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Graph Representation

Course on Data Structure

Pankaj Sharma • Lesson 31 • Aug 13, 2024

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CS & IT Engineering

Data Structure

Tree

Lecture Number- 31

By- Pankaj Sir

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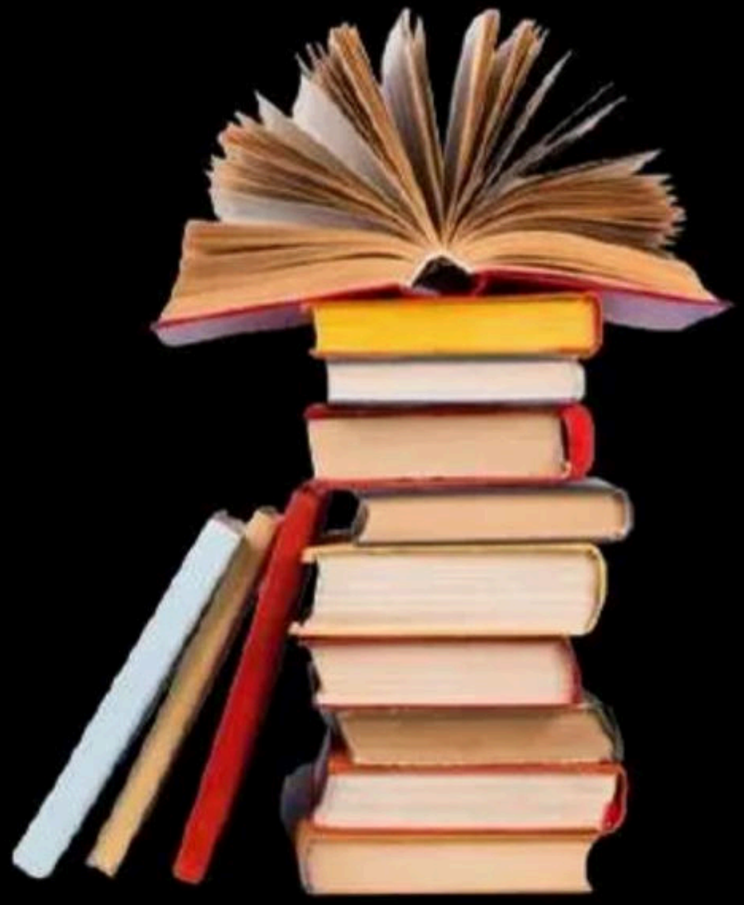
Topics

to be covered



1. Tree-X

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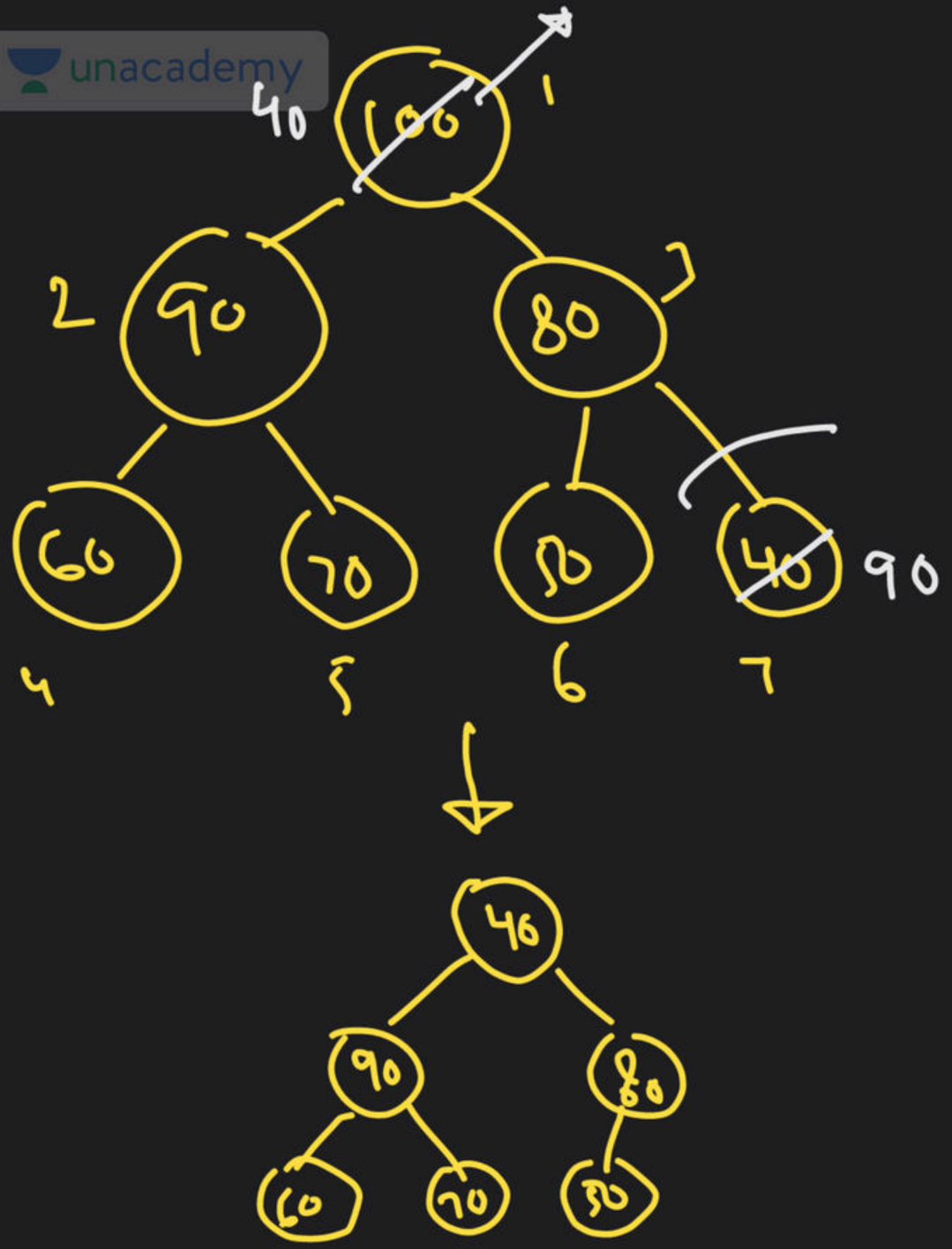

