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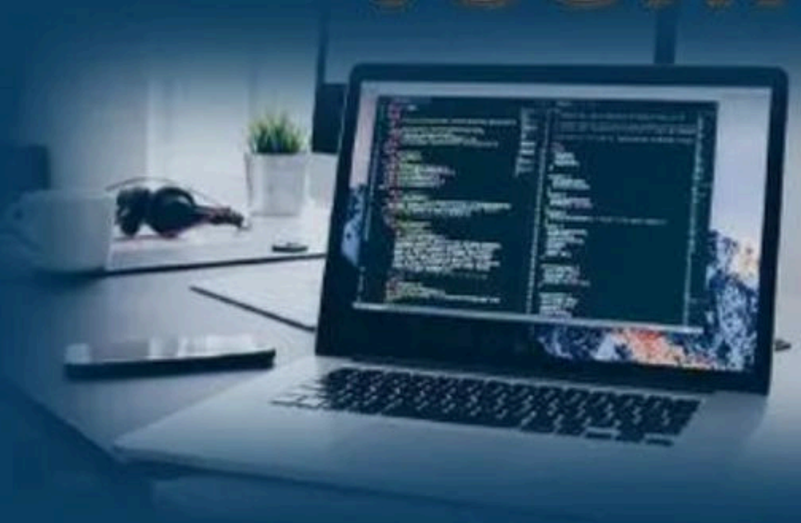
Problem Solving - Part I

Course on Data Structure

Pankaj Sharma • Lesson 35 • Aug 21, 2024

Computer Science And Information Technology



Lecture Number : 35

Data Structure

By- Pankaj sir

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#Q. Where in a heap is the smallest element?

A. At the root
B. It is the leftmost leaf
C. It is the rightmost leaf
D. It could be any leaf node
E. It could be any internal node

max

Max-heap

① Max - Root
Min - Leaf

Min-heap

① Min - Root
Max - Leaf

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#Q. Select the true statement about the worst-case time for operations on heaps.

A. Neither insertion nor removal is better than linear.

B. Insertion is better than linear, but removal is not.

C. Removal is better than linear, but insertion is not.

D. Both insertion and removal are better than linear.

Max-heap → Insert an element → $O(\log_2 n)$

→ delete → $O(\log_2 n)$

$O(n)$

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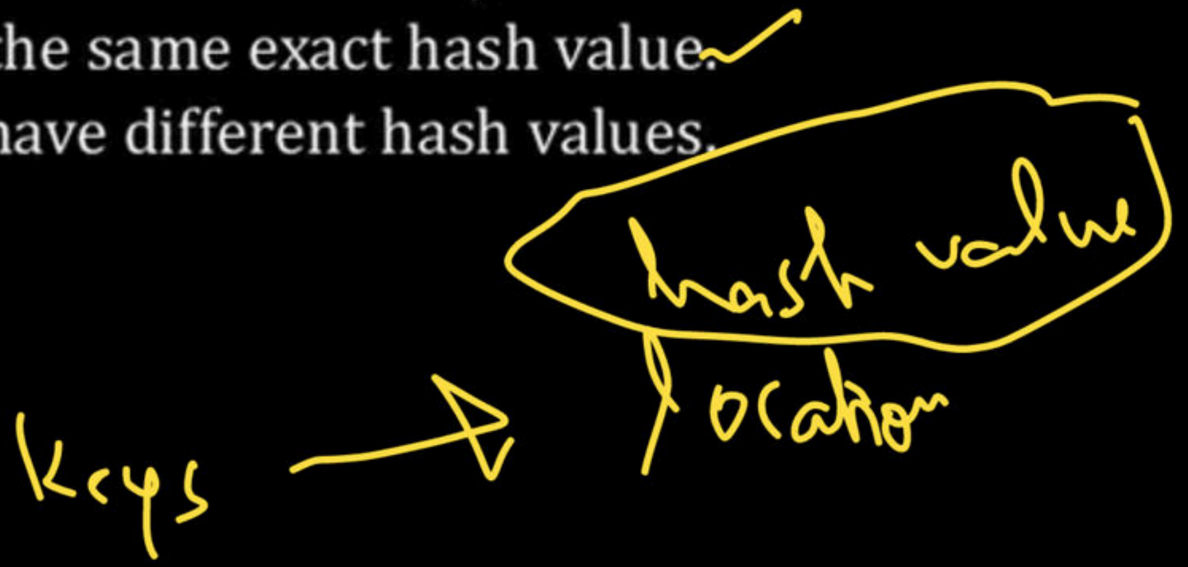
#Q. What is the best definition of a collision in a hash table?

A. Two entries are identical except for their keys.

B. Two entries with different data have the exact same key.

C. Two entries with different keys have the same exact hash value.

D. Two entries with the exact same key have different hash values.



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#Q. A complete n–any tree is a tree in which each node has n children or no children (leaf node) Let, I be the number of internal nodes and L be the number of leaf nodes. If L = 1027, I = 54 then n = _____.

$N = n \cdot I + 1$

$L + I = n \cdot I + 1$

$L = (n-1) \cdot I + 1$

$1027 = (n-1) \cdot I + 1$

$(n-1) \cdot 54 = 1026$

$(n-1) = \frac{1026}{54}$ lg

$n - 1 = \lg$

$n = 20$

#Q. In a ternary tree the number of internal nodes of degree 1, 2 and 3 are 3, 5 and 4 respectively. The number of leaf nodes in the given tree is _____

$$N = 1\times3 + 2\times5 + 3\times4 + 1$$

$$3 + 10 + 12 + 1$$

$$N = 26$$

$$n_0 + n_1 + n_2 + n_3 = 26$$

$$n_0 + 3 + 5 + 4 = 26$$

$$n_0 + 12 = 26$$

$$\boxed{n_0 = 14}$$

#Q.

head is the pointer to the linked list what is the value of head→ next →prev →next →next->data_____3_____.

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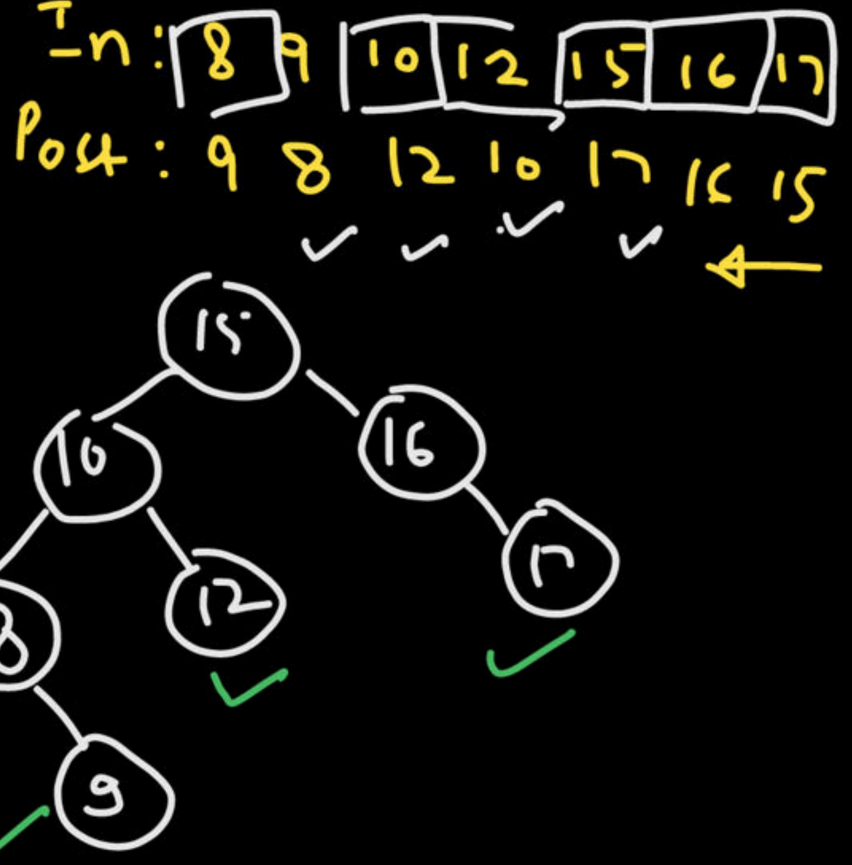
#Q. If the postorder traversal of a binary search tree is a 9, 8, 12, 10, 17, 16, 15 then the leaf nodes of the tree are,

A. 9, 12, 17

B. 15, 16, 17

C. 9, 10, 15

D. 10, 9, 15



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#Q. A hash function 'h' defined as ,

h (key) = key mod 11.

with linear probing, is used to insert the keys.

