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Course: GATE
Computer Science Engineering(CS)

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TOPICWISE : PROGRAMMING AND DATA STRUCTURES-2 (GATE - 2019) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(4) | INCORRECT(6) | SKIPPED(7)

Q. 1

Which of the following algorithm is best suitable for sorting of linked list?

Solution Video | Have any Doubt ?

A. Quick sort

B. Merge sort — Your answer is **Correct**

Solution :
(b)
Merge sort time complexity is θ(n logn) for sorting of linked list.

C. Heap sort

D. None of the above

QUESTION ANALYTICS +

Q. 2

Consider the following statements about linked list and array?

S_1 : Random access is not allowed in implementation of linked list.
S_2 : Insertion and deletion of elements in easy in linked list than array.
S_3 : Array has better cache locality than linked list which make array preferable in terms of performance.

Which of the following is true?

Solution Video | Have any Doubt ?

A. S_1 and S_2 only — Your answer is **Wrong**

B. S_1 and S_3 only

C. S_2 and S_3 only

D. All of the above — Correct Option

Solution :
(d)
• Random access is not allowed in linked list but allowed in array.
• Insertion and deletion in array is difficult, since we need to shifts other elements, while insertion and deletion in linked list in easy (only few pointers need to be charged in worst case both take O(n) time).
• Since array are contiguous memory blocks, so large chunk of them will be loaded into the cache upon cache upon first access. Which make cache access faster for future elements of array i.e. gives better cache locality which is not possible in case of linked list.

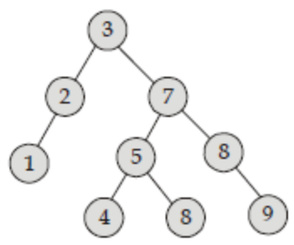
QUESTION ANALYTICS +

Q. 3

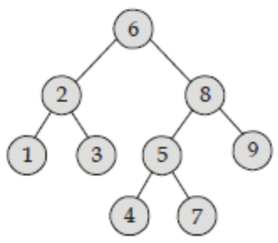
Which of the following represents the final AVL tree if 8, 1, 9, 3, 2, 6, 5, 4, 7 elements are inserted into an empty tree?

Solution Video | Have any Doubt ?

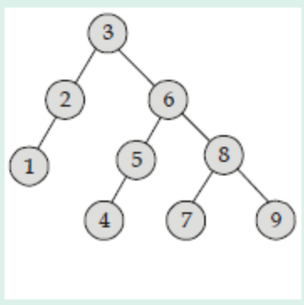
A.



B.

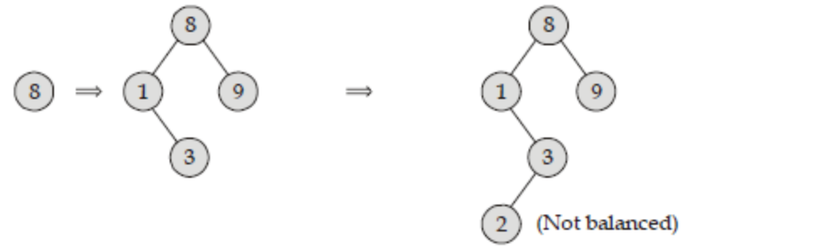


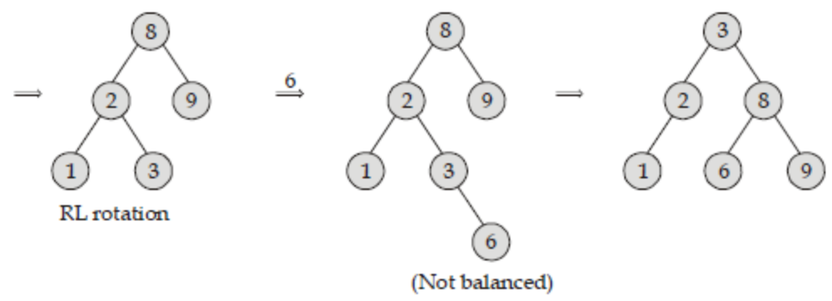
C.