100	90	80	60	70	50	40
1	2	3	4	5	6	7

Extract-Max

① A[1] ↔ A[n]

40	90	80	60	70	50	100

② n = n-1;

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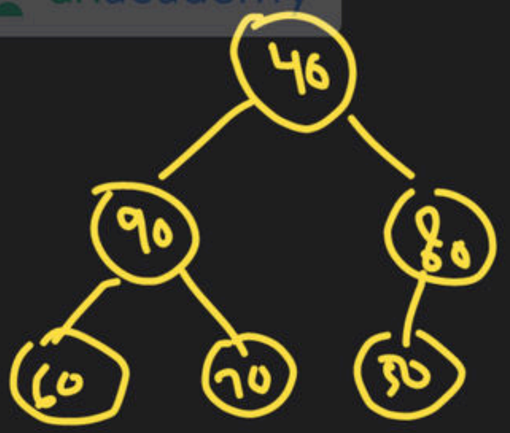
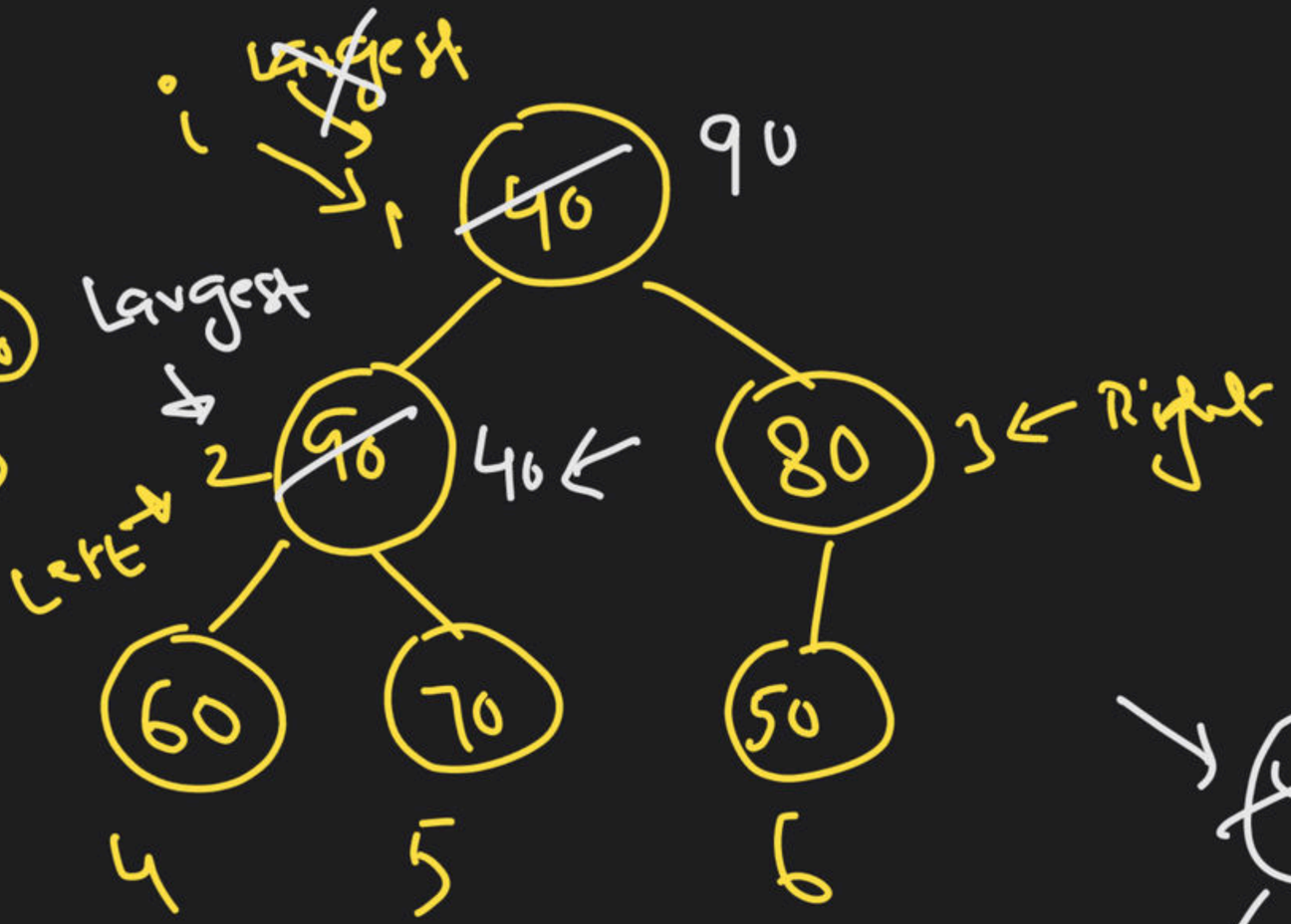