11, 121, 89, 34, 39, 67, 73, 99, 101 into a table indexed from 0 to 10. The location of key 99 will be _____.

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[NAT]

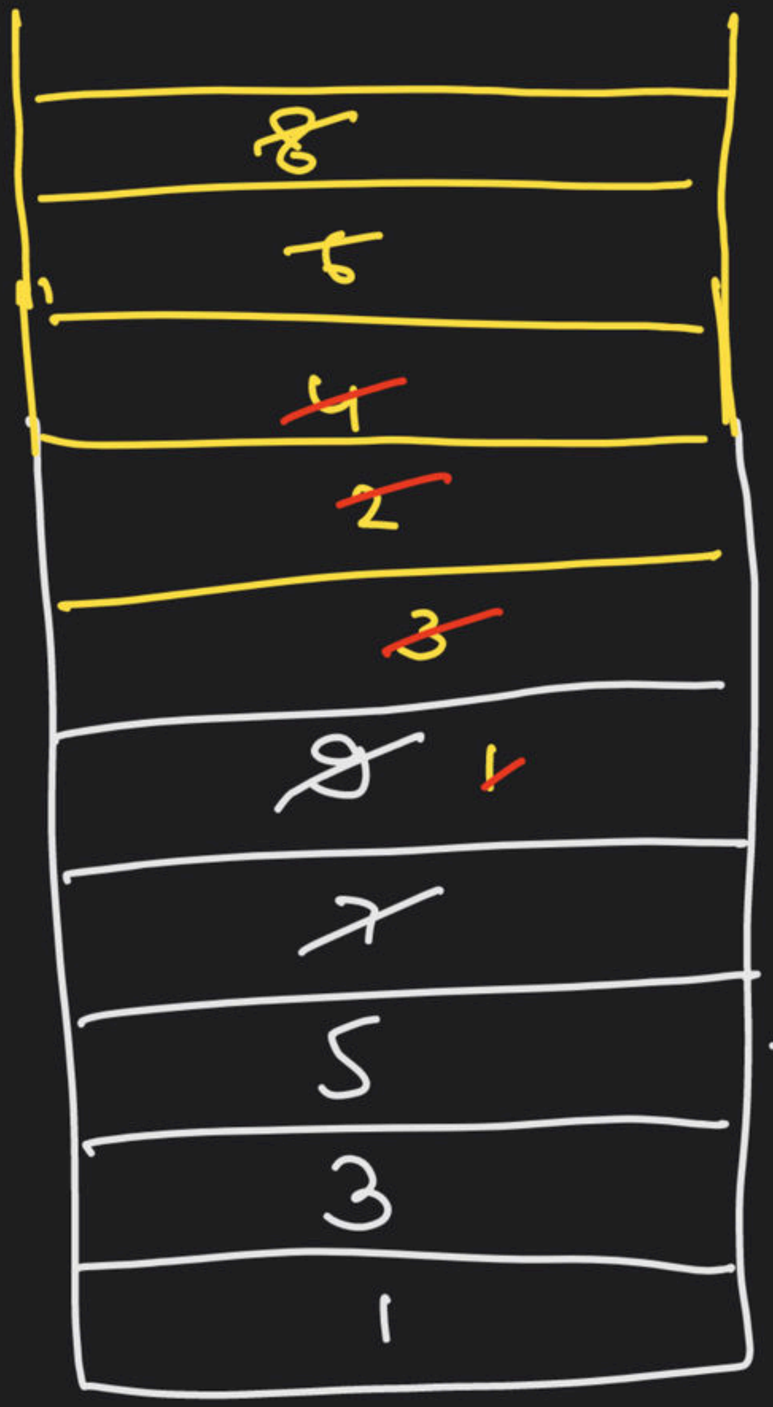
#Q. Consider a sequence of element $a_0 = 1$, $a_1 = 3$, $a_2 = 5$, $a_3 = 7$, $a_4 = 9$, $a_5 = 2$, $a_6 = 4$, $a_7 = 6$, $a_8 = 8$.

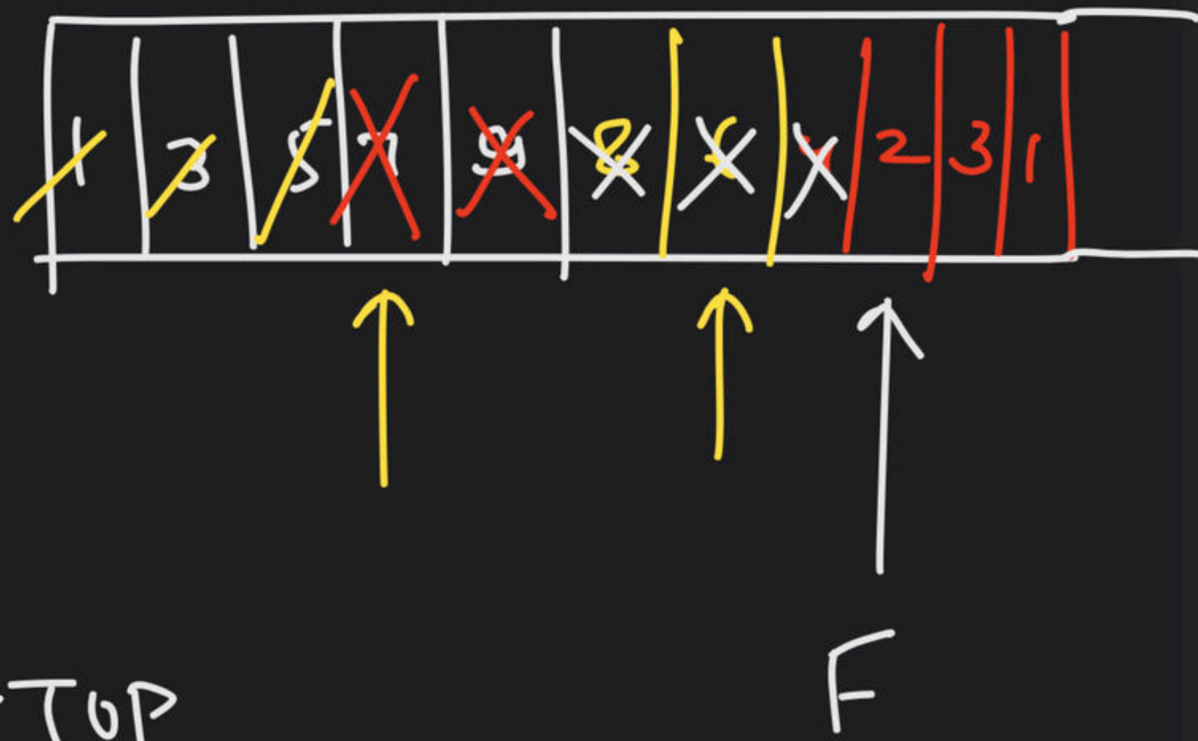
The following operations are performed on a stack 'S 'and a queue 'Q'. Both of which are initially empty.

I. Push the elements of a_0 to a_4 in that order into 'S'.
II. Enqueue the elements a_0 to a_3 in that order 'Q'.
III. POP an elements form 'S' and enqueue into 'Q' same elements.
IV. Dequeue two elements from Q and same element push into 'S'.
V. Push a_5 to a_8 into S.
VI. POP two element from 'S' and enqueue into 'Q' same elements.
VII. Dequeue an element from 'Q'.
VIII. Repeat operation VI to VII in sequence two more times.
IX. POP an element from S.
X. Dequeue three elements from 'Q'.

The summation of top element form 'S' and front element from 'Q' after executing the above operation is_____.

