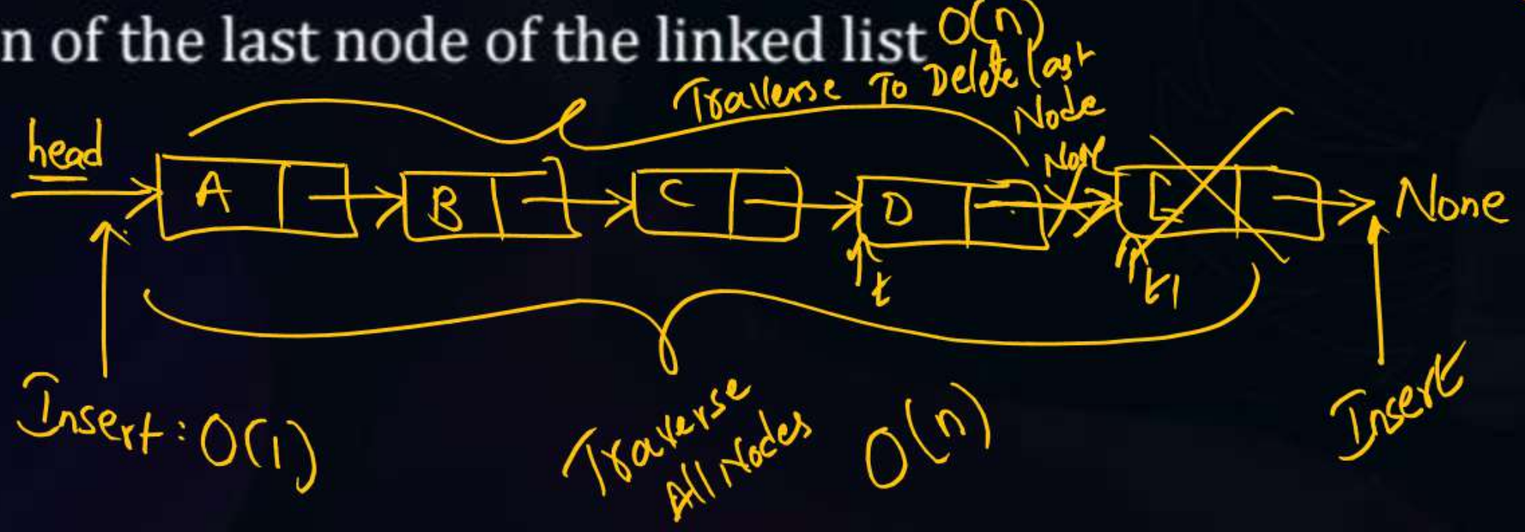
SUPER 1500+ - DSP- CLASS – 4 - Homework Question - 2

#Q. Consider an implementation of unsorted singly linked list. Suppose it has its representation with a head pointer only. Given the representation, which of the following operation can be implemented in O(1) time?

A) Insertion at the front of the linked list O(1)
B) Insertion at the end of the linked list O(n)
C) Deletion of the front node of the linked list O(1)
D) Deletion of the last node of the linked list O(n)

Deletion of 1st Node

```
Temp = head
head = head.next
Temp = None
```



MSQ

SUPER 1500+ - DSP- CLASS – 4 - Homework Question - 3

#Q. Which of the following points is/are not true about Linked List data structure when it is compared with [array? as Lists] [MSQ] ⟹ ANS: B, D.