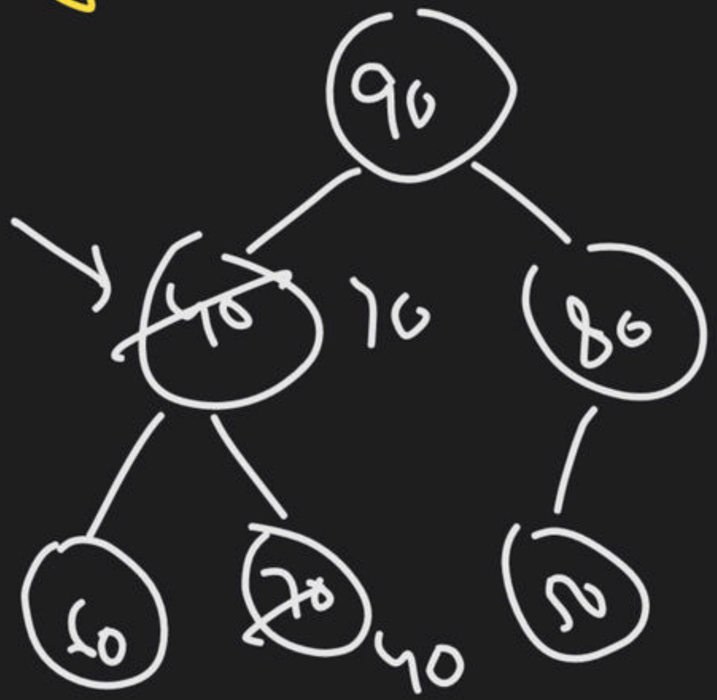
Heapify (A, i, n)



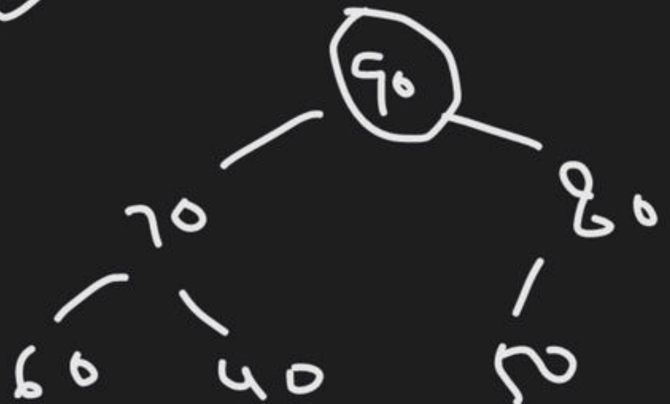




1) Swap A_1, A_n

2) $n = n-1$

3) Heapify



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Extract_max $\Rightarrow O(\log_2 n)$