5+2 = (7)





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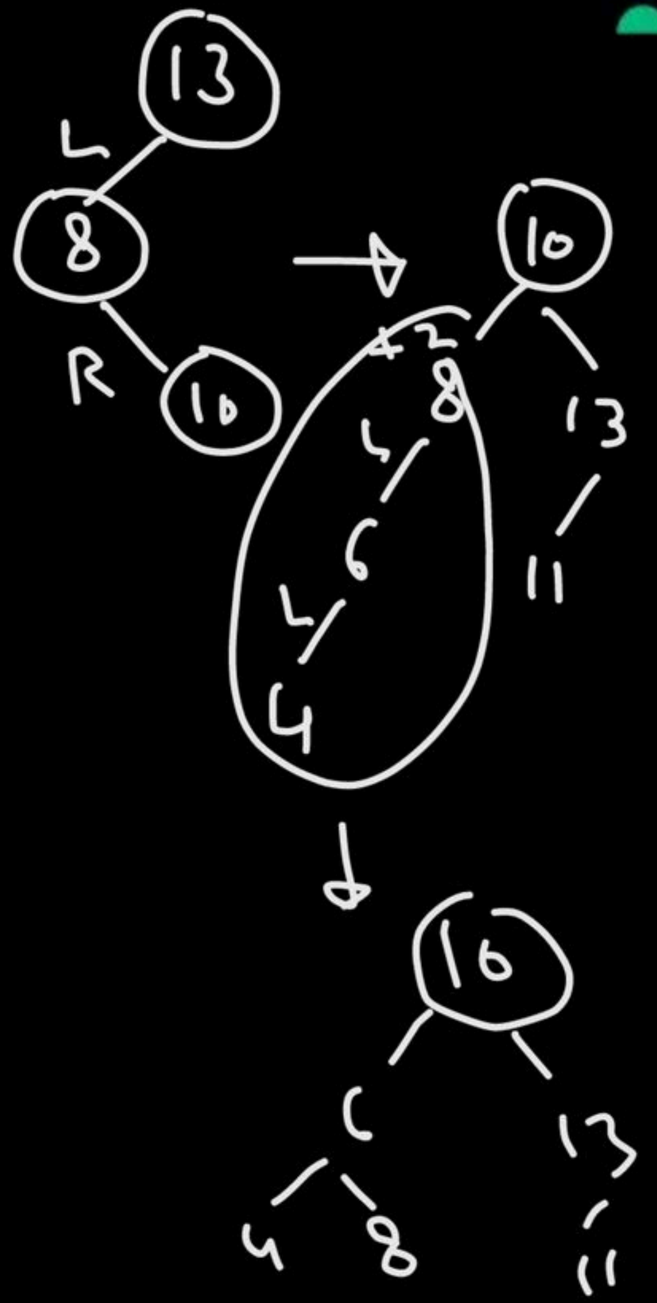
[MCQ]

1 double

#Q. The following nodes are inserted into an AVL tree:

13, 8, 10, 6, 11, 4, then how many rotations did it take.



A 1 single rotation

B 2 double rotations

C one double rotation, one single rotation

D 2 high rotations

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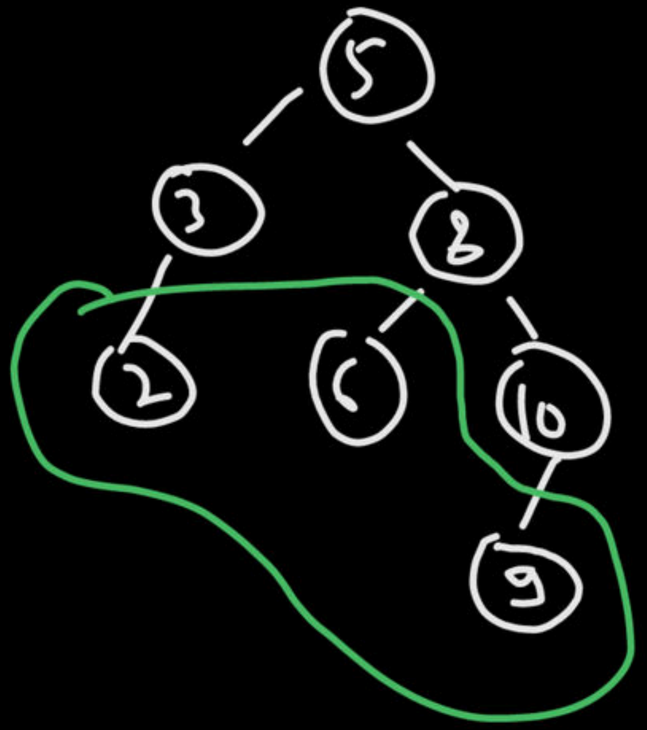
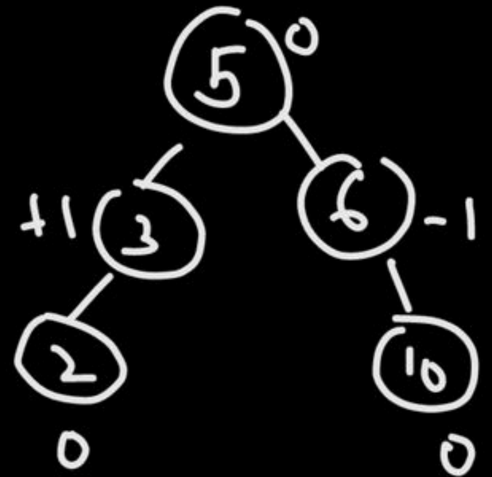
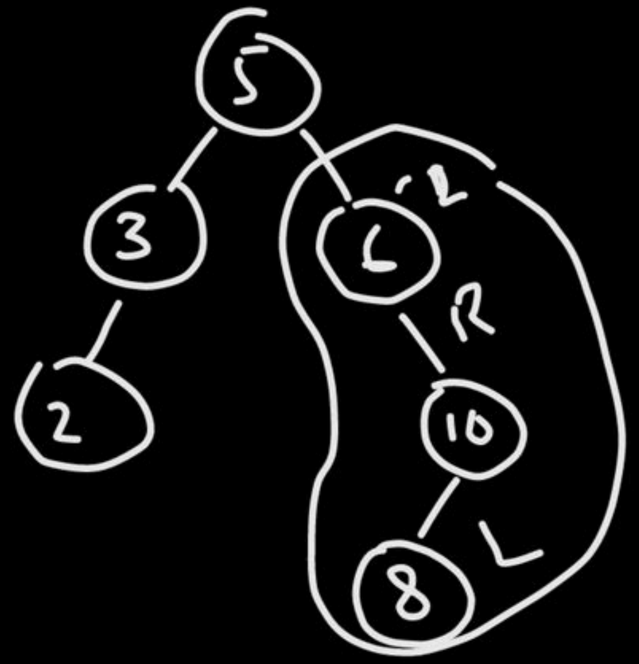
#Q. If the following elements are inserted into an empty AVL tree 5, 6, 3, 2, 10, 8, 9 then the sum of leaf nodes is 17.







17

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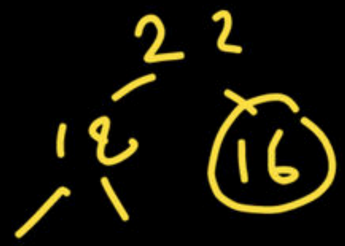
[MCQ]



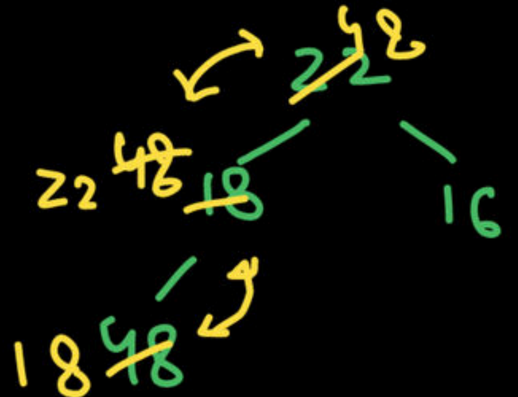
#Q. Construct max heap by inserting following elements 22, 18, 16, 48, 26, 9, 8
Note that after every insertion the heap should be heapified then what is the element which is right child of the root.