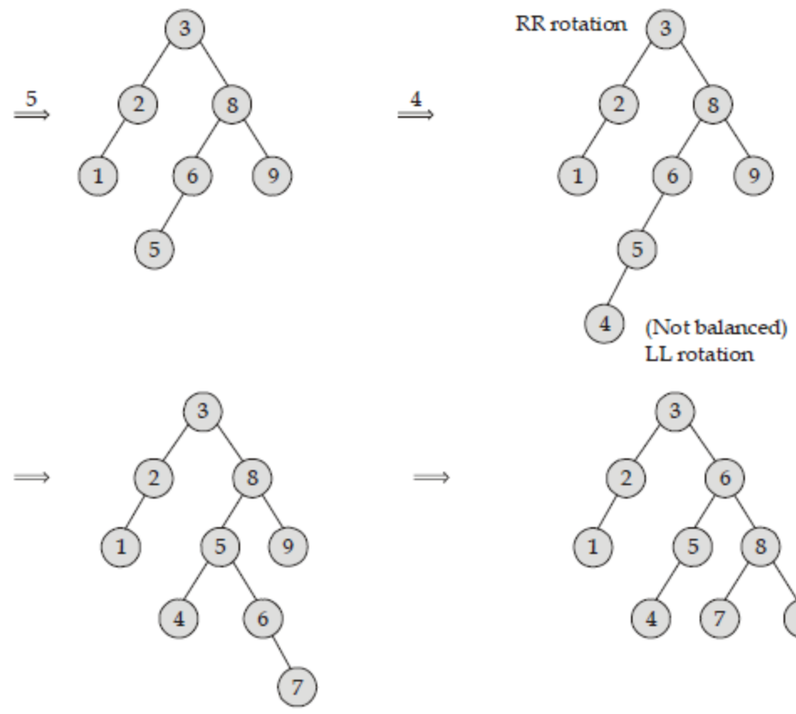


Your answer is **Correct**

Solution :
(c)
8, 1, 9, 3, 2, 6, 5, 4, 7







∴ Option (c) is correct.

D None of these

QUESTION ANALYTICS +

Q. 4

Consider the following code fragment where head of the 2 sorted linked list is passed as an argument:

```
struct node * fun (struct node * x, struct node * y) {
    struct node * z = NULL;
    if (x = = NULL) return (y);
    else if (y == NULL) return (x);
    if (x → data < = y → data) {
        z = x;
        z → next = fun (x → next, y);
    }
    else
    {   z = y;
        z → next = fun (x, y → next);
    }
    return(z);
}
```

Which of the following is correct about fun ( )?

Solution Video | Have any Doubt ?

A Returns the list which concatenates the given two lists

B Returns the smallest list of given two lists

C Returns the sorted list of given two lists — Correct Option

Solution :
(c)
It merges the two sorted lists.
In every recursion, z gets a node which is smallest node from x and y.
∴ Finally z gets entire sorted list of given two sorted lists of x and y.
So option (c) is correct.

D None of these

QUESTION ANALYTICS +

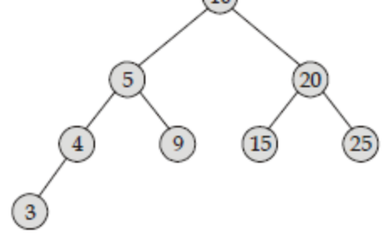
Q. 5

Assume a Binary Search Tree is not allowed to have duplicates, there is more than one way to delete a node in the tree when the node has two children. If we resolve the situation in favor of choosing elements for replacement from left subrtree, then which of the following is true about replacement element?

Solution Video | Have any Doubt ?

A Largest node in the left subtree — Correct Option

Solution :
(a)
When we delete any node in Binary Search Tree then it is either replaced by inorder successor (smallest in right subtree) or inorder predecessor (largest in left subrtree).
So, elements will be largest element in subtree.



When 10 is deleted then it is either replaced by 9 or 15 i.e. largest in left subtree or smallest is right subtree.