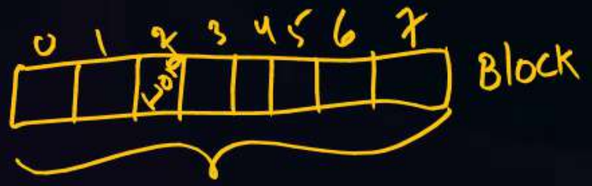
a) Arrays have better cache locality that can make them better in terms of performance ✓True — Temporal, Spatial

↳ In 'C' Implementation: True.

b) It is easy to insert and delete elements in Linked List (In Python Implementation) false. ✓

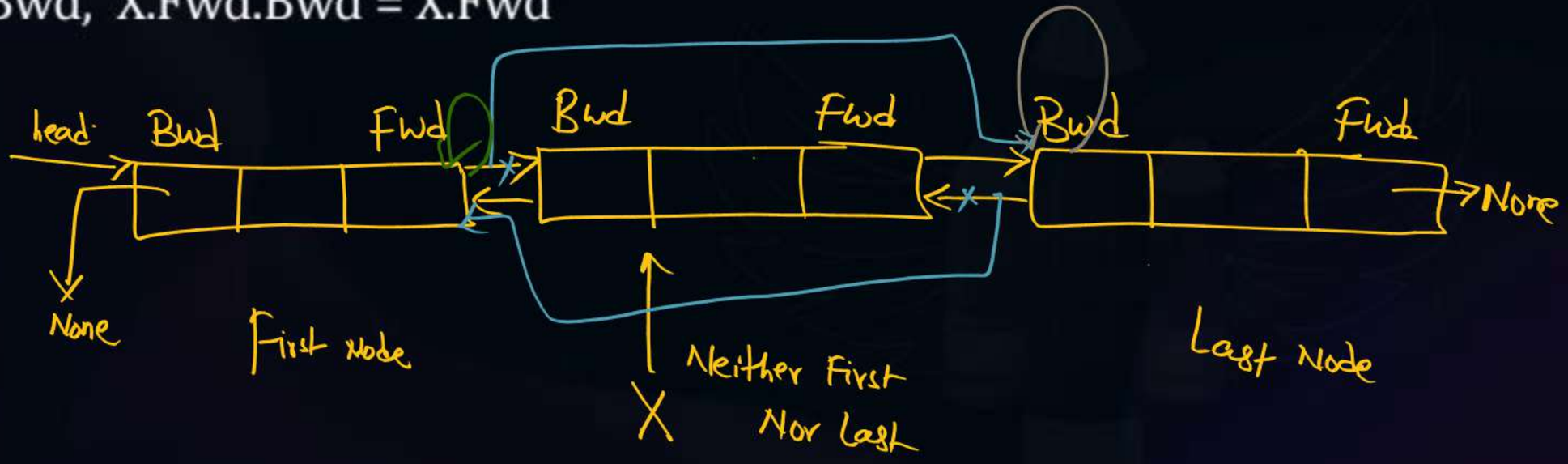
c) Random access is not allowed in a typical implementation of Linked Lists True

d) Access of elements in linked list takes less time than compared to arrays false ✓



#Q. Consider a doubly linked list, Where Fwd and Bwd represent forward and backward link to the adjacent elements of the list. Which of the following segments of code deletes the node referred to by X from the doubly linked list, if it is assumed that X refers to neither the first nor the last node of the list?