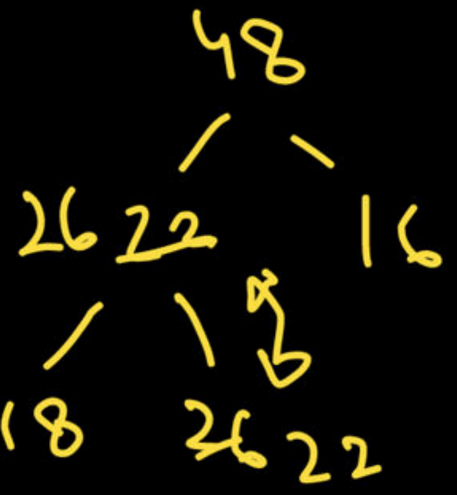
A 48

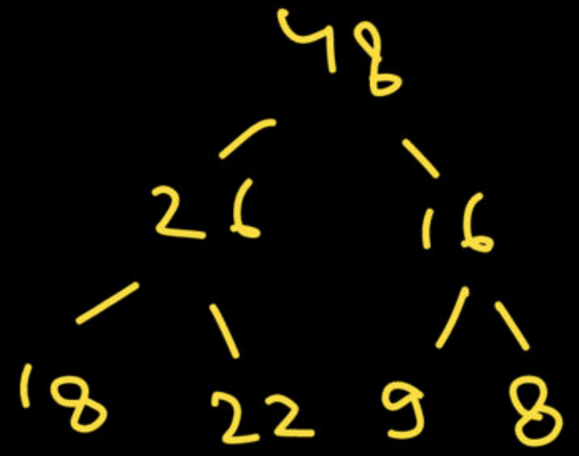
B 16

C 9

D 26







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[MCQ]

#Q. A 4-Ary tree where every internal nodes has exactly 4 children then number of internal nodes are there if there are 21 nodes in total.

A 2

B 5

C 1

D 3

$$21 = 4 \cdot I + 1$$

$$21 - 1 = 4 \cdot I$$

$$20 = 4I$$

$$I = 5$$

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[NAT]

#Q. Consider a hash table which stores string, hash table size is 10 and hash function h(x) = x%10 where x is XOR of all characters in the string.

Consider 2, 3, 4, 6, 8 places are filled in the hash table if quadratic probing is used then at what index 'ab' will be stored 7.

a → 01100001

b → 01100010

00000011 → 3

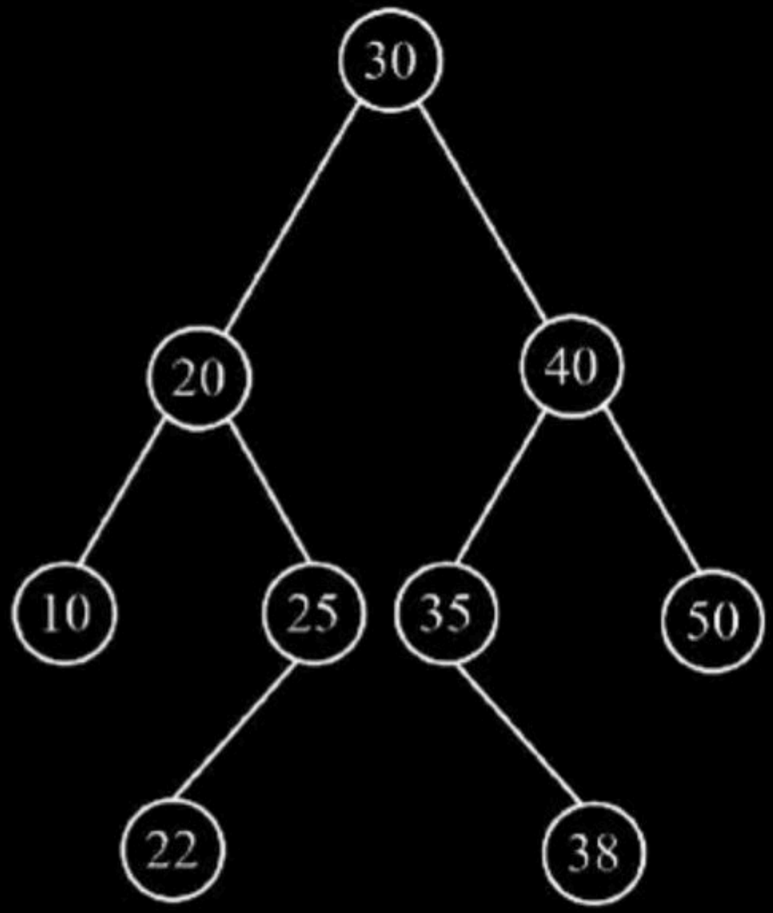
h('ab') = 3%10 = 3 collission

(3+1²) mod 10 = 4 → collission

(3+2²) mod 10 = 7 ✓

[MCQ]

#Q. Consider this AVL tree after deleting 40 & 30 from the tree, what is the in order traversal of the tree.



A 10, 20, 22, 25, 35, 38, 50

B 10, 20, 22, 25, 38, 35, 50

C 10, 20, 22, 25, 35, 50, 38

D 10, 20, 25, 22, 35, 50, 38

[MCQ]

#Q. What is the minimum number of nodes in a minimal AVL tree of height 4 12.

$$n(h) = n(h-1) + n(h-2) + 1 \quad h \geq 2$$

12

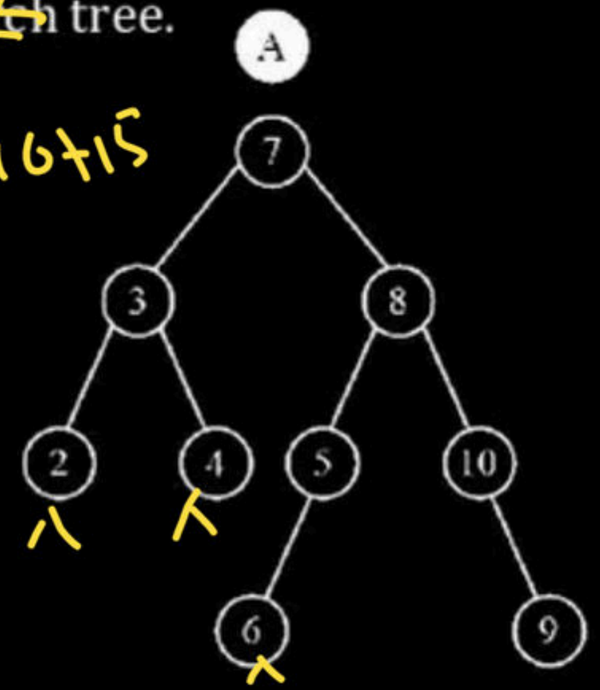
$n(0) = 1$

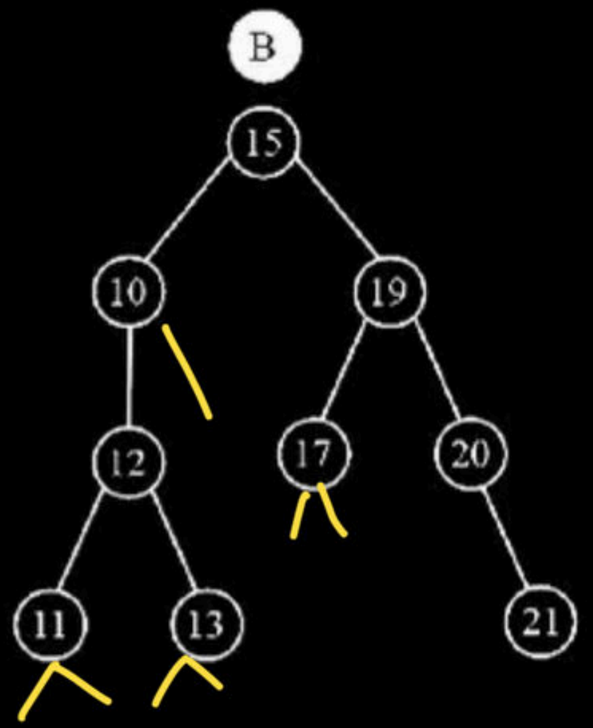
$n(1) = 2$

h	0	1	2	3	4
n(h)	1	2	4	7	12

[NAT]

#Q. Consider below given two binary search tree.





