Heaps Class-1

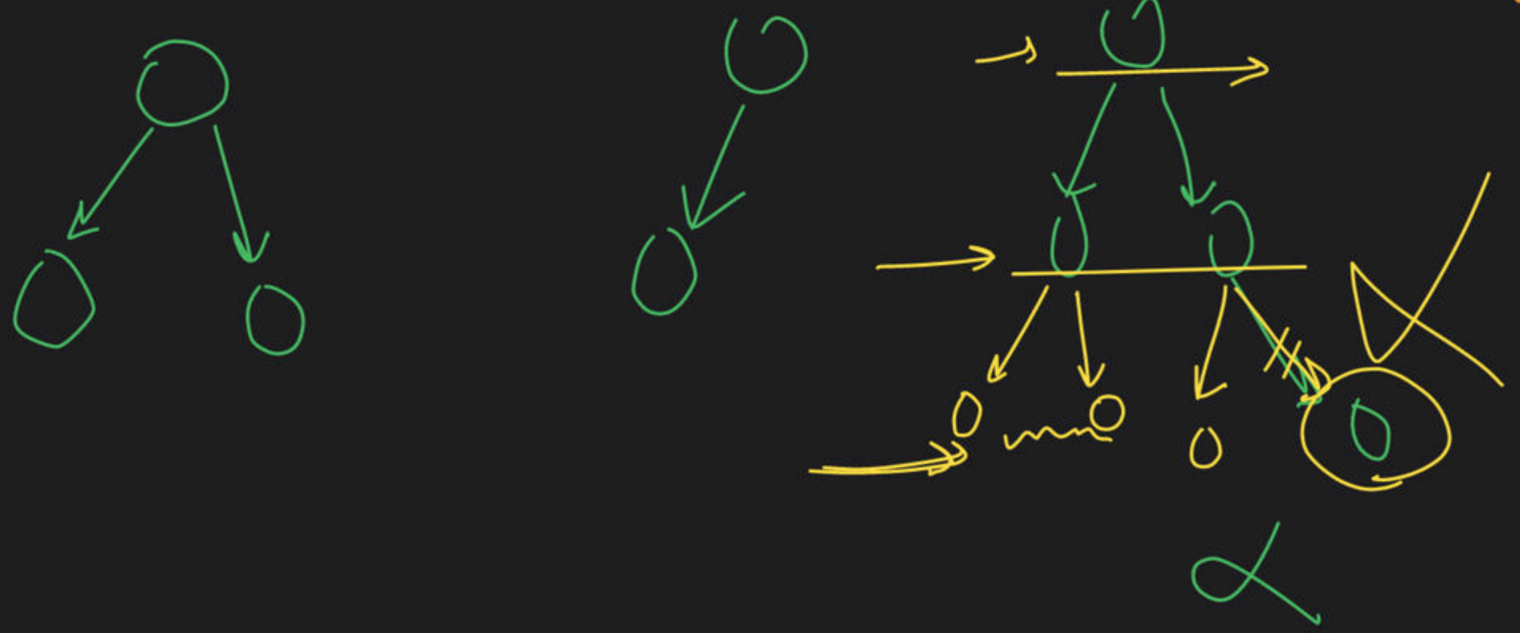
Special class

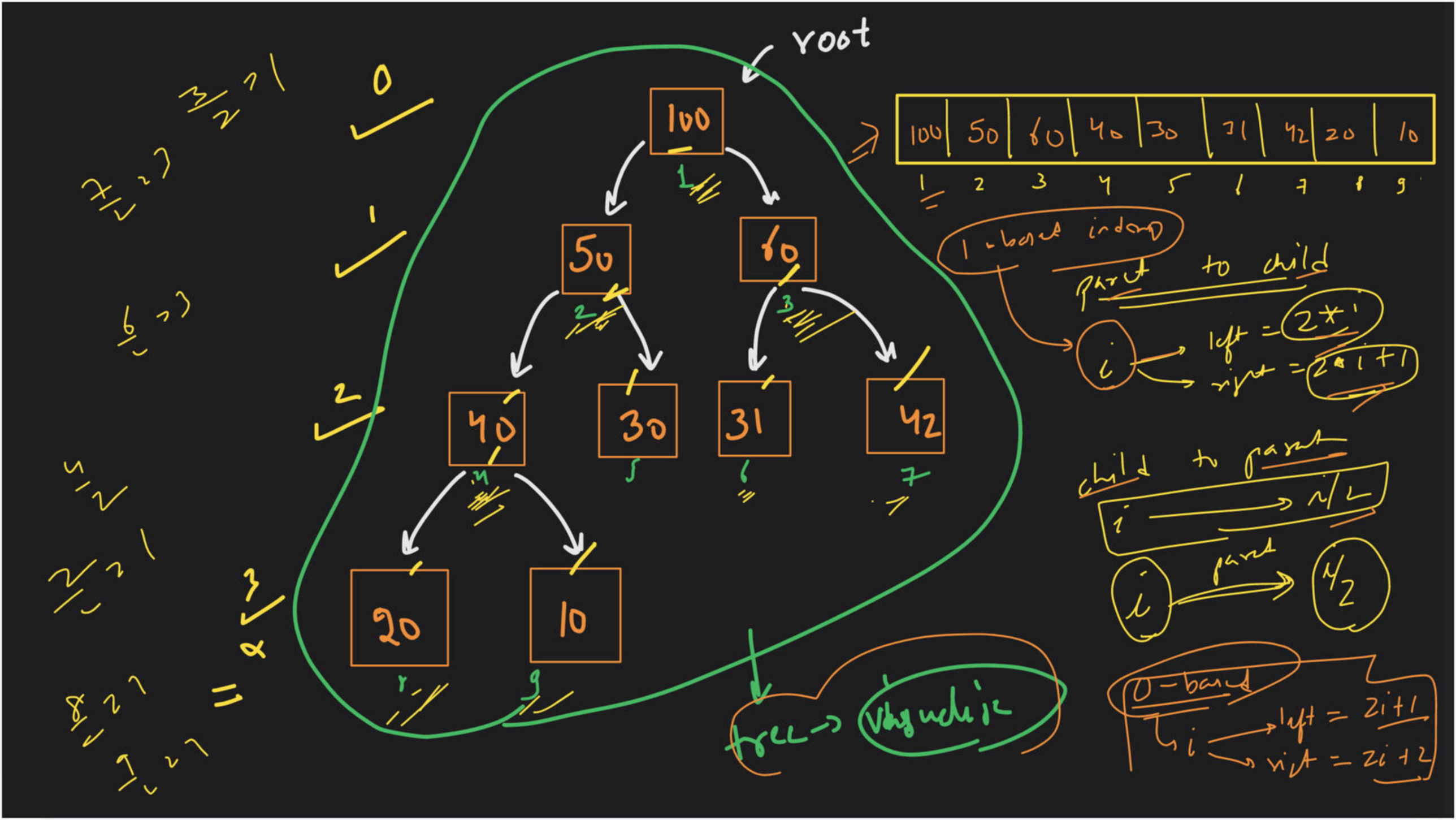
Love Babbar • Dec 15, 2023