B Smallest node in the subtree

C Root of the left subtree

D Any one from (a) and (c)

QUESTION ANALYTICS +

Q. 6

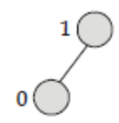
Consider a binary tree where for every node $|P - Q| \leq 2$. P represents number of nodes in left sub tree for node S and Q represents the number of nodes in right sub tree for node S for $h > 0$. The minimum number of nodes present in such binary tree of height $h = 4$ _____. (Assume root is at height 0)

FAQ Solution Video Have any Doubt ?

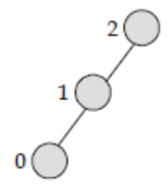
9 Correct Option

Solution :
9

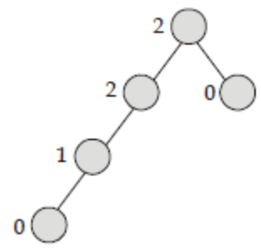
For height (h = 1) minimum number of node is 2 by using formula $2^{h-1} + 1$ i.e.



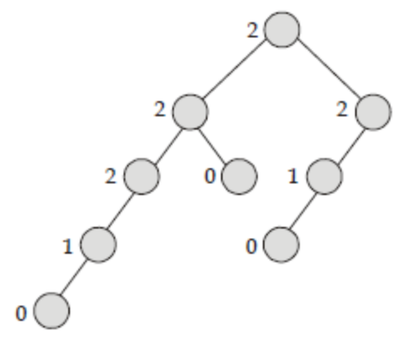
For height (h = 2) minimum number of node is 3 by using formula $2^{h-1} + 1$ i.e.



For height (h = 3) minimum number of node is 5 by using formula $2^{h-1} + 1$ i.e.



So for height (h = 4) minimum number of node will be 9 by using formula $2^{h-1} + 1$.

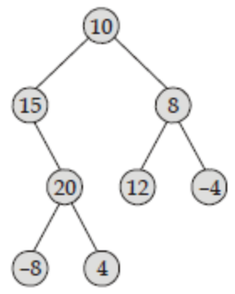


QUESTION ANALYTICS +

Q. 7

Consider the following C-programming run over given binary tree by passing root node as the parameter:

```
int count (struct * node * node) {
    if (node = = NULL)
        return 0;
    int old_val = node → data;
    node → data = count (node → left) + count (node → right);
    return node → data + old value;
}
```

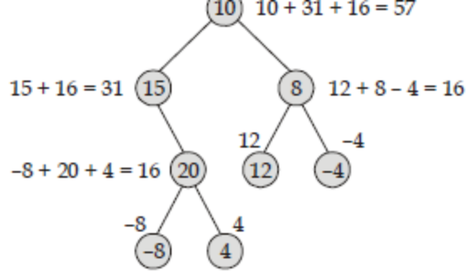


The final value return by count ( ) function is _____.

Solution Video Have any Doubt ?

57 Corrcct Option

Solution :
57



The given code calculate node data → sum of left subtree + sum of right subtree for each node.

QUESTION ANALYTICS

Q. 8

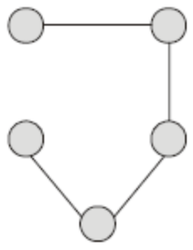
The maximum number of edges possible in an undirected graph with 5 nodes, when Depth First Search (DFS) call made on any random node in the graph results in stack size '5' i.e. 5 function calls present in stack simultaneously are _____.

FAQ | Solution Video | Have any Doubt ?

10 — Correct Option

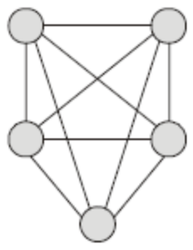
Solution :
10

Since number of function calls simultaneously present in stack is '5'.



Since maximum edges asked, so, it must be complete graph i.e.

$$\frac{5\times(5-1)}{2} = \frac{20}{2} = 10$$

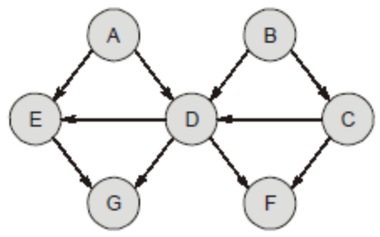


So, 10 edges are present in such graph.