$P_A = 24$

$R_A = 22$

$R_B = 11 + 12 + 13 + 16 + 15$

$R_B = 61$

$Q_B = 63$

Consider, P = summation of first five terms of preorder traversal.

Q = summation of first five terms of postorder traversal.

R = Summation of first five terms of in-order traversal.

Then $(P_A - R_A) + (Q_B - R_B)$ is _____.

$24 - 22 + 63 - 61 \Rightarrow 2 + 2 \Rightarrow 4$

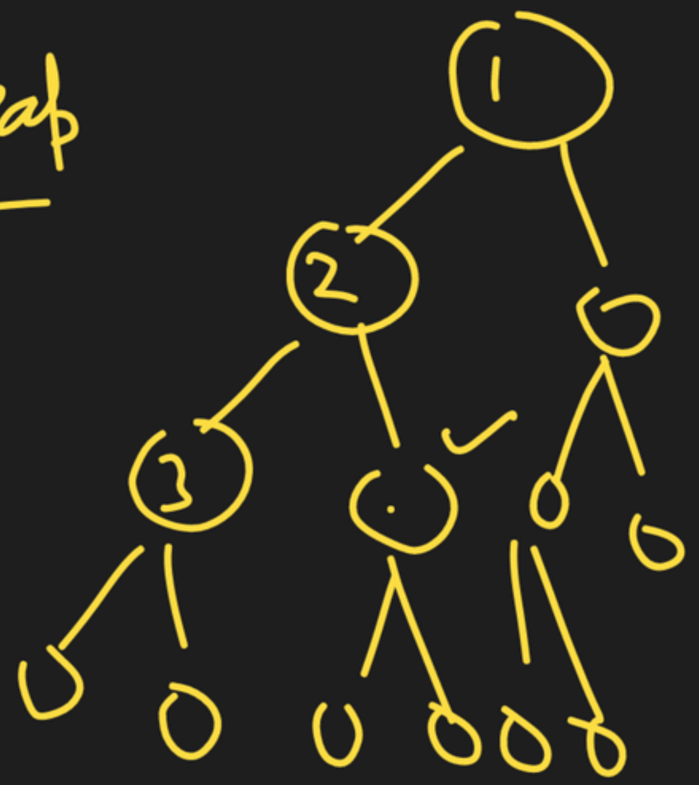
[NAT]

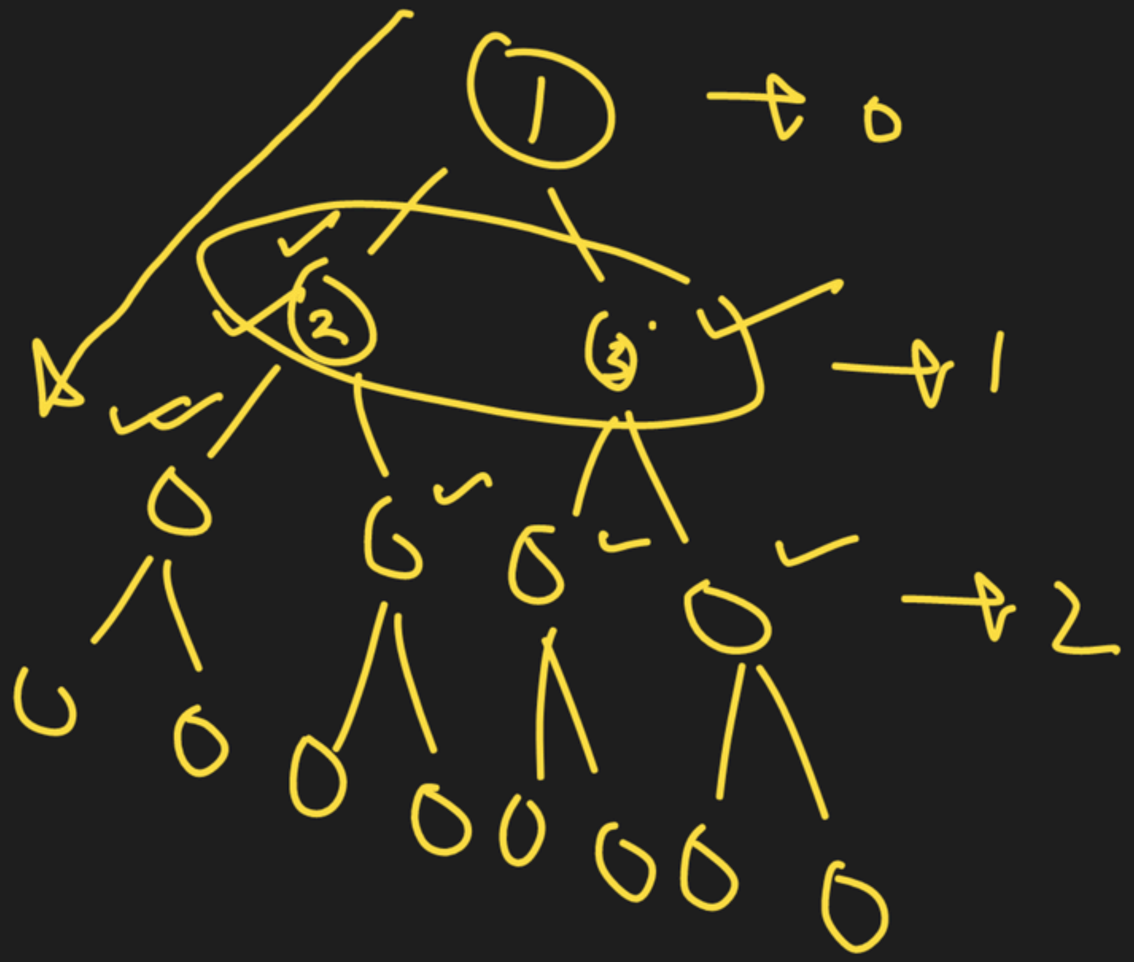
min

#Q. A complete binary max-heap is made by including each integer in [1, 1023] exactly once. The depth of a node in the heap is the length of the path from the root of the heap to that node thus the root is at depth '0'. The maximum depth at which integer 8 can appear is____.

[1,1023]

