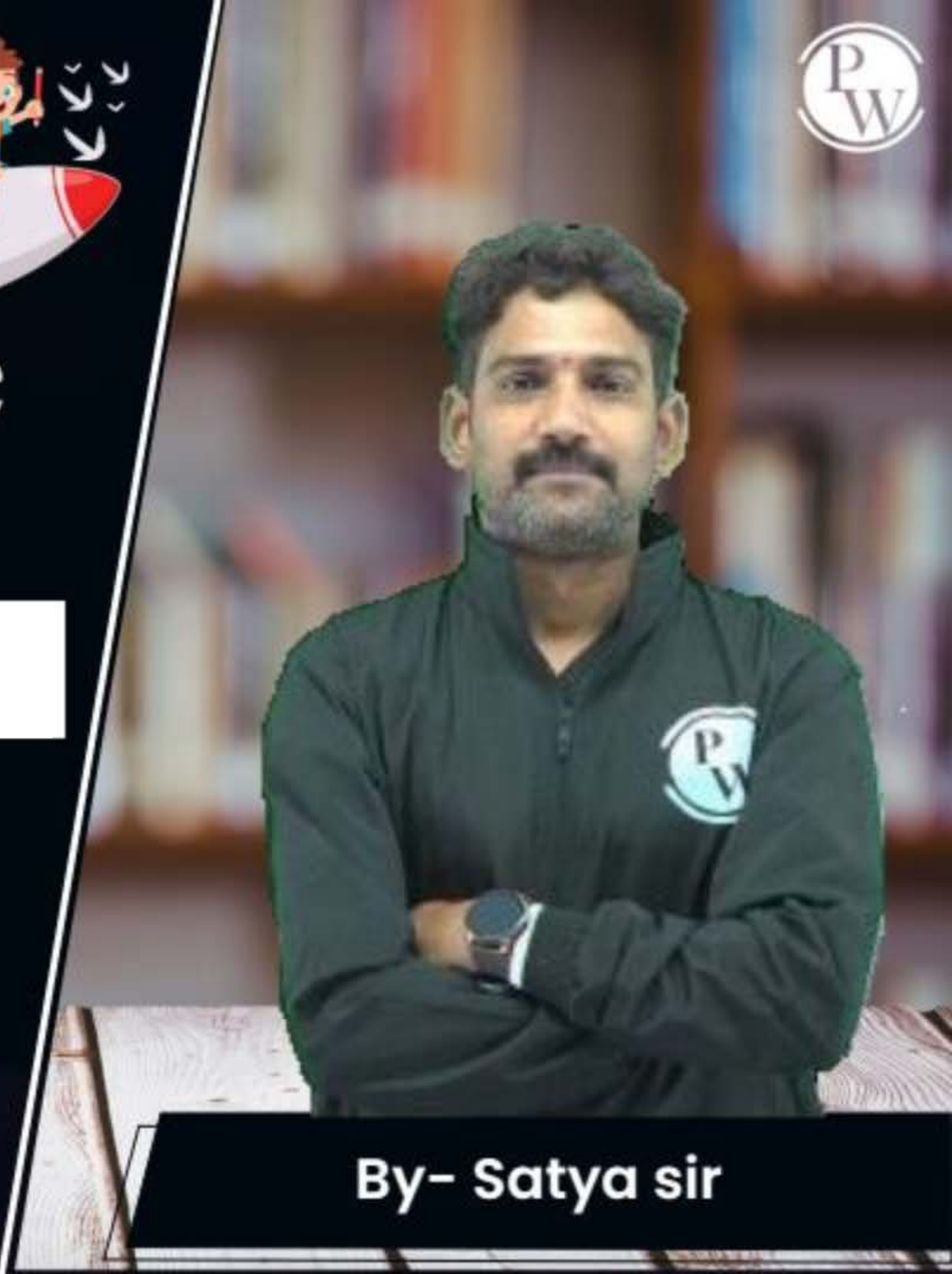
Data Science & Artificial Intelligence

Data Structure through Python

Super 1500+

Lecture No.- 06



By- Satya sir

Topics to be Covered

Trees

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

$\Rightarrow 0 + 0.25 + 1 + 3 = 4.25$

#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) _____.