QUESTION ANALYTICS

Q. 9

Consider the following graph:

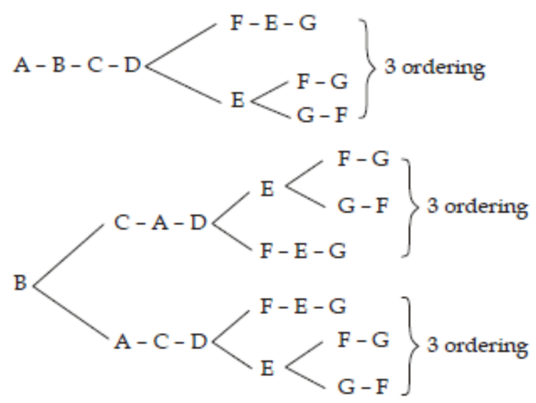


The number of topological orders for the given graph are _____.

FAQ | Solution Video | Have any Doubt ?

9 — Correct Option

Solution :
9



Total 9 ordering are possible.

Your Answer is 7

QUESTION ANALYTICS

Q. 10

Consider the following statements:
S_1 : Rotation operation in AVL always preserves the inorder numbering.
S_2 : The median of all element in the AVL trees is always at root or one of its two children.
S_3 : If every node in binary search tree has either 0 or 2 child, then searching time is O(logn).
S_4 : A 3-array tree is a tree in which every internal node has exactly 3 children. The number of leaf nodes in such a tree with 20 internal will be 41.
Which of above statements are true?

FAQ | Solution Video | Have any Doubt ?

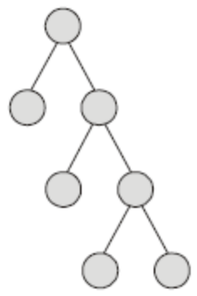
A *S_1, S_2 only*

B *S_2, S_3 only*

C S_3, S_4 only

D S_1, S_4 only — Your answer is **Correct**

Solution :
(d)
• Rotation operation in always preserves the inorder numbering so 1st is true.
• AVL tree doesnot guarantee that both left and right subtree has equal number of nodes, so statement is false.
• Consider



satisfying the property of statement 3, in this tree if element present is at last level the time complexity will be $c \times n/2 \simeq O(n)$. So S_3 is false.

- Total nodes = 3 × internal nodes + 1
  = 3 × 20 + 1 = 61
  and 20 + 41 = 61
  (Leaf + internal = total) so S_4 is true.

QUESTION ANALYTICS +

Q. 11

Consider the following function with a Binary Tree with atleast one node:
int path (struct node * x, int len

```
{
    if (x == NULL) return (B);
    else return (A);
}
```

Assume the above function is used "to check the given binary tree has any path with specified length from root to the leaf node". Let T be a binary tree with root pointed by x. The function path $(x, 10)$ returns non-zero if there exist any path from root to leaf has a path length of 10.
Otherwise return zero. Find B and A with the recursive calls of path?

Solution Video | Have any Doubt ?

A A is path($x \rightarrow$ left, len–1) || path($x \rightarrow$ right, len–1), B is (len = = 0)

B A is path($x \rightarrow$ left, len–1) || path($x \rightarrow$ right, len–1), B is (len = = 1)

C A is path($x \rightarrow$ left, len–1) || path($x \rightarrow$ right, len–1), B is (len = = –1) — Correct Option

Solution :
(c)

Given function call is recursive.
Before calling any recursive call, it decrements length. So at leaf node recursive call will decrement by 1 even there exist no path.
∴ B is (len == –1)
Before traversing its child it decrements the length, whenever a length reaches to –1 and node is leaf then it implies there exist a path with given length.
∴ A is path($x \rightarrow$ left, len – 1) || path($x \rightarrow$ right, len – 1)
If one of the path returns non-zero then it recursively returns back. So option (c) is correct.