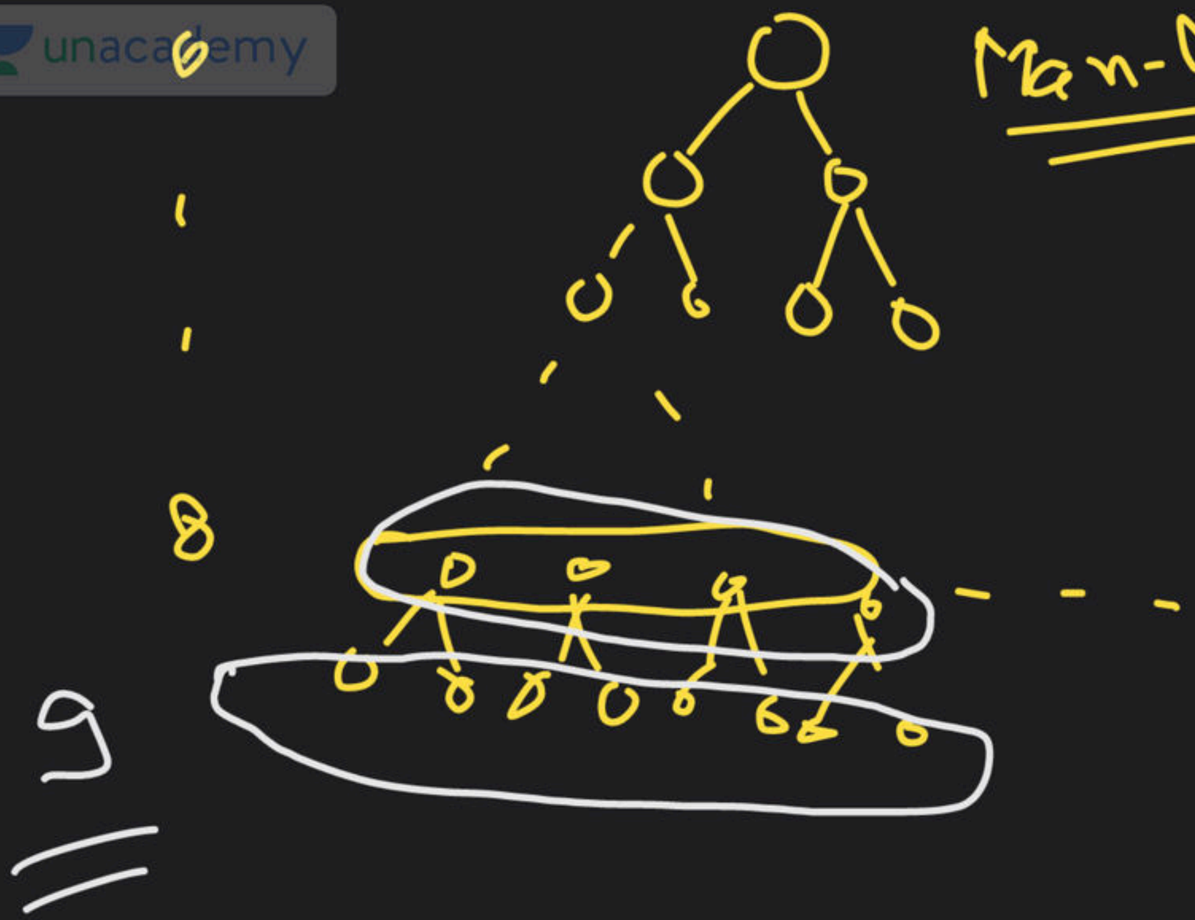
Min-heap





ur min

8 → 7



Max-heap

$[1, 1023]$

$\Rightarrow$

$2^0 + 2^1 + \cdots 2^8$

$\Rightarrow 2^9 - 1$

$\Rightarrow 511$

8

H.W

Max-heap $[1, 1024)$

1016 $\Rightarrow$ max. depth

H.W

[NAT]

#Q. Given a binary max heap. The elements are stored in an array as 67, 23, 50, 19, 27, 9, 13, 8, 1.

If two elements are deleted from the heap then using ~~happify~~ heapify _____number of swaps will happen.

[NAT]

#Q. Consider a hash table which can allow a maximum load factor 0.8. If the hash table size is 45 then the maximum allowed keys in the table are_____.

$$\lambda = \frac{n}{45}$$

$$0.8 = \frac{n}{45}$$

$$\boxed{n = 36}$$

[MCQ] /MSQ

#Q. Given a queue and a binary search tree:

Operation I. Delete 40 from BST and insert it to queue.

Operation II. Delete 3 elements from queue.

Operation III. Delete one element from queue and add it to BST

The value of,

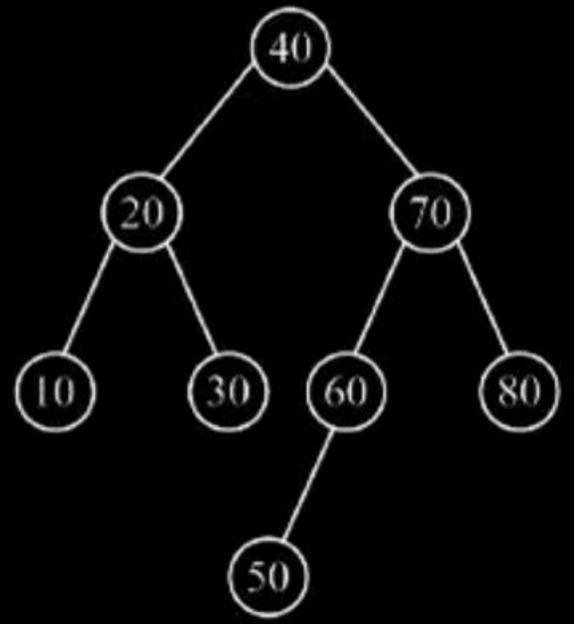
P+Q+R is_____.

Where P = front element of queue

Q = Root element of BST

R = Last element of inorder traversal of BST.

Quene



BST

A 230

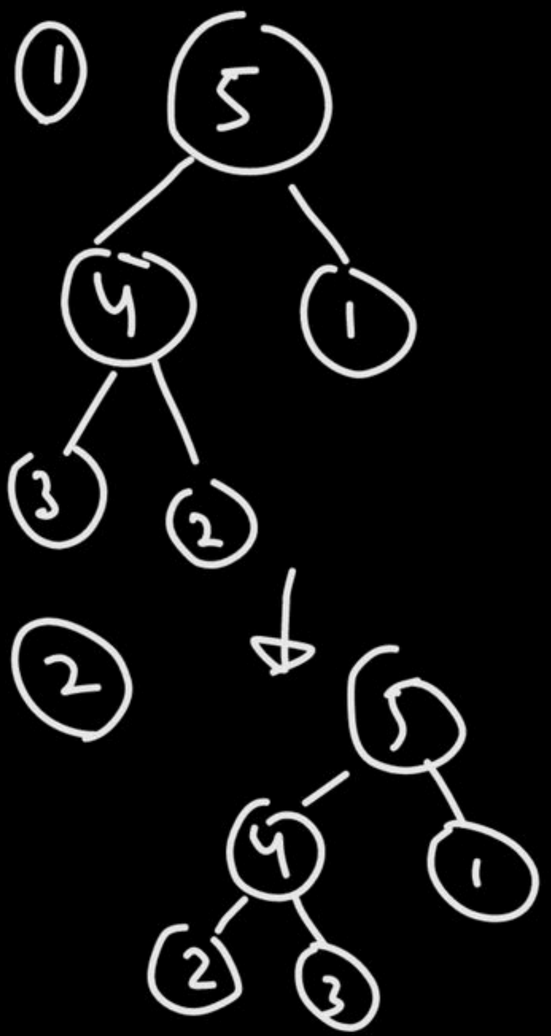
B 190

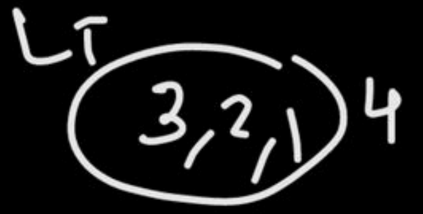
C 175

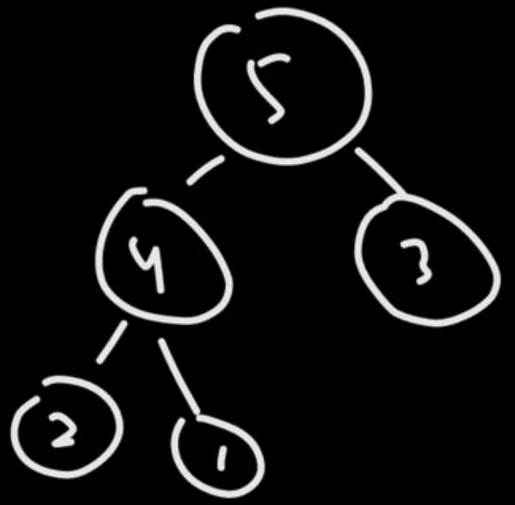
D 180

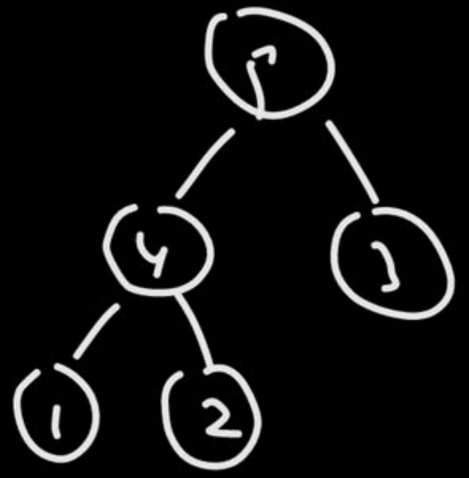
[NAT]

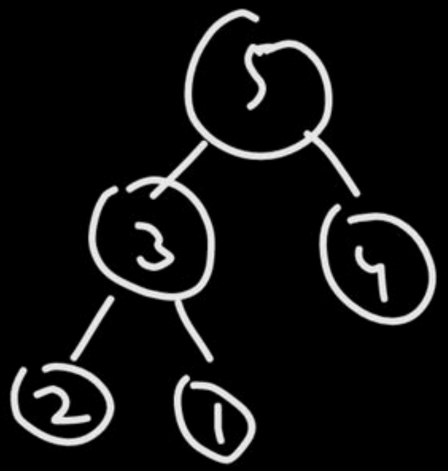
#Q. For the elements 5 4 3 2 1 , how many max heap representations are possible____.