a and b same Leaf Node, distance = 0 $\Rightarrow$ 8 Possibilities

a and b as Sibling Nodes, Distance = 2 $\Rightarrow$ 8 Possibilities

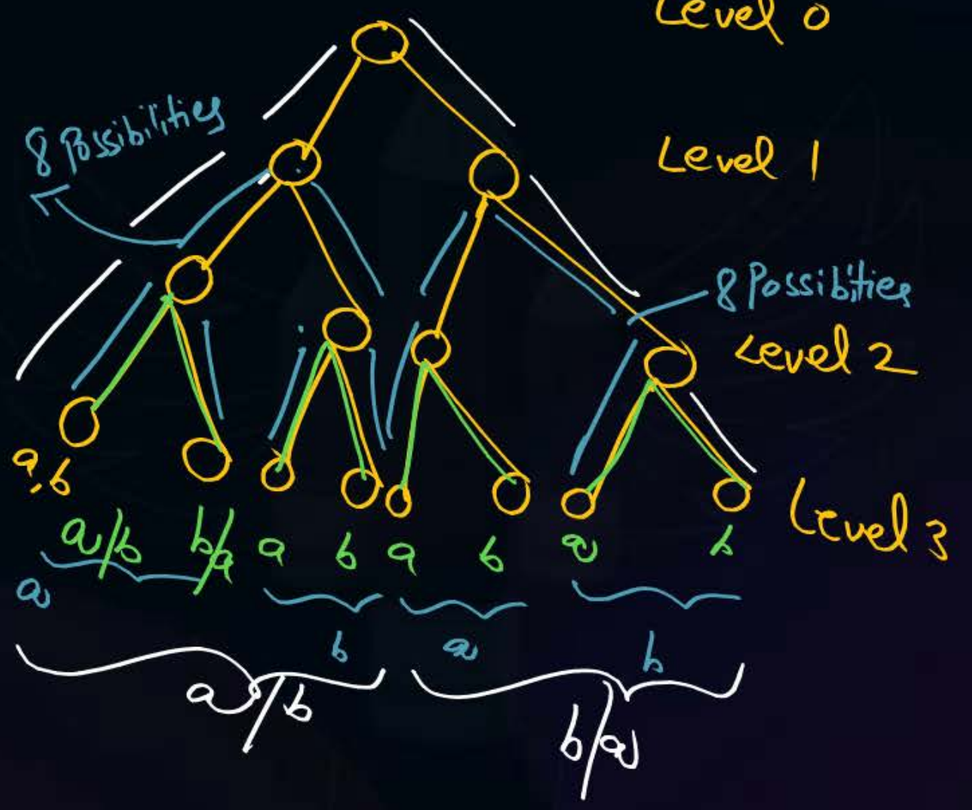
a and b Selected with distance = 4 = 16 Possibilities

a and b Selected with distance = 6 = 32 Possibilities

Total = 64

$$\text{Avg distance} = \left(0 \times \frac{8}{64}\right) + \left(2 \times \frac{8}{64}\right) + \left(4 \times \frac{16}{64}\right) + \left(6 \times \frac{32}{64}\right)$$