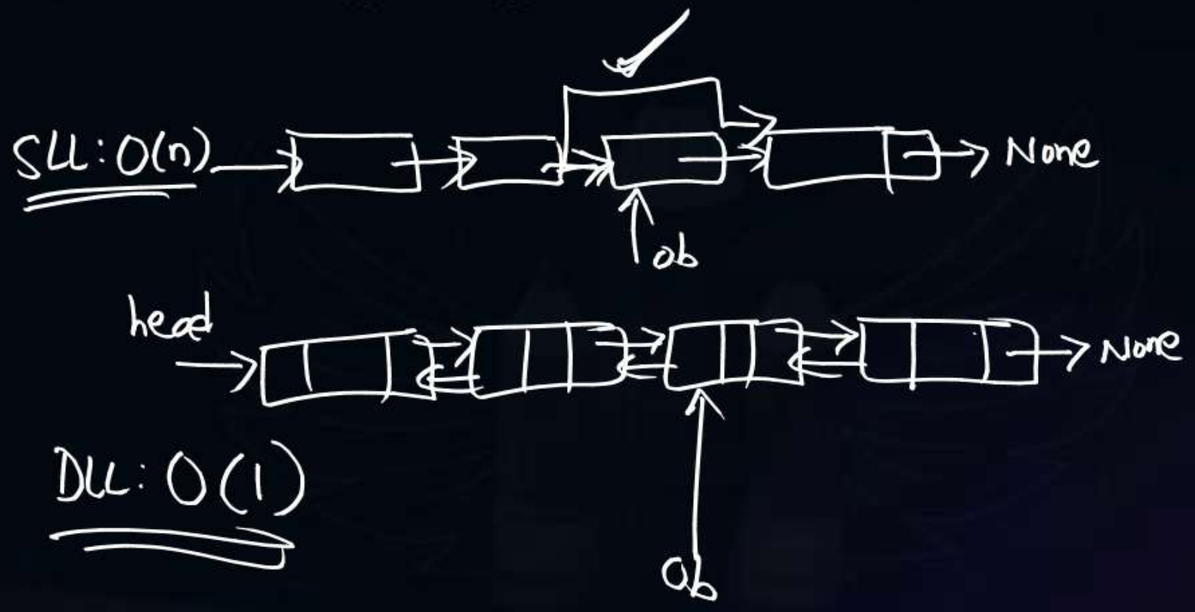
A. X.Bwd.Fwd = X.Fwd, X.Fwd.Bwd = X.Bwd
B. X.Bwd.Fwd = X.Fwd, X.Fwd.Bwd = X.Bwd
C. X.Bwd.Fwd = X.Bwd, X.Fwd.Bwd = X.Bwd
D. X.Bwd.Fwd = X.Bwd, X.Fwd.Bwd = X.Fwd



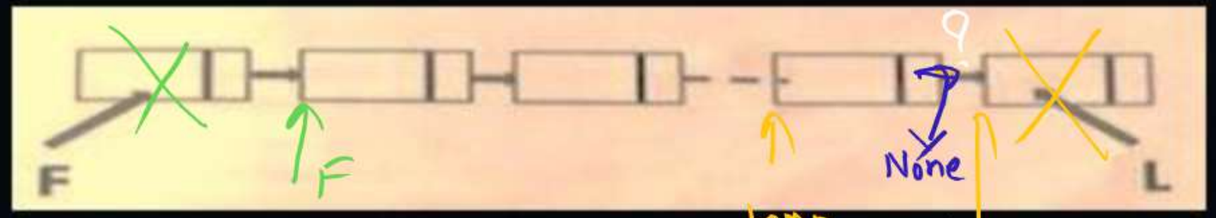
#Q. Let SLLdel be a function that deletes a node in a singly-linked list given an object that refer to the node and head of the list. Similarly, let DLLdel be another function that deletes a node in a doubly-linked list given an object that refer to the node and head of the list.

Let n denote the number of nodes in each of the linked lists. Which one of the following choices is TRUE about the worst-case time complexity of SLLdel and DLLdel?

A. SLLdel is O(1) and DLLdel is O(n)
B. Both SLLdel and DLLdel are O(log(n))
C. Both SLLdel and DLLdel are O(1)
D. SLLdel is O(n) and DLLdel is O(1)



#Q. Consider a singly linked list of the form where F is a pointer to the first element in the linked list and L is the pointer to the last element in the list. The time of which of the following operations depends on the length of the list?