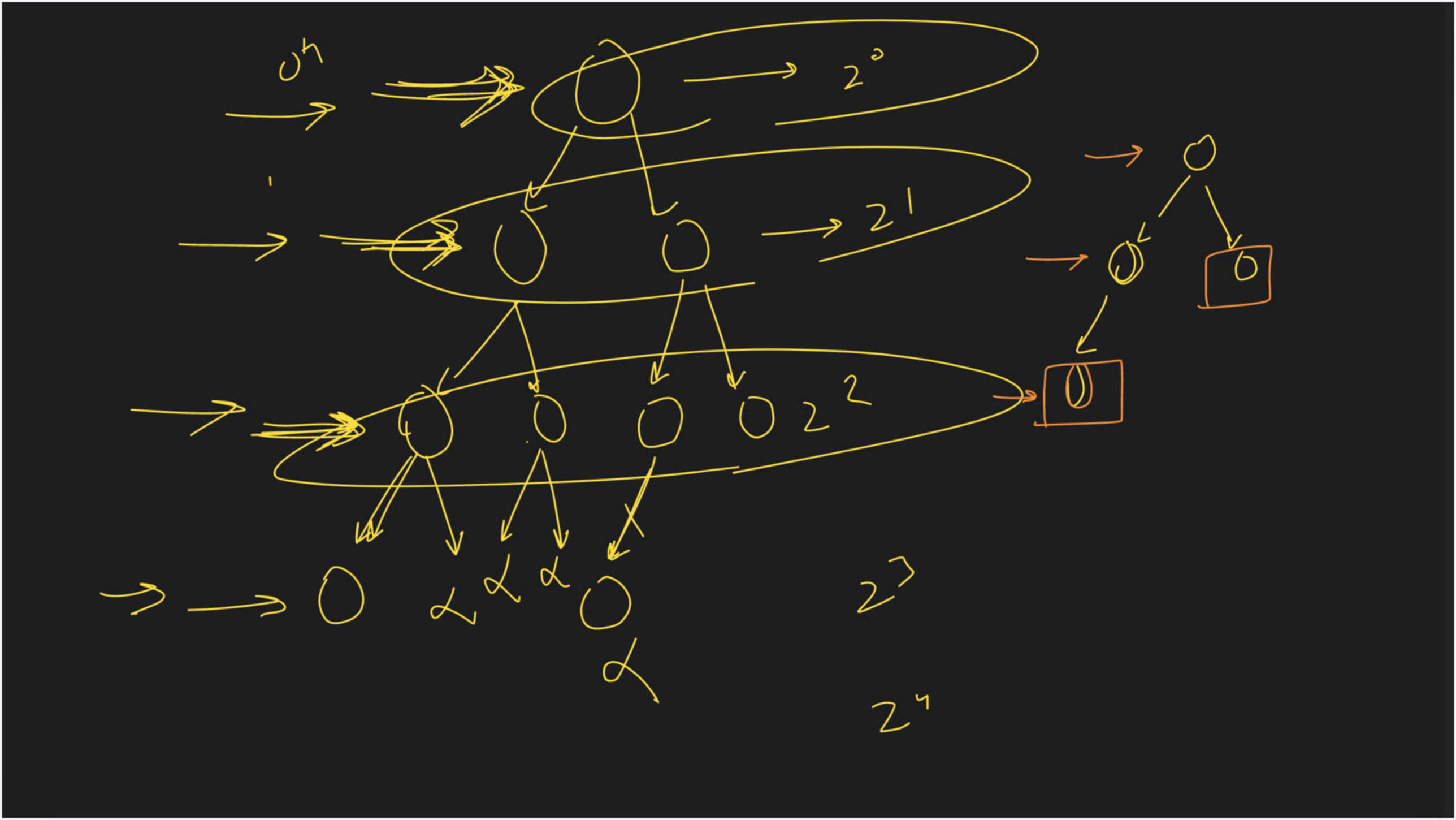
Heap → D.S → C.B.T + follow heap property

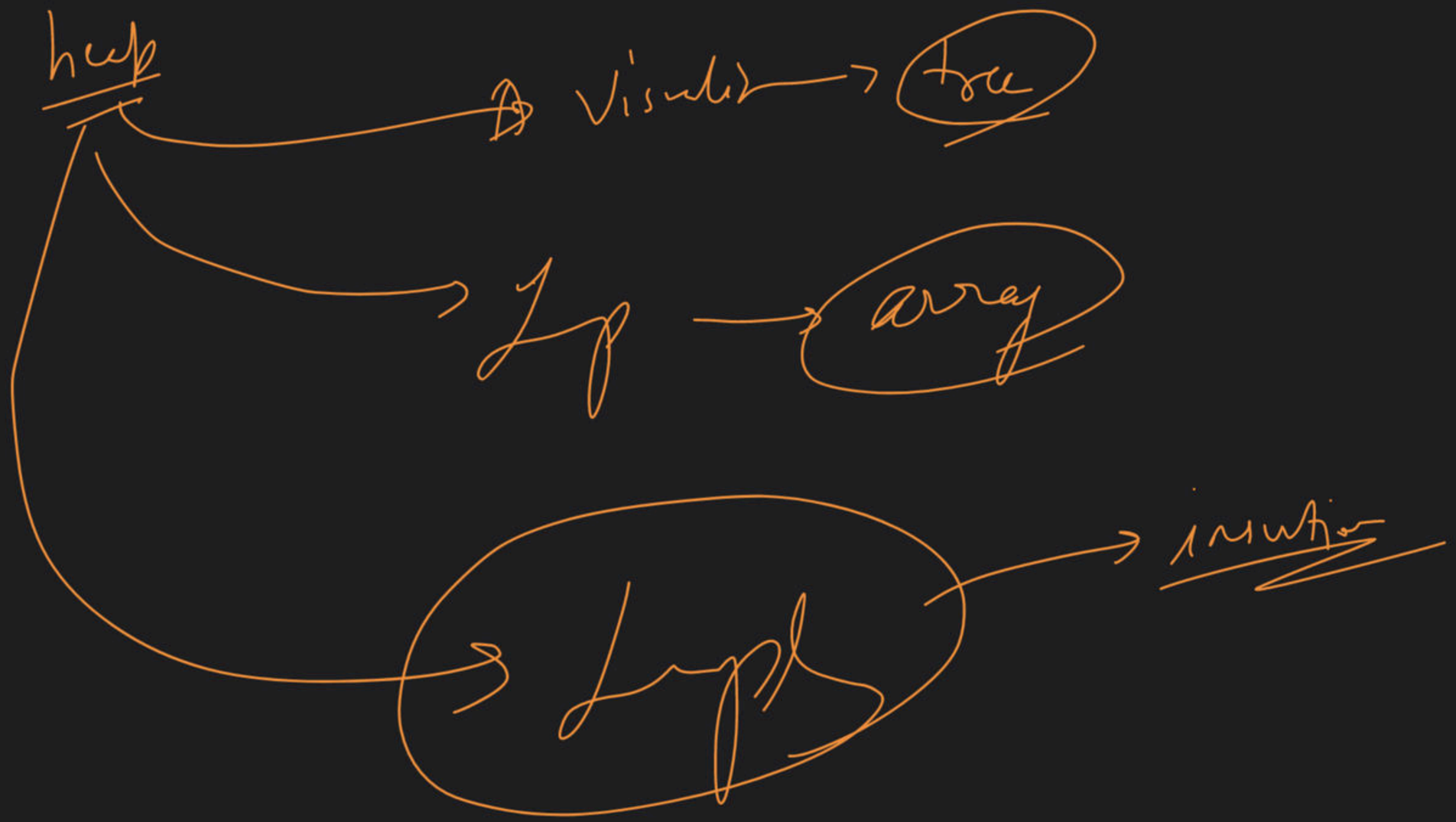