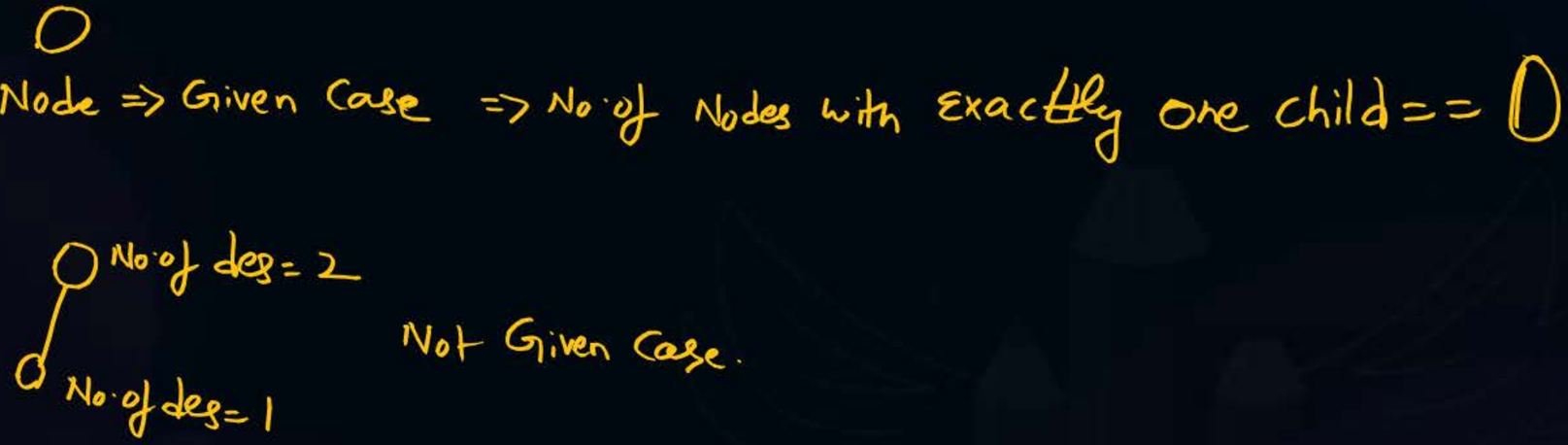
$\Rightarrow$



SUPER 1500+ - DSP- CLASS – 5 - Homework Question - 2

#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

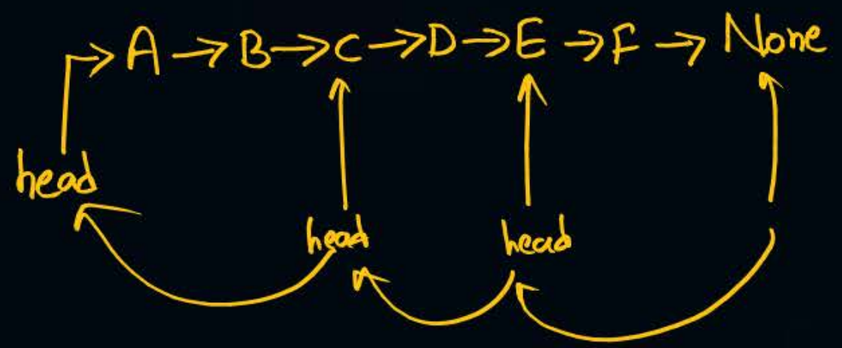


SUPER 1500+ - DSP- CLASS – 5 - Homework Question - 3

#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)
```



o/p: A, B, E

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

29

⇒ "X" Leaf Nodes, No of Nodes with Exactly 2 children == (X−1)

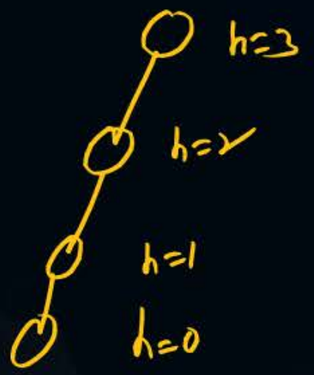
⇒ 30 Leaf Nodes ⇒ 29 Nodes will have Exactly 2 children.

#Q. The Minimum number of nodes with height 2^n in a binary tree will be _____

A. 2^n
B. 2^n+1
C. 2^n-1
D. 2^{n+1}

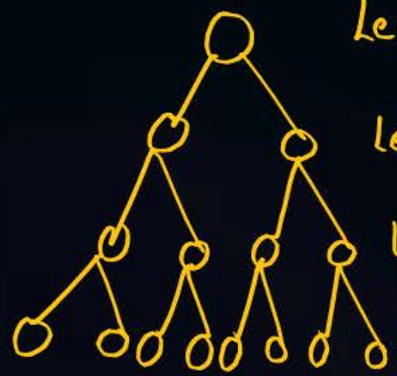
With H height, min Nodes required = H+1

height = 2^n ⇒ min Nodes = $2^n + 1$



#Q. The Number Of Nodes in a Perfect binary tree at level 6 will be ____
(NOTE: Level Numbering started from 1)

A. 31 B. 63 C. 32 D. 64



Level (L) No. of Nodes

1 ⇒ $2^{1-1} = 2^0$

2 ⇒ $2^{2-1} = 2^1$

4 ⇒ $2^{3-1} = 2^2$

8 ⇒ $2^{4-1} = 2^3$

$L \Rightarrow 2^{(L-1)}$

$6 \Rightarrow 2^5 = 32$

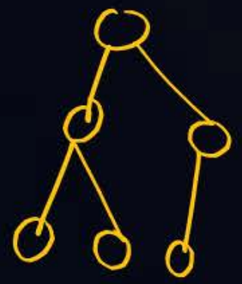
#Q. Which of the below statement is/are Invalid?