A. Delete the last element of the list O(n)
B. Delete the first element of the list O(1)
C. Add an element after the last element of the list O(1)
D. Interchange the first two elements of the list O(1)

O(n)

```
temp=head
while temp.next.next is not None:
    temp=temp.next
temp1=temp.next
temp.next=None
temp1=None
```

```
temp=F
F=F.next
temp=None
```
O(1)

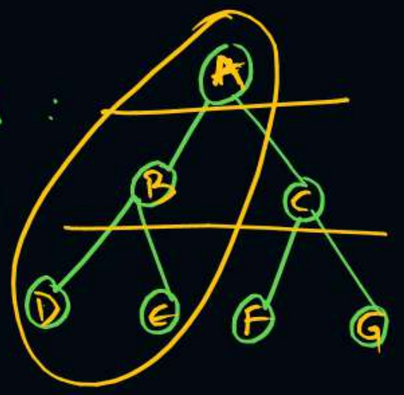
O(1)

```
L.next=New
New.next=None
```

```
temp=F.next
temp1=temp.data
temp.data=F.data
F.data=temp1
```
O(1)

#Q. Consider a complete binary tree with 7 nodes. Let A denote the set of first 3 elements obtained by performing Breadth-First Search (BFS) starting from the root. Let B denote the set of first 3 elements obtained by performing Depth-First Search (DFS) starting from the root. The value of |A−B| is _____ .

CBT with 7 Nodes :



A = set visiting (3 nodes) in BFS order (Level order) = Level 0 (1 Node) + Level 1 (2 Nodes)

= {A, B, C} ⇒ 3 Nodes

B = DFS set = { A, A→B / A→C, B→D, B→E, C→F, C→G } ⇒ DFS set will have 4 Nodes.

|A − B| = 1

#Q. The post-order traversal of binary search tree is ACEDBHIGF. The pre-order traversal is:

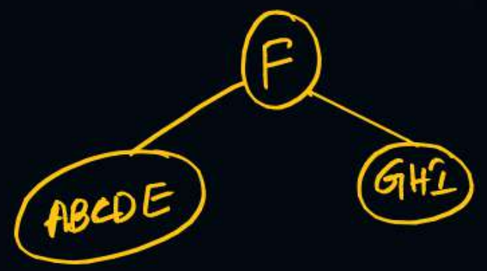
(Lexicographical order for Inorder)