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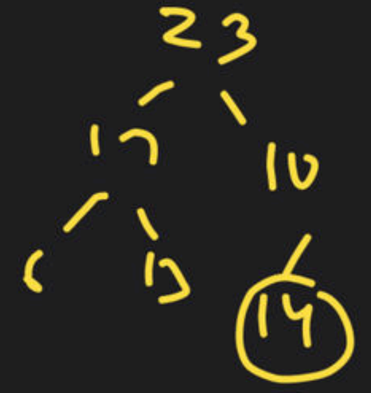
Q1. Which one of the following seq. when stored in array at loc. $A[1], \ldots A[10]$ forms a max-heap.

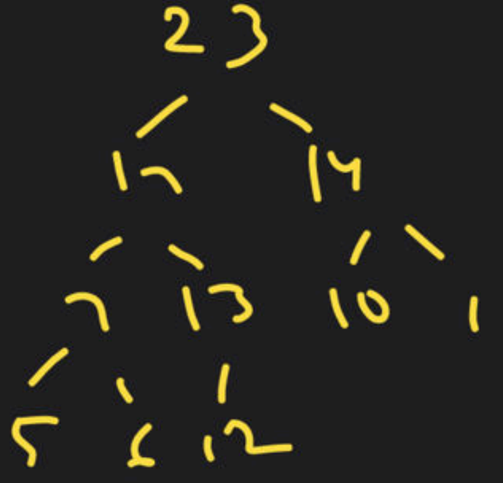
A) 23, 17, 10, 6, 13, 14, 1, 5, 7, 12

B) 23, 17, 14, 7, 13, 10, 1, 5, 6, 12



C) 23, 17, 14, 6, 13, 10, 1, 5, 7, 15

D) 23, 14, 17, 1, 10, 13, 16, 12, 7, 5



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9) Consider the array rep. of a binary min-heap containing 1023 elements. The min. no. of comp. required to find the max. ele in the heap is 511

100 ele
↳ max ⇒ 99

n → (n-1) Comp.

min-heap ⇒ max. ele ⇒ leaf node.

#leaf-node = $\lceil \frac{n}{2} \rceil = \lceil \frac{1023}{2} \rceil = 512$

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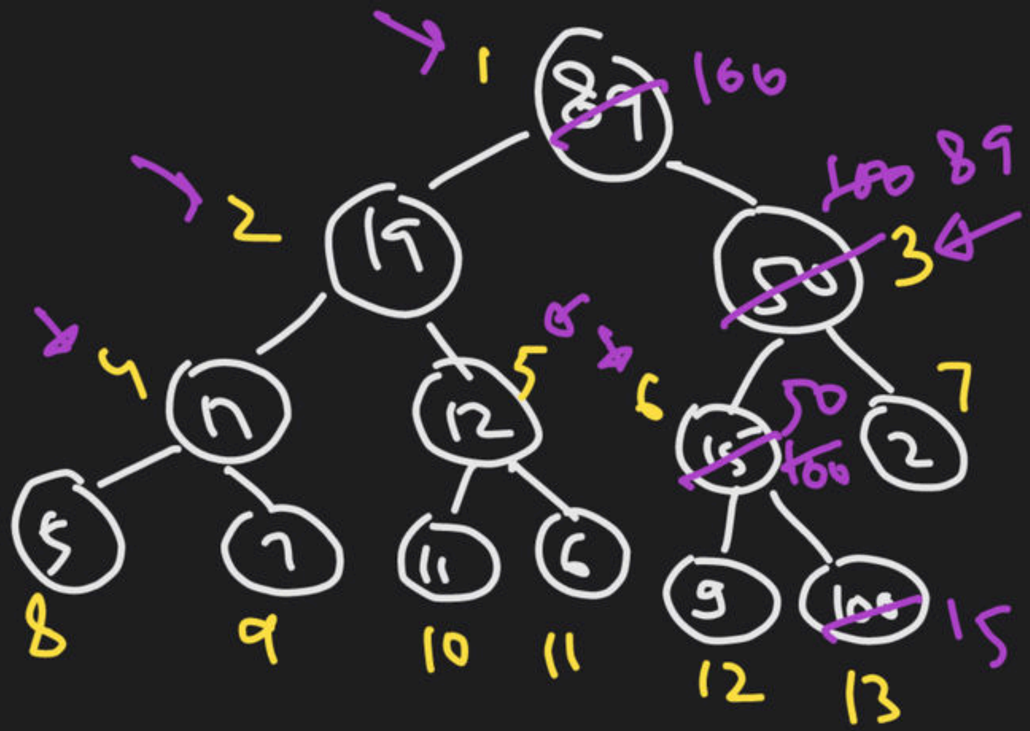
9) Consider the following array of elements