A. Every Perfect Binary Tree is a Complete Binary Tree
B. Every Complete Binary Tree is a Full Binary Tree
C. Every Full Binary Tree is a Complete Binary Tree
D. Every Full Binary Tree is a Perfect Binary Tree

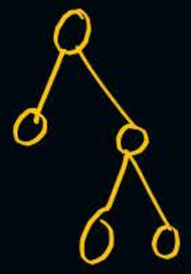
Ans: B, C, D

MSQ

PBT, FBT, CBT



CBT, but Not FBT



FBT, Not CBT Not PBT

#Q. The number Of labelled binary trees with 4 nodes is ____

A. 14 B. 24 C. 70 D. 336

No. of Labelled Binary trees Possible with 'n' nodes $\Rightarrow \frac{2n_{C_n}}{(n+1)} * n!$

Unlabelled $= \frac{2n_{C_n}}{n+1}$

$n=4 \Rightarrow \frac{8_{C_4}}{5} * 4!$

$\Rightarrow \frac{8*7*6*5*4!}{4! * 4!} * \frac{1}{5} * 4!$

$\Rightarrow 336$

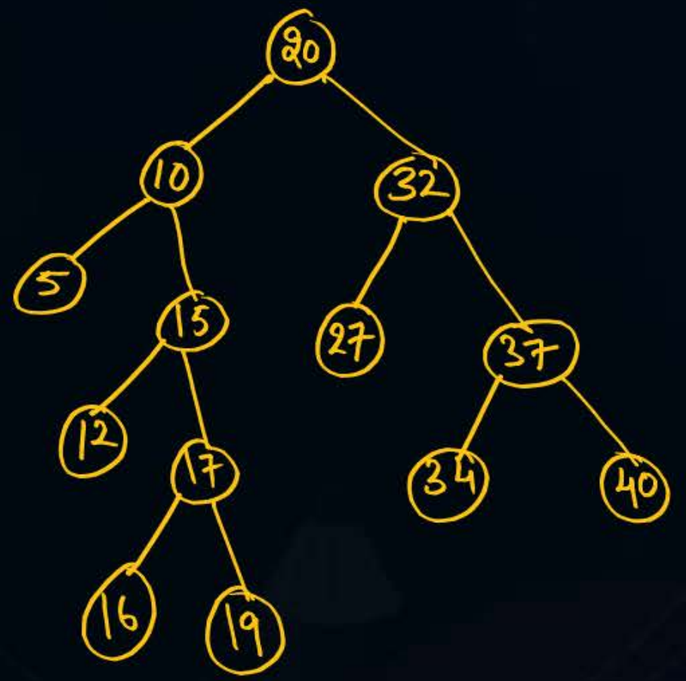
#Q. The Post Order traversal sequence for the BST with Pre order sequence as 20,10,5,15,12,17,16,19,32,27,37,34,40 is _____

A. 5, 12, 16, 19, 17, 15, 10, 27, 34, 40, 37, 32, 20

B. 5, 12, 16, 19, 17, 15, 10, 34, 27, 40, 37, 32, 20

C. 5, 12, 16, 19, 17, 15, 10, 27, 34, 37, 40, 32, 20

D. 5, 12, 16, 19, 17, 15, 10, 27, 37, 40, 34, 32, 20

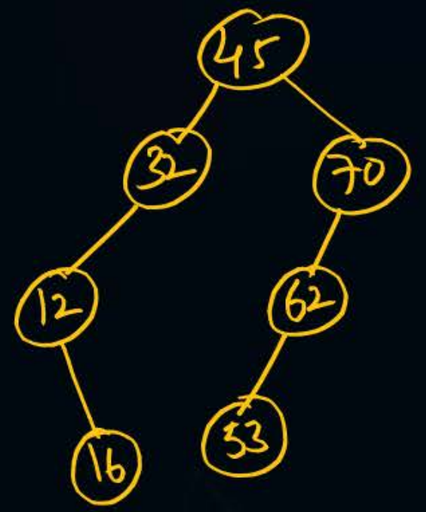


Inorder: 5, 10, 12, 15, 16, 17, 19, 20, 27, 32, 34, 37, 40

Post: 5, 12, 16, 19, 17, 15, 10, 27, 34, 40, 37, 32, 20