D A is path($x \rightarrow$ left, len) || path($x \rightarrow$ right, len), B is (len = = 1)

QUESTION ANALYTICS +

Q. 12

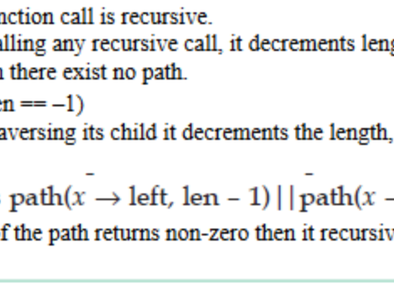
Which of the following is true?

FAQ Solution Video | Have any Doubt ?

A In breadth first search of an undirected graph there are no back edge and no forward edge. — Correct Option

Solution :
(a)

Since for undirected graph, breadth first search does not have back edge and forward edge but for directed graph we have back edge.
Ex: Consider Random Graph (Directed):



BFS of graph: Assume (A) is start node

Here in graph no forward edge present, but E → A back edge present, so (b) is false.
Since undirected graph for BFS does not create back edge so statement is false.

B In breadth first search of an directed graph there are no back edge and no forward edge.

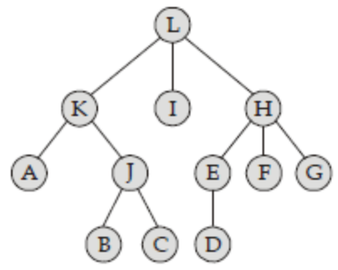
C In breadth first search of an undirected graph, for each back edge (u, v), we have $0 \leq v.d \leq u.d$. — Your answer is **Wrong**

D Both (b) and (c)

QUESTION ANALYTICS +

Q. 13

Consider the following:



Which of the following represent Inorder and Postorder of the tree?

Have any Doubt ?

A Inorder: ABKJCLIEDHFG
Postorder: ABCJKIDEFGHL

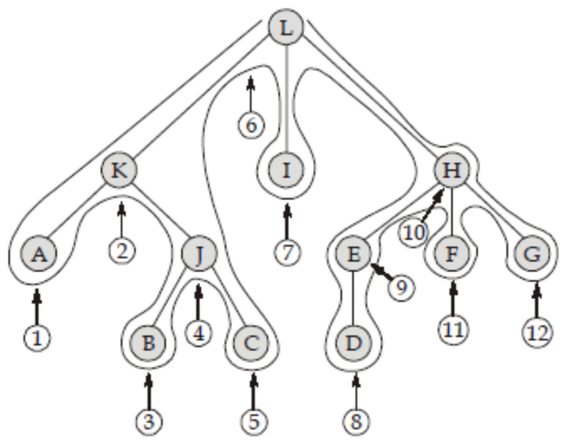
B Inorder: AKBJCILDEFHG
Postorder: ABCJKIDEFGHL

Your answer is **Wrong**

C Inorder: AKBJCLIDEHFG
Postorder: ABCJKIDEFGHL

Correct Option

Solution :
(c)
• Inorder of tree is: Left, Root, Right (any other)



So, Inorder: AKBJCLIDEHFG
• Postorder of tree is Left, Right (any other), Root
So, Post order is: ABCJKIDEFGHL

D Inorder: ABCJKILDEHFG
Postorder: ABCJKLIEDHFG

QUESTION ANALYTICS +

Q. 14

A d-ary heap is like a binary heap, but instead of two children, nodes have 'd' children. A d-ary heap can be represented in a 1-dimensional array as follows. The root is kept in A[1], its d children are kept in order in A[2] through A[d + 1] their children are kept in order in A[d + 2] through A[$d^2 + d +$ 1] and so on. What index does maps the j^{th} child for ($1 \le j \le d$) of i^{th} index node?

Solution Video | Have any Doubt ?