<89, 19, 50, 17, 12, 15, 2, 5, 7, 11, 6, 9, 100>

The min. no. of **interchanges** needed to convert it into a max-heap is:

1 ✓
2 ✓
3 ✓

3 swaps



Q A priority queue is implemented as Max-Heap. Initially it has 5 elements. The level order traversal of the heap is: 10, 8, 5, 3, 2. Two elements 1 and 7 are inserted into the heap in that order. The level order traversal of heap after insertion.

A) 10, 8, 7, 3, 2, 1, 5

B) 10, 8, 7, 2, 3, 1, 5

C) 10, 8, 7, 1, 2, 3, 5

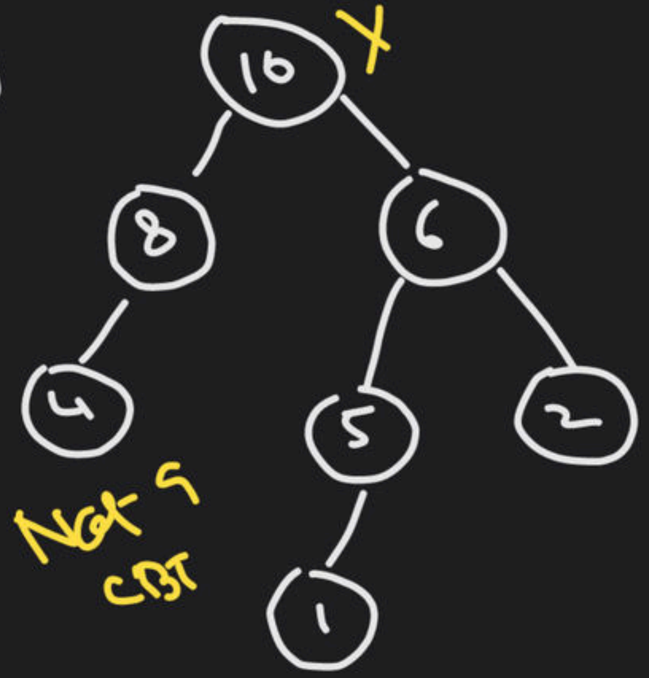
D) 10, 8, 7, 5, 3, 2, 1

A priority queue is implemented as Max-Heap. Initially it has 5 elements. The level order traversal of the heap is: 10, 8, 5, 3, 2. Two elements 1 and 7 are inserted into the heap in that order. The level order traversal of heap after insertion

1

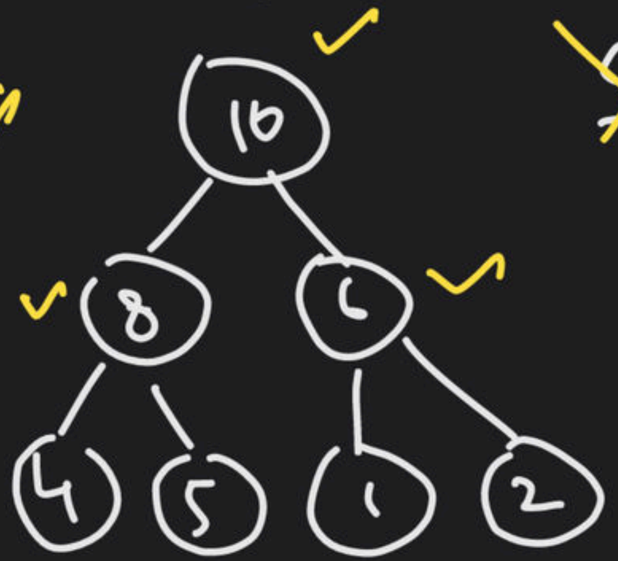
Q. Which of the following is a max-heap

A)