#Q. If The Elements 45, 32, 70, 62, 53, 12 and 16 are inserted into a BST in the same sequence, Then The resultant BST is given as ____

A. 45, 32, 70, 16, 62, 12, 53
B. 45, 32, 70, 62, 12, 16, 53
C. 45, 32, 70, 12, 16, 62, 53
D. 45, 32, 70, 12, 62, 16, 53



Resultant BST.

Level order: 45, 32, 70, 12, 62, 16, 53

#Q. Consider a Left Skewed Binary Tree with elements labelled A to H, while A being root and H being leaf node (In Alphabetical order, level wise). Then, For such tree, Pick Correct statement from below:

A. In Order Traversal == Level Order Traversal
B. Pre Order Traversal == In Order Traversal
C. In Order Traversal == Post Order Traversal
D. Post Order Traversal == Level Order Traversal

Inorder = HG FEDCBA = Post order

Preorder = ABCDEFGH = Level order.

H/W

#Q. Consider a Right Skewed Binary Tree with elements labelled A to E, while A being root and E being leaf node (In Alphabetical order, level wise). Then, For such tree, Pick Incorrect statement(s) from below:

A. In Order Traversal == Level Order Traversal == Post Order Traversal
B. Pre Order Traversal == In Order Traversal == Level Order Traversal
C. In Order Traversal == Post Order Traversal == Pre Order Traversal
D. Post Order Traversal == Level Order Traversal == Pre Order Traversal