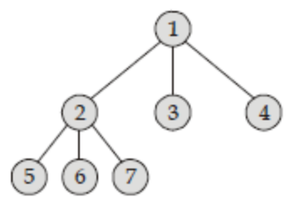
A $d(i - 1) + 1$

B $d(i - 1) + j + 1$

Correct Option

Solution :
(b)

Consider 3 array heap:



Array = A	1	2	3	4	5	6	7	.....	
	1	2	3	4	5	6	7	.....	n

So, root at at A[1] i.e. $d(i - 1) + j + 1$

$= 3(1 - 1) + j + 1$

$= 0 + 0 + 1 = 1$

1st child of root $= d(i - 1) + j + 1$

$= 3(1 - 1) + 1 + 1 = 2$

3rd child of root $= d(i - 1) + j + 1$

$= 3(1 - 1) + 3 + 1$

$= 0 + 4 = 4$

Index for node 7 $= d(i - 1) + j + 1$

$= 3(2 - 1) + 3 + 1$

$= 3 + 3 + 1 = 7$

So, index maps to $d(i - 1) + j + 1$.

C $d(i - 1) + j$

D $(d \times i) + j + 1$

QUESTION ANALYTICS

Q. 15

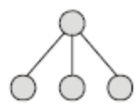
A 3-array tree is a tree in which every internal node has exactly 3 children. The number of leaf nodes in such a tree with 20 internal nodes will be _____.

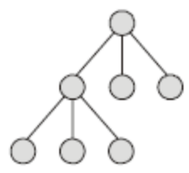
Solution Video | Have any Doubt ?

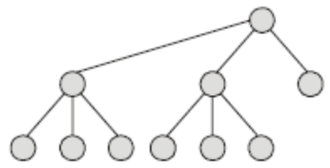
41 — Your answer is **Correct**41

Solution :
41

$n \rightarrow$ number of internal nodes:

Let $n = 1$  $\Rightarrow$ 3 $\Rightarrow$ 2 (1 – 1) + 3

Let $n = 2$  $\Rightarrow$ 5 $\Rightarrow$ 2 (2 – 1) + 3

Let $n = 3$  $\Rightarrow$ 7 $\Rightarrow$ 2 (3 – 1) + 3

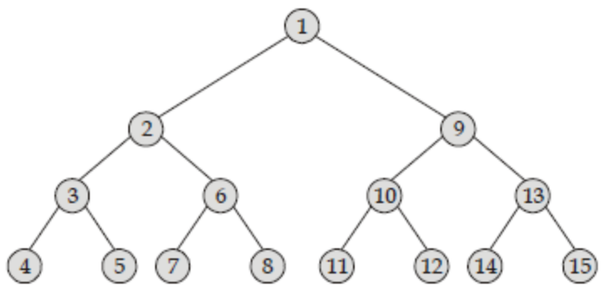
Number of internal nodes = 2 (n – 1) + 3 = 2 (20 – 1) + 3 = 41

For every internal node accept root node, 2 leaf nodes are added.

QUESTION ANALYTICS

Q. 16

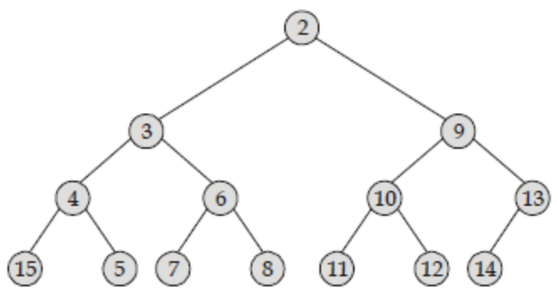
Consider a binary min heap given below containing integer in [1, 15]. The maximum number of node movement on 5 successive removal of element are _____.



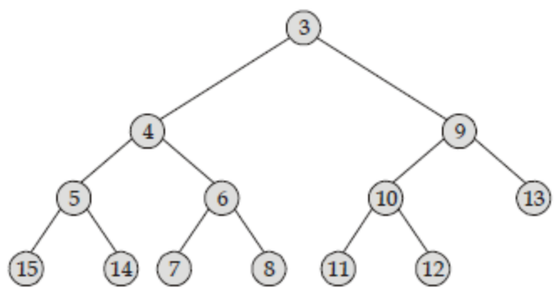
Solution Video | Have any Doubt ?