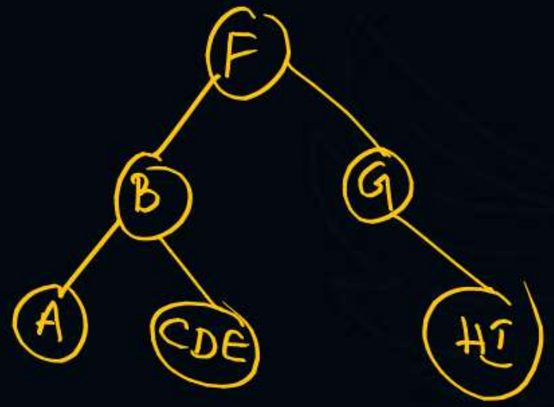
Inorder: A B C D E F G H I

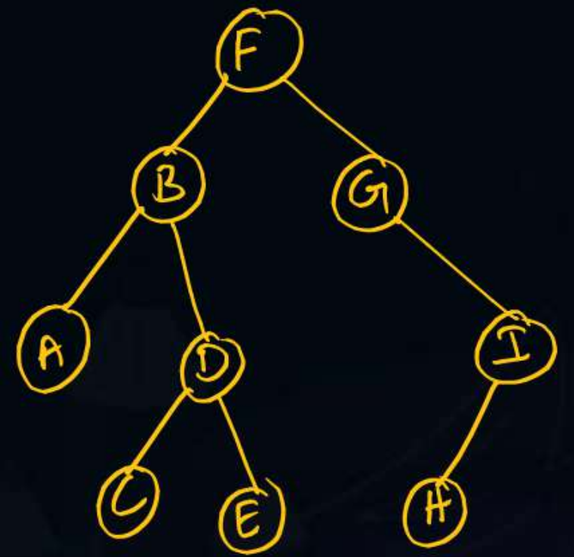
Pre/Post: Parent Identification

In: Left/Right subtree

A. ABCDEFGHI
B. FBADCEGIH
C. FABCDEGHI
D. ABDCEFGIH







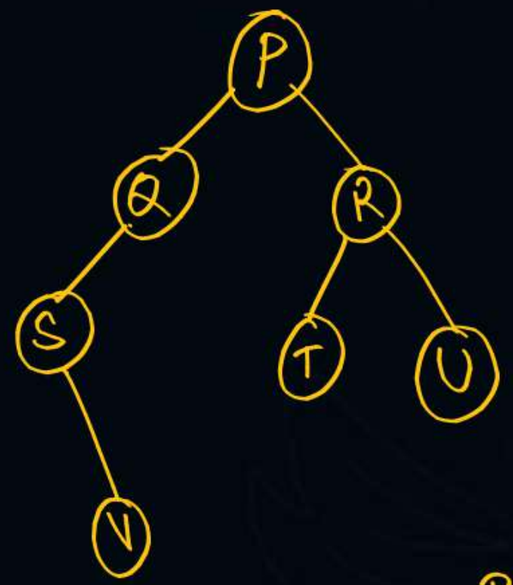
Preorder: F B A D C E G I H

(PLR)

#Q. Let the Post Order Traversal of a BST is given by VSQTURP. If S<V<Q<P<T<R<U, Then Pre Order is _____

A) SVQPTRU
B) PQSVRTU
C) SVRUTQP
D) PRQSUTV

In order (Ascending order): SVQPTRU



Pre order: PQSVRTU

#Q. In a binary tree, the number of internal nodes of degree 1 is 5, and the number of internal nodes of degree 2 is 10. The number of leaf nodes in the binary tree is 10

- FBT: either 0 child (or) 2 children
- In a FBT / PBT : Total Nodes: $2n+1$ → n Internal, (n+1) External.

Not applicable for this Question as Nodes with degree 1!