MSQ

#Q. Consider a min heap with elements 8, 15, 23, 17, 20, 30, 40, 25, 27, 32. After 3 Delete Operations, The elements of tree would be ___

a. 20, 25, 23, 32, 27, 30, 40
b. 20, 23, 25, 32, 27, 30, 40
c. 20, 25, 23, 27, 32, 30, 40
d. 20, 25, 23, 32, 27, 40, 30

Given min-heap:

#Q. The Fibonacci Series Elements are given as input for construction of a heap. It forms _____

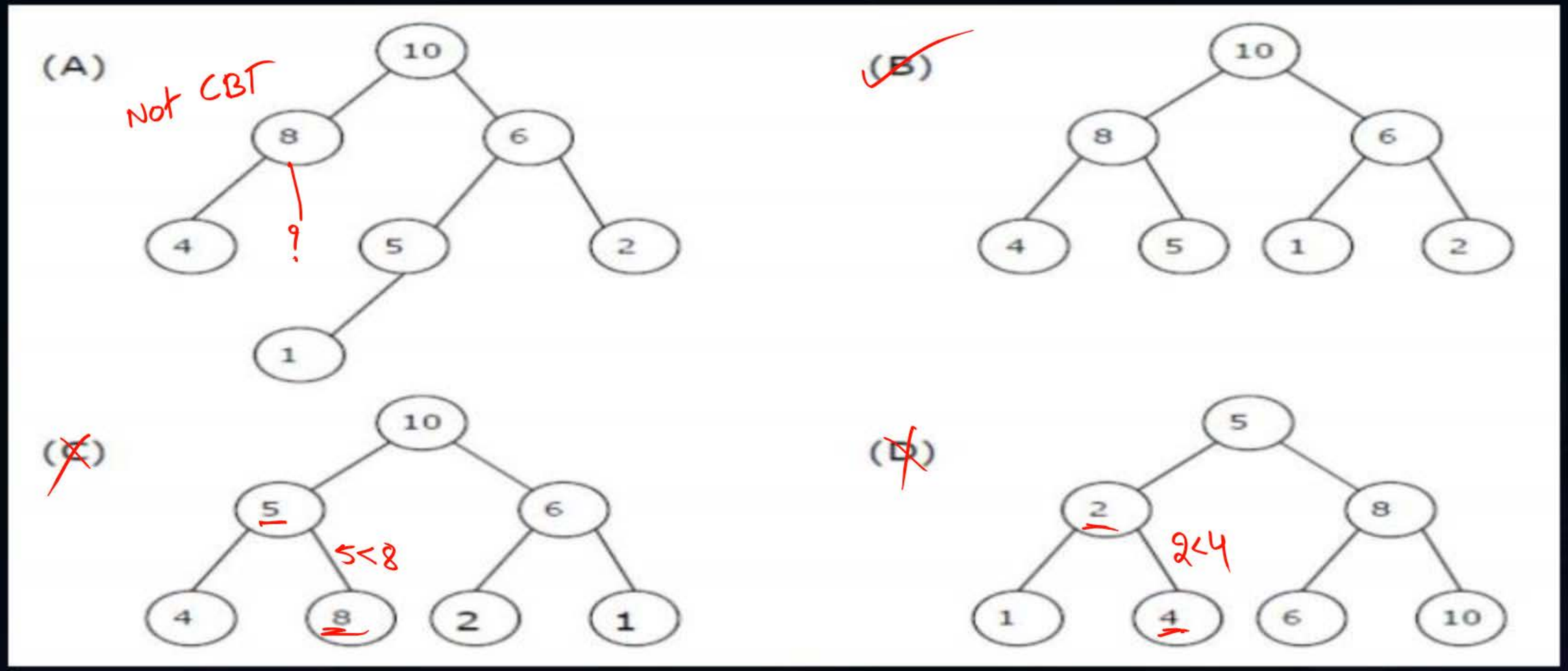
A. Max Heap
B. Min Heap
C. BST
D. AVL Tree

0, 1, 1, 2, 3, 5, 8, 13, 21 - - -

Ascending order

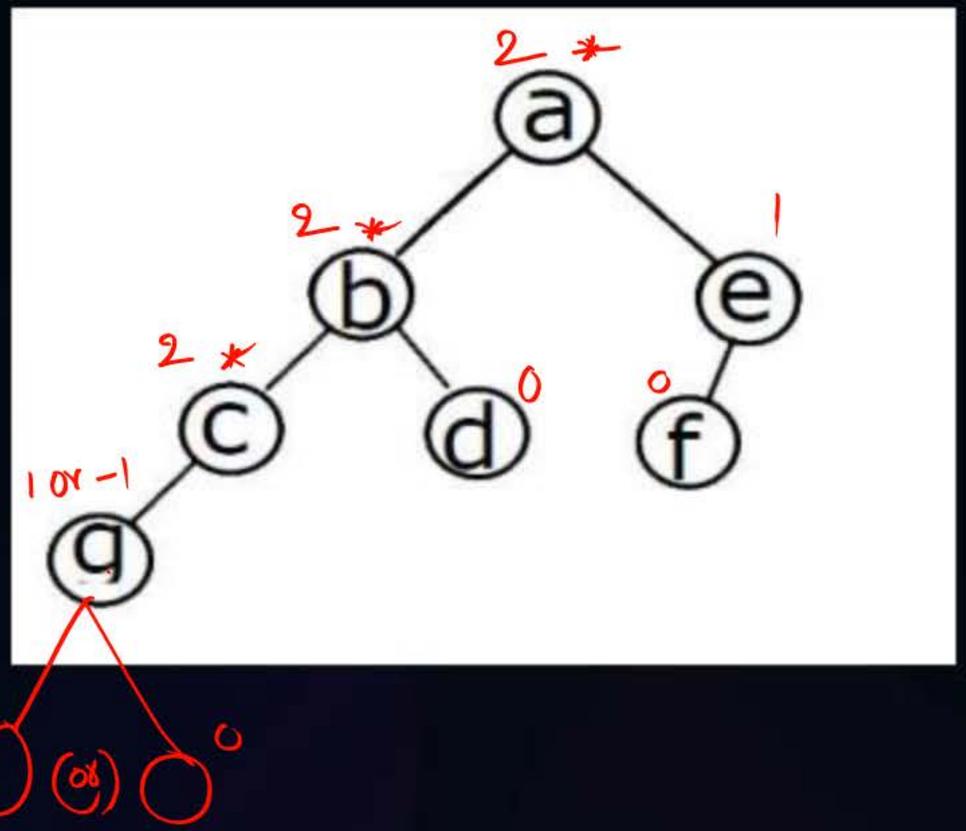
=> Max - heap.

#Q. Which of the following is a Max- Heap?



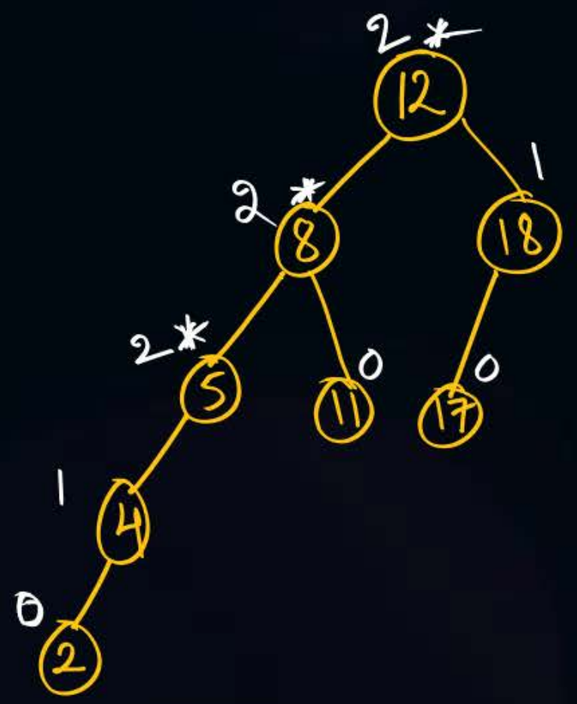
#Q. In the balanced binary tree in the figure given below, how many nodes will become unbalanced when a node is inserted as a child of the node “g”?

(a) 1 (b) 3 (c) 7 (d) 8



#Q. The Critical Node(s) in the given BST with elements 12, 8, 18, 5, 11, 17, 4, 2 is / are ___

A. 12
B. 5
C. 11
D. 8



MSQ

ANS: A, B, D

HW

#Q. Consider a min heap with elements 15, 30, 25, 40, 42, 27. After inserting elements 20 and 7, The Level order traversal sequence would be _____

A. 7, 15, 20, 30, 40, 42, 27, 25
B. 7, 15, 20, 30, 42, 40, 27, 25