18 — Correct Option

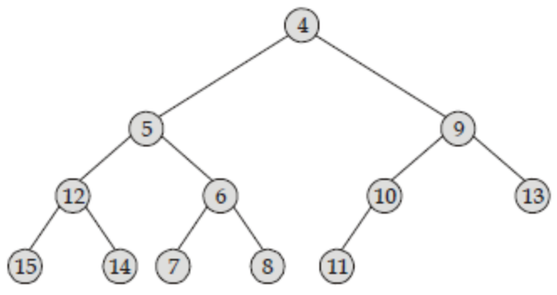
Solution :
18



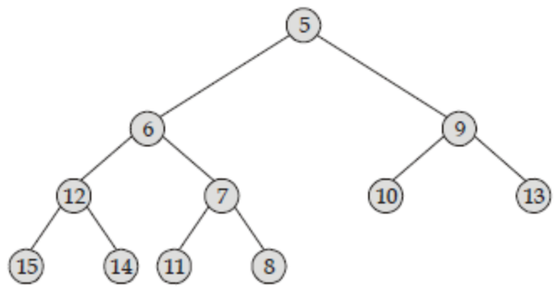
First deletion takes 4 node movement



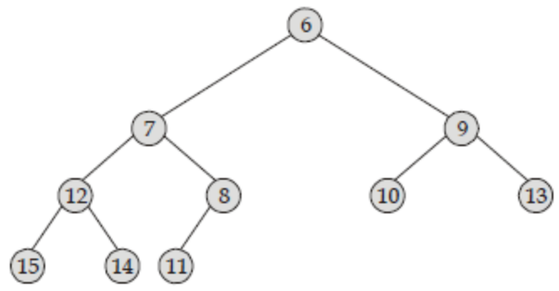
Second deletion takes 4 node movement



Third deletion takes 3 node movement



Fourth deletion takes 4 node movement



Fifth deletion takes 3 node movement

Total number of head movement = 4 + 4 + 3 + 4 + 3 = 18

Your Answer is 19

QUESTION ANALYTICS

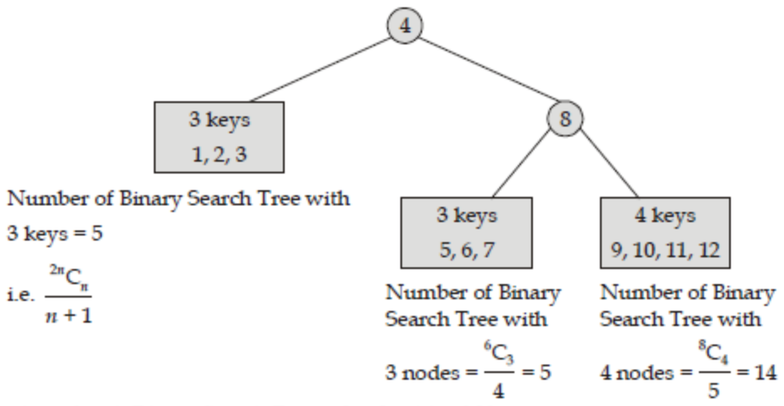
Q. 17

The number of binary search trees possible with 12 keys, when keys 1, 2, 3, 4, ... 12 are inserted into empty Binary Search Tree with condition such that (4) is the root of binary search tree and (8) is immediate right child of (4) are _____.

Solution Video | Have any Doubt ?

350 Correct Option

Solution :
350



Number of Binary Search Tree with 3 keys = 5

i.e. $\frac{^{2n}C_n}{n+1}$

Number of Binary Search Tree with 3 nodes = $\frac{^{6}C_3}{4} = 5$

Number of Binary Search Tree with 4 nodes = $\frac{^{8}C_4}{5} = 14$

So, number of such Binary Search Tree = $5 \times 5 \times 14 = 350$

Your Answer is 17280

QUESTION ANALYTICS +