Total Nodes = 5 * 1 child + 10 * 2 children

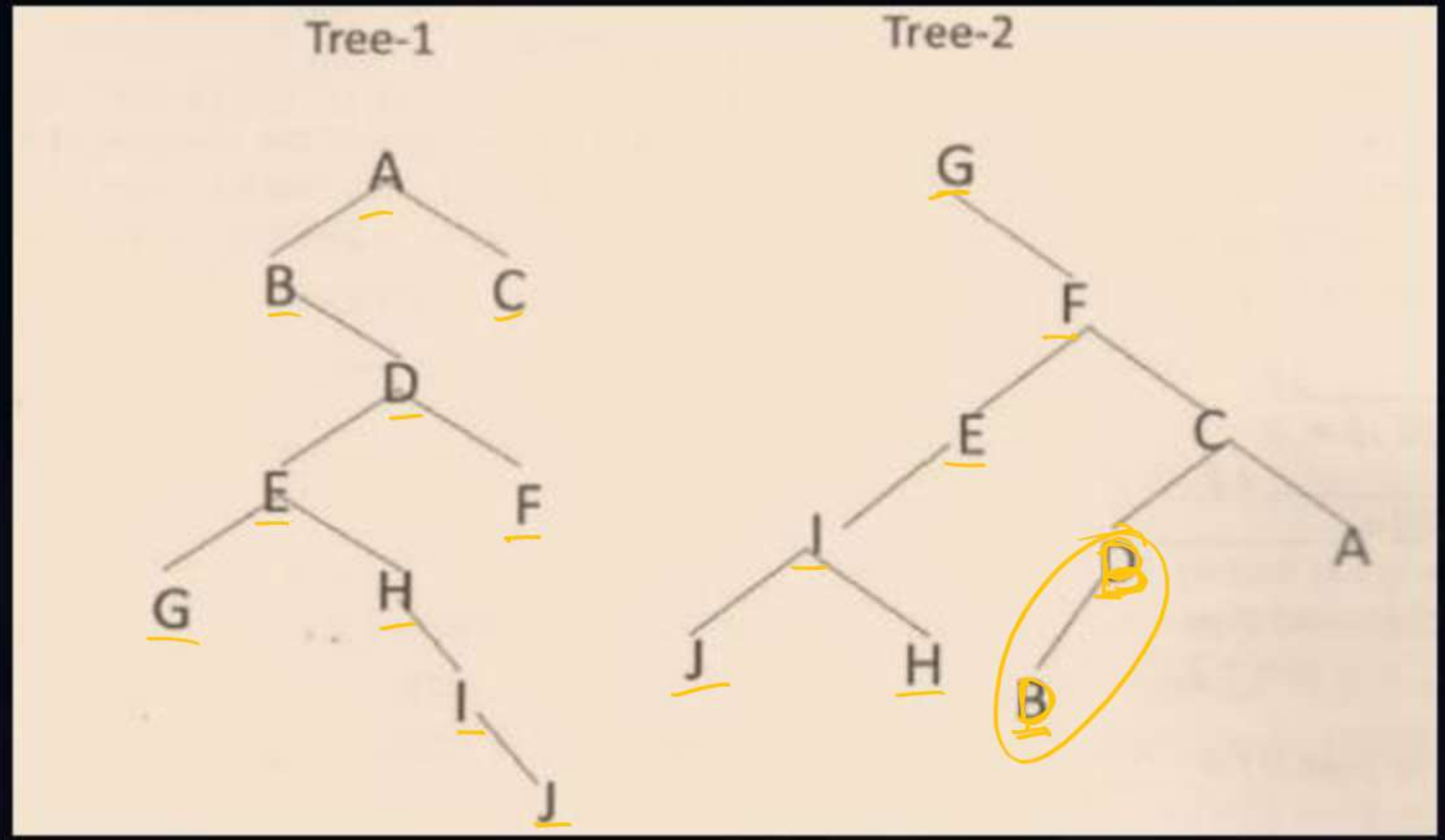
= 5 + 20 = 25

No. of Internal Nodes = 5 + 10 = 15

⇒ No. of External Nodes / Leaf Nodes = 25 - 15 = 10

#Q. If Tree-1 and Tree-2 are the trees indicated below : Which traversals of Tree-1 and Tree-2, respectively, will produce the same sequence?

A. Pre order, post order
B. Post order, in order
C. Post order, pre order
D. In order, preorder



Tree1: In : BGEHIJDFAC
Pre : ABDEGHIJFC
Post : GJIHEFDBCA

Tree2: In : GJIHEFDBCA
Pre : GfEIJHCBDA
Post : JHIEDBACFG

#Q. In a binary tree with n nodes, every node has an odd number of descendants. Every node is considered to be its own descendant. What is the number of nodes in the tree that have exactly one child?

A. 0
B. 1
C. (n-1)/2
D. n-1

H/w-2

SUPER 1500+ - DSP- CLASS – 5 - Homework Question - 1

#Q. Let T be a full binary tree with 8 leaves. (A full binary tree has every level full.) Suppose two leaves a and b of T are chosen uniformly and independently at random. The expected value of the distance between a and b in T (i.e., the number of edges in the unique path between a and b) is (rounded off to 2 decimal places) _____ .

SUPER 1500+ - DSP- CLASS – 5 - Homework Question - 3

#Q. What does the following function do for a given Linked List with first node as head?

```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None

def fun1(head):
    if head is None:
        return
    print(head.data, end='  ')
    fun1(head.next.next if head.next else None)
```

a) Prints all nodes of linked lists
b) Prints all nodes of linked list in reverse order
c) Prints alternate nodes of Linked List
d) Prints alternate nodes in reverse order

SUPER 1500+ - DSP- CLASS – 5 - Homework Question - 4

#Q. Consider a binary tree with 30 Leaf nodes. The number of nodes with exactly 2 children is _____

2 mins Summary

Trees

NEXT CLASS TOPIC: TREES - 2

THANK - YOU