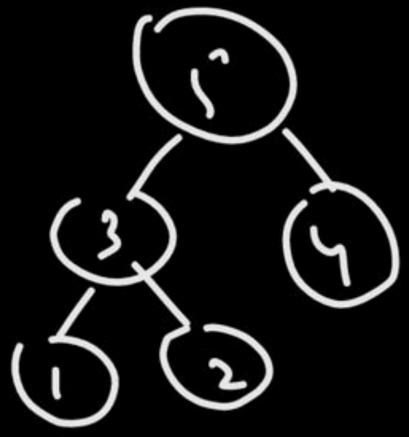


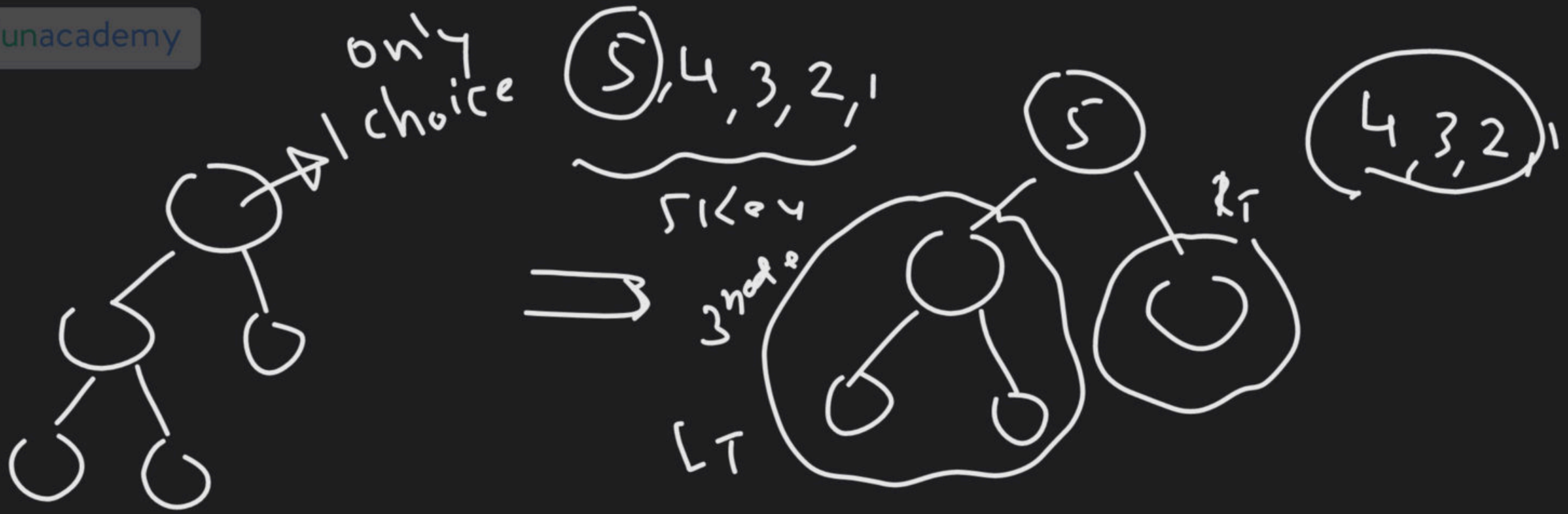












out of 4 selecting any 3

$$\Rightarrow \left({}^{4}C_{3} \times 2\right) \times \underline{1} \Rightarrow 4 \times 2 = 8$$

LT

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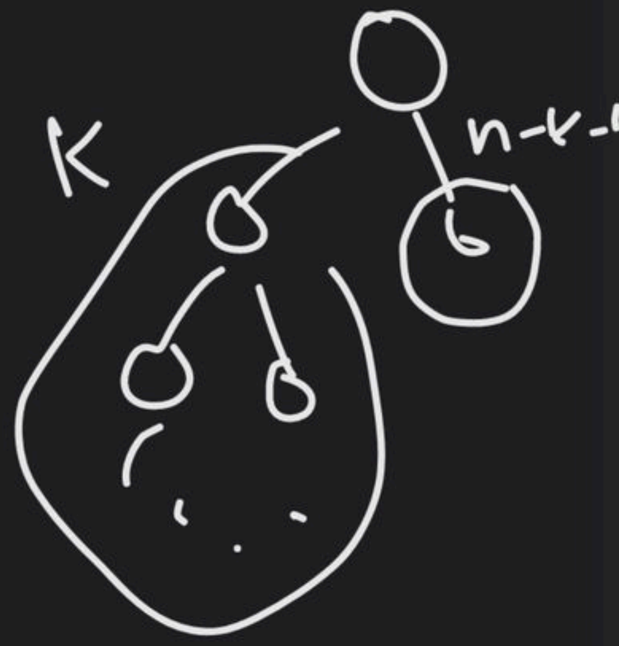
n keys → (1) → CBT

$F(n)$: no. of max. heaps possible



1) Root — 1 choice

2) Rem. keys ⇒ (n-1)

$L_T \rightarrow$ k nodes → a) ${}^{n-1}C_k \times F(k)$

b) $F(n-k-1)$

$F(n) = 1 \times {}^{n-1}C_k \times F(k) \times F(n-k-1)$

250 Questions

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▲ 2 • Asked by Kratik

Sir agr question me no. Of rotation puchha hh or usme LL,RL rotation aaye then we should give ans as 3 ? If question ask abt total no. Of rotation

2 hrs

23

6 hrs

4

[NAT]

#Q. Push operation takes 2 units of times, pop takes 1 unit of time, printing an element takes 3 units of time. Suppose S_1, S_2 are 2 stacks where S_1 has elements {1, 2, 3, 4, 5}, 5 is at top and S_2 is empty. The min unit of time required to print the sequence 53142 is_____.

(Note: only push, pop print can be used.)

[NAT]

#Q. A = 9 5 2 + * 15 3 /-

B = – +/16^ 23*10 4 A

If above given expression evaluated using stack then, B =_____.

[NAT]

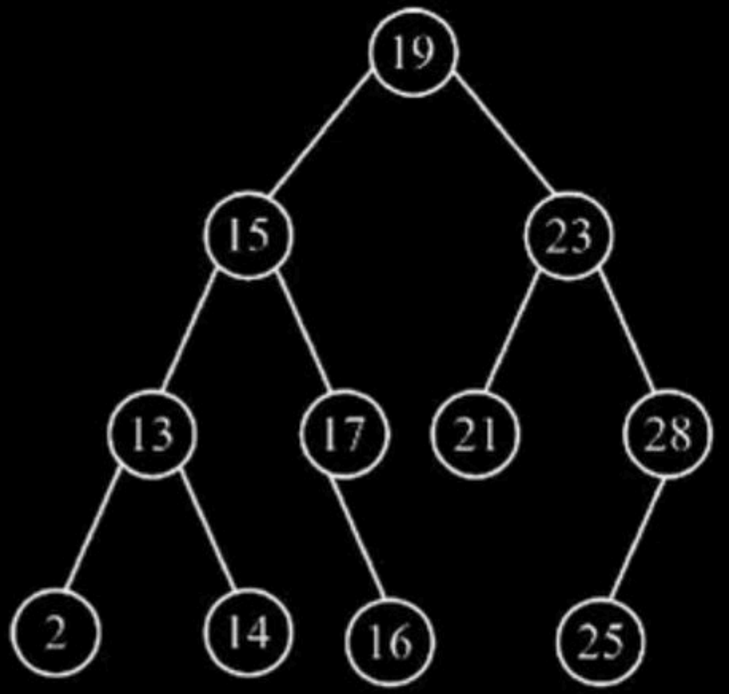
#Q. Let

A = preorder successor of 17

B = preorder successor of 21

C = inorder successor of 19

Then A/(B–C)=_____.