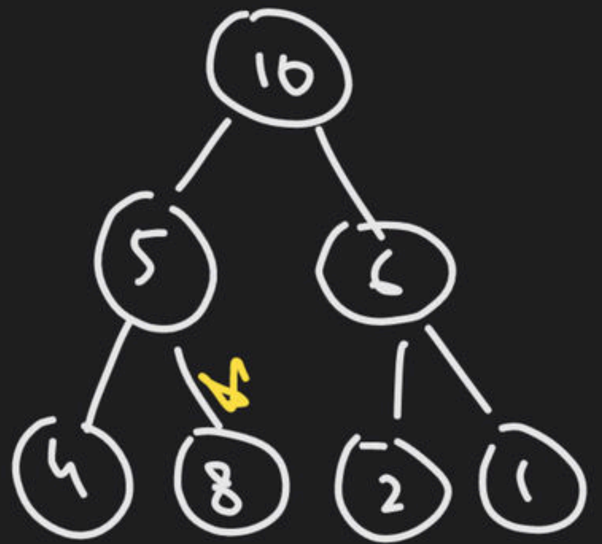


Not a CBT

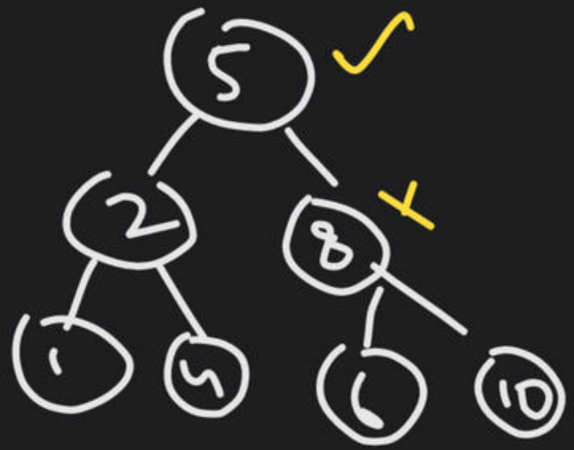
B)



C)



D)



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Q Which one of the following array rep. a binary max-heap.

A) 25, 12, 16, 13, 10, 8, 14 ✗

B) 25, 14, 13, 16, 10, 8, 12 ✗

C) 25, 14, 16, 13, 10, 8, 12 ✓

D) 25, 14, 12, 13, 10, 8, 16

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Q) Consider a binary max-heap implemented using an array.

What is the content of the array after 2 delete op. on the correct answer to prev. question.

{25, 14, 16, 13, 10, 8, 12}

A) {14, 13, 12, 10, 8}

B) {14, 12, 13, 8, 10}

C) {14, 13, 8, 12, 10}

D) {14, 13, 12, 8, 10}

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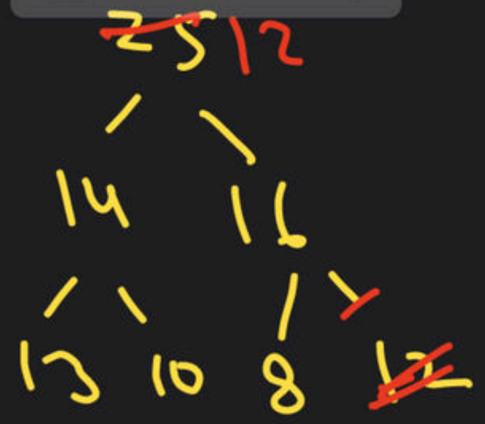
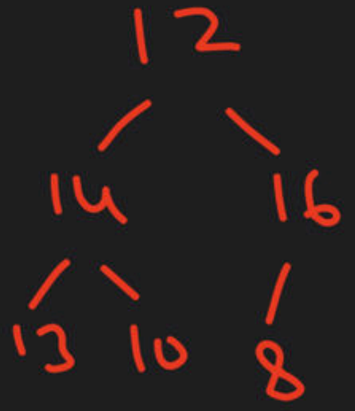
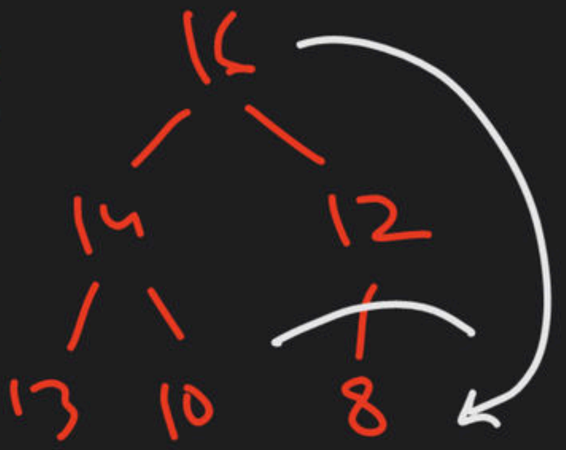
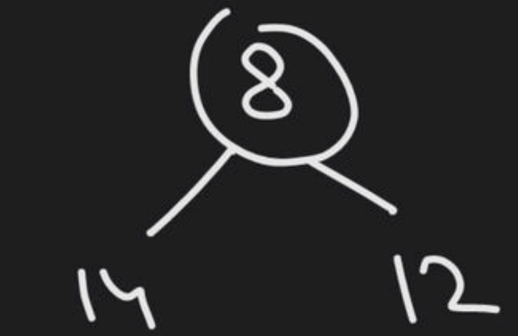




heapify



{25, 14, 16, 13, 10, 8, 12}



heapify

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9) The preorder traversal of a BST is: 15, 10, 12, 11, 20, 18, 16, 19

Which of the following is the postorder traversal of the tree?