C. 7, 15, 20, 30, 27, 42, 40, 25
D. 7, 15, 20, 30, 42, 27, 25, 40

#Q. Which of the following sequences of array elements forms a heap?

(A) {23, 17, 14, 6, 13, 10, 1, 12, 7, 5}
(B) {23, 17, 14, 6, 13, 10, 1, 5, 7, 12}
(C) {23, 17, 14, 7, 13, 10, 1, 5, 6, 12}
(D) {23, 17, 14, 7, 13, 10, 1, 12, 5, 7}

#Q. The Max heap after construction with elements 20, 40, 15, 60, 70, 50, 45, 28 inserted in that order is _____

H/w

A. 70, 60, 50, 40, 28, 15, 45, 20
B. 70, 60, 50, 28, 40, 45, 15, 20
C. 70, 60, 50, 28, 40, 15, 45, 20
D. 70, 60, 50, 40, 28, 45, 15, 20

H/w

#Q. The second leaf node in min heap after construction with elements 10, 7, 8, 9, 3, 2, 6, 12, 15, 13 inserted in that order is _____

A. 8 B. 15 C. 6 D. 12

H/W

#Q. _____ Number Of Rotations required to insert a sequence of elements 9, 6, 5, 8, 7, 10 into an empty AVL Tree. (Consider LR/RL also as 1 rotation)

A. 1 B. 2 C. 3 D.4

H/w

#Q. While Construction of an AVL Tree with elements inserted in the order, 45, 21, 30, 12, 15, 17, 27, 35, 47, 33, The Rotation(s) performed is/are _____

A. LR
B. RL
C. LL
D. RR

MSQ

H/W

#Q. What is the maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0.

(A) 2
(B) 3
(C) 4
(D) 5

THANK - YOU