[MSQ]

#Q. Which of the following properties is/are correct for binary trees.

A Maximum number of nodes in a binary tree of height H is $2^{H+1} - 1$.

B Total number of leaf nodes in a binary tree is a equal to (total number of nodes with 2 children+1)

C Maximum number of nodes at any level 'L' in a binary tree is 2^{L}.

D Minimum number of nodes in a binary tree of height H is H+1.

[MCQ]

#Q. To apply binary search which of the following data structure is /are suitable.

A. Single linked list

B. Double linked list

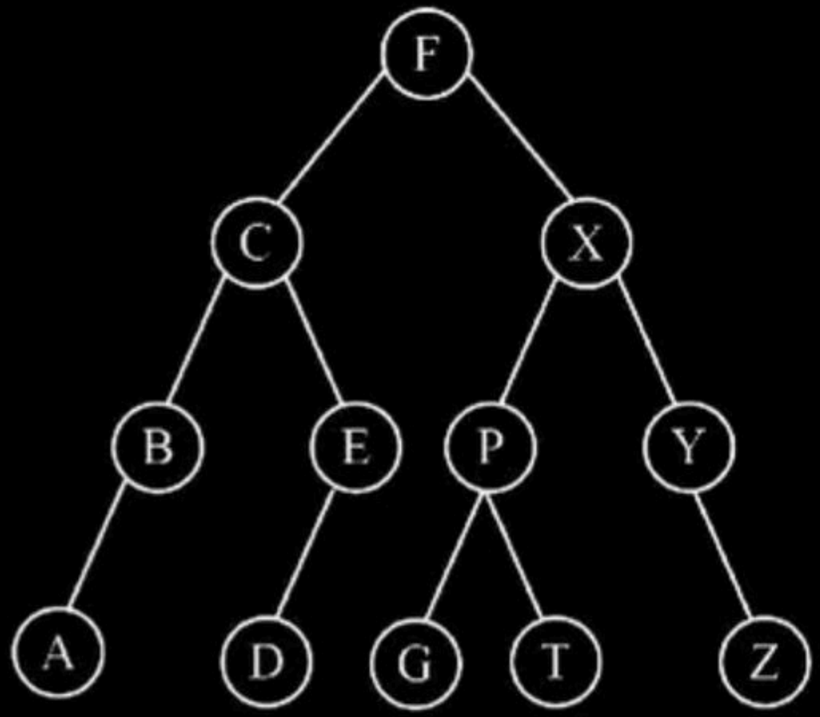
C. array

D. Circular linked list

[MCQ]

#Q. Consider binary search tree,

If preorder traversal and post order traversal applied on left subtree of F and right sub tree of F respectively then which of the following option is correct?



A. ABCDE, GPTXYZ

B. ABDEC, XPGTYZ

C. CBAED, GTPZYX

D. ABCDE, XPGTYZ

[NAT]

#Q. The number of binary trees possible with the following given labelled nodes A,B,C,D,E is_____.

[MSQ]

#Q. Which of the following is/are correct corresponding to height balance tree?

A. Maximum height of AVL tree can not exceed $1.44 \log_2 n$ if there are 'n' nodes.

B. If height of AVL tree is 'h' maximum number of nodes in a tree can be $2^{h+1} - 1$.

C. Minimum possible height of AVL tree is $\lfloor \log_2(n+1) \rfloor$ if there are 'n' nodes.

D. Minimum possible number of nodes in AVL tree of height 7 is 33.

[MCQ]

#Q. Consider an array A[3][5], the address of A[0] [0] is 200 & A[0][1] is 212 then what is the address of A[2][4]

A 380

B 368

C 370

D 382

[MCQ]

#Q. Consider a single linked list of a n elements, then the min order of time to interchange m^{th} and l^{th} elements.

A max (m, *l*)

B max (n, m, *l*)

C min (m. *l*)

D l + min (m, l)

[HW]

#Q. Array of 1023 elements used to construct the binary heap with starting index '0'. If the right child node is stored at index 510 then its parents parent node is at index_____.

[MCQ]

#Q. Which data is most efficient to find top k largest items out of n items stored in file?

A. Max heap

B. Min heap

C. BST

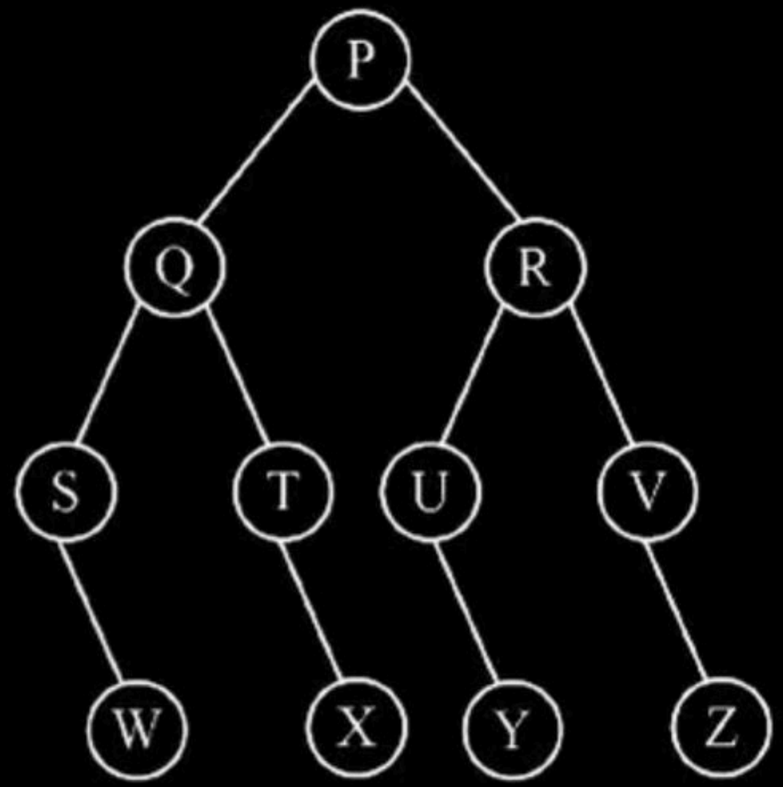
D. Sorted array

[NAT]

#Q. The height of a binary tree is the maximum number of edges in any root node to leaf node path. The maximum number of nodes in a binary of height 15 is_____.

[NAT]

#Q. Consider the following tree



If the postorder traversal of above tree is, 3–9+ * 14 + 17 – + /. Then the SWQXPYVZ = _____(round off two decimal places)

[NAT]

#Q. Assume P is an array of characters given as P ['G', 'A', 'T', 'E', '2', '0', '2', '4'] with indices going from 0 to n–1 (where n = 8). Consider running the following operation on stack 'S' with input array P given as above. The size of the stack 'S' at the end of the execution of below code is____.

```
stack S = new stack ( ) ;
int i = 0;
while (i < n) {
        if (S.is empty ( )){
            S. Push (P [i]);
            i + + ;
        }
elseif (S. top > P[i]) {
            S. pop ( ) ;
}
else {
        S. Push (P[i]);
        i++;
}
}
```

[MCQ]

#Q. Which traversal is the most suitable for deleting all the nodes in a binary tree?

A. Inorder

B. Preorder

C. Postorder

D. Any Traversal

[MCQ]

#Q. Stack s1 has elements 5 4 3 2 1 in the sequence where 1 is at top. s2 is an empty stack. when an element popped from s1, it can be either printed or pushed into s2 not both. But when you pop from s2 it can only be printed. Which permutation is not possible.

A 1 2 3 4 5

B 3 4 5 2 1

C 3 4 5 1 2

D 1 3 5 4 2

THANK - YOU