A) 20, 19, 18, 16, 15, 12, 11, 10

B) 11, 12, 10, 16, 19, 18, 20, 15

C) 19, 16, 18, 20, 11, 12, 10, 15

D) 10, 11, 12, 15, 16, 18, 19, 20

Q. The postorder traversal of a binary tree is

8, 9, 6, 7, 4, 5, 2, 3, 1.

The inorder traversal of the same tree is

8, 6, 9, 4, 7, 2, 5, 1, 3.

The height of a tree is the length of the longest path from the root to any leaf. The height of the above binary tree is ____

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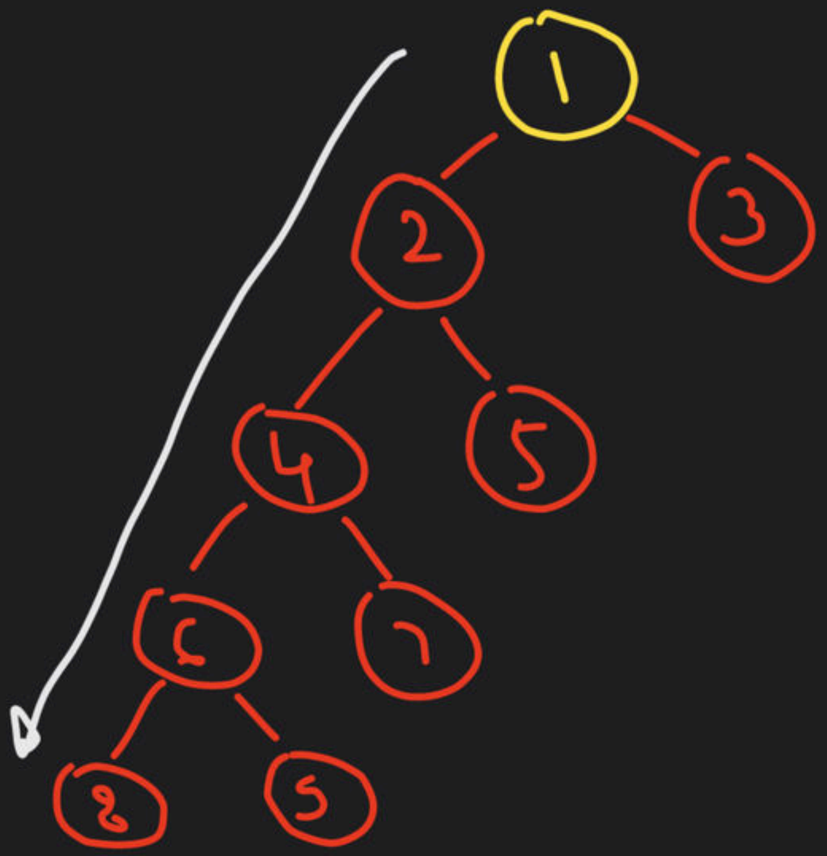
Post: 8, 9, 6, 7, 4, 5, 2, 3, 1.

In: 8, 6, 9, 4, 7, 2, 5, 1, 3.



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Q The pre-order traversal of a BST is given

Pre: 12, 8, 6, 2, 7, 9, 10, 16, 15, 19, 17, 20

Then the post-order traversal of the tree is –

A

B

C

D

Q) Which of the foll. is/are correct inorder traversal seq. of BST(s)?

1. 3, 5, 7, 8, 15, 15, 25 ✓
2. 5, 8, 9, 12, 10, 15, 25 ✗
3. 2, 7, 10, 8, 14, 16, 20 ✗
4. 4, 6, 7, 9, 18, 20, 25 ✓

A) 1 and 4

B) 2 and 3

C) 2 and 4

D) 2 only

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Q Let T be a BST with 15 nodes

The min & max. possible height of T are:

(Note: The height of a tree with a single node is 0)

A) 4 and 15 resp.

B) 3 and 14 resp.

C) 4 and 14 resp.

D) 3 and 15 resp.

$n_{min} = h+1 \quad 15 = h+1 \Rightarrow \boxed{h = 14}$

$n_{max} = 2^{h+1} - 1$

$15 = 2^{h+1} - 1 \Rightarrow 2^{h+1} = 16$

$h+1 = 4 \Rightarrow \boxed{h = 3}$

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1. Time
2. response → content → ⟷ ⟷
3. Java → 150 → 100 → = 50 —

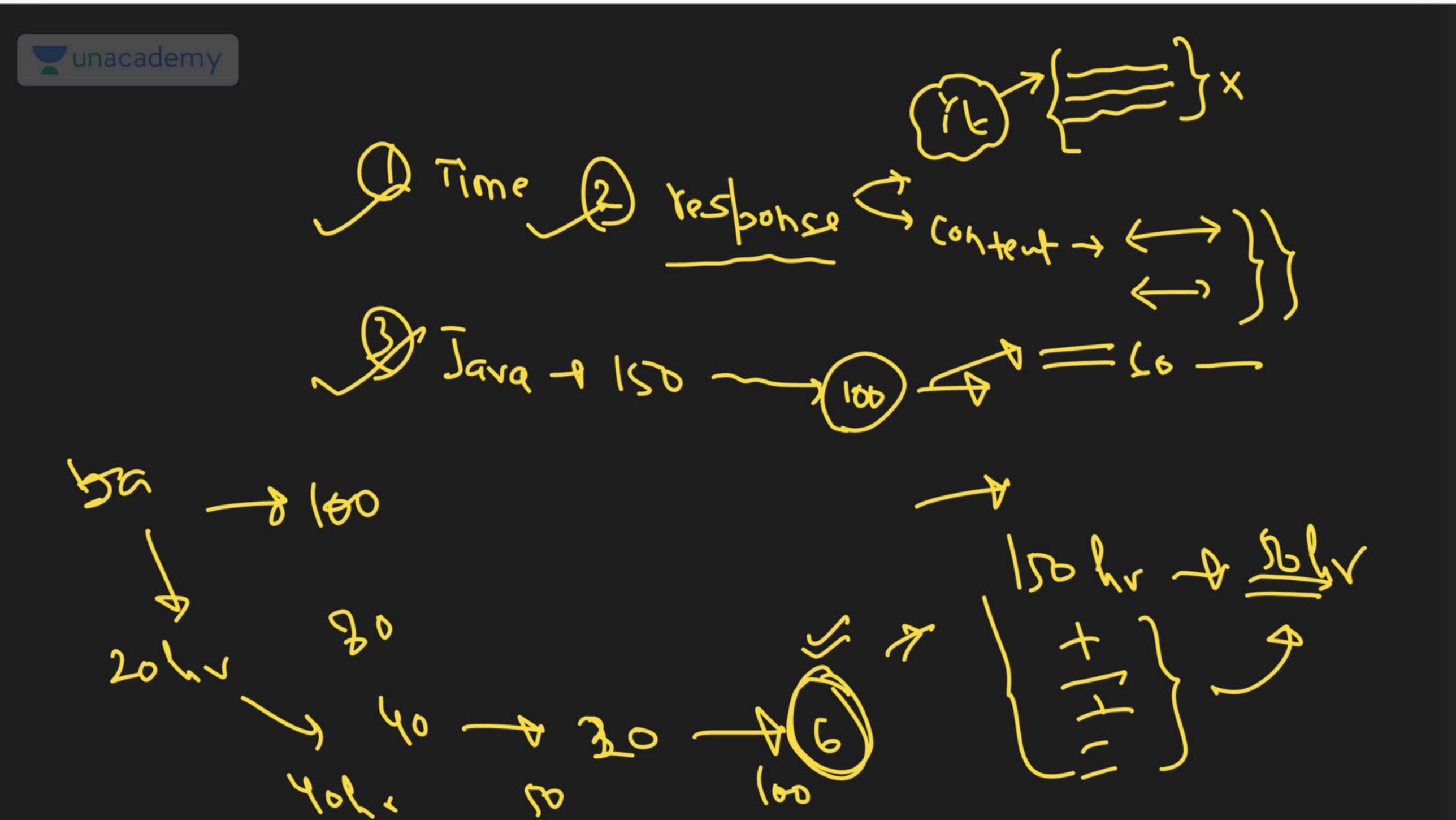
ba → 100

20 hr → 80

40 → 30 → 6

40 hr 50 100

150 hr → 50 hr



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15, 10, 12, 11, 20, 18, 16, 19

Pre: 15 10 12 11 20 18 16 19

In: 10 11 12 15 16 18 19 20

11 12 10 16 19

18 20 15

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THANK YOU!

Here's to a cracking journey ahead!