- min heap
- max heap

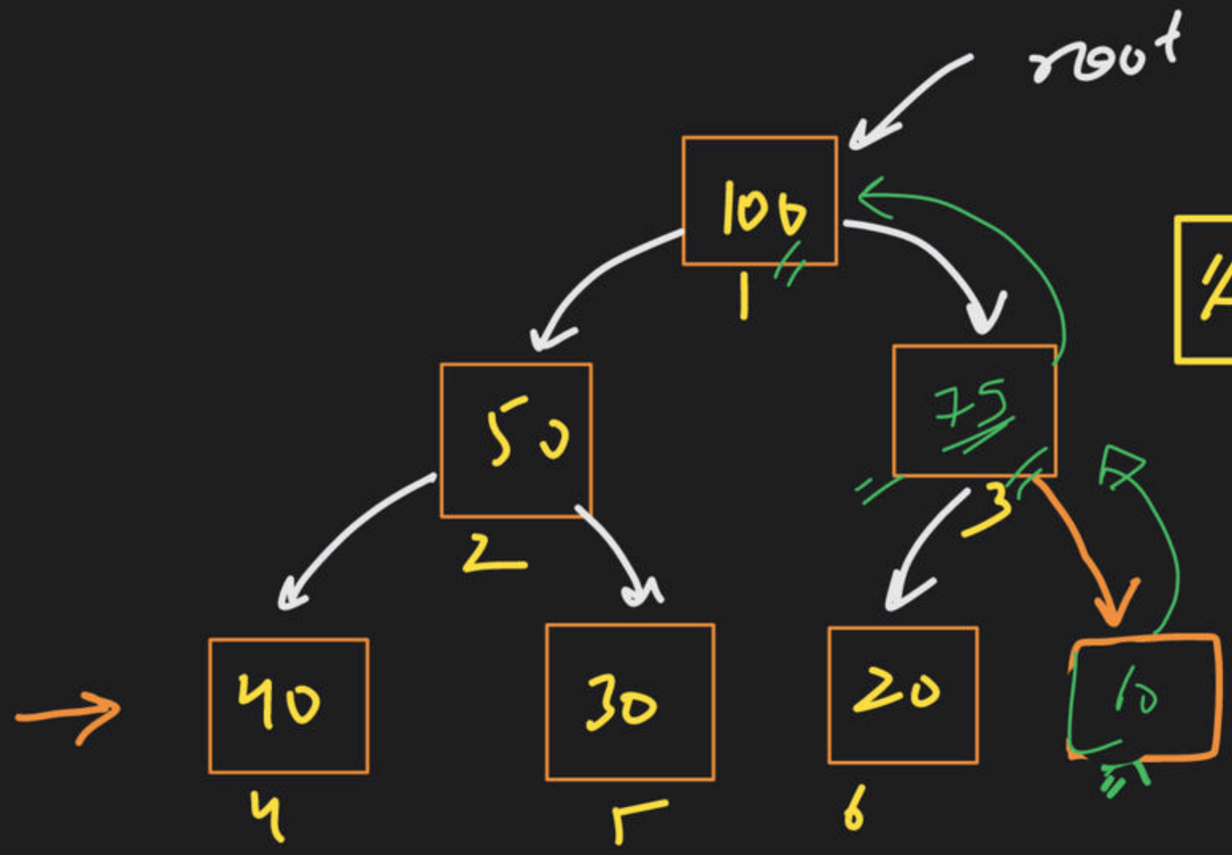
C.B.T ⟹ Complete Binary Tree

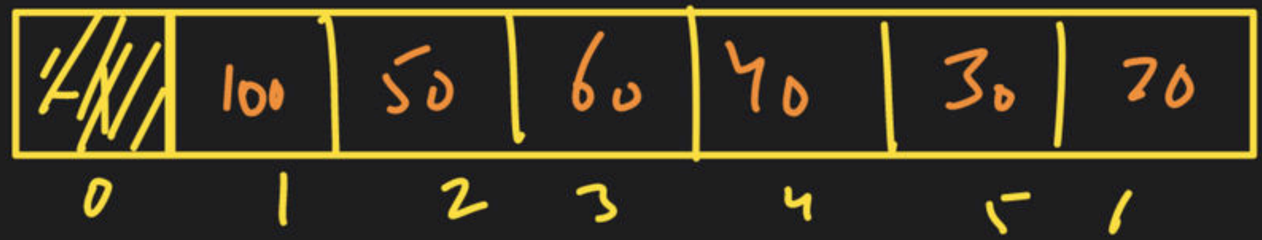



root
100
50
10
40
30
31
42
20
10
100 | 50 | 10 | 40 | 30 | 31 | 42 | 20 | 10
1 2 3 4 5 6 7 8 9
1-based indexing
parent to child
left = 2*i
right = 2*i+1
child to parent
i → i/2
parent
i/2
tree -> Binary tree
0-based
left = 2i+1
right = 2i+2


2^0
2^1
2^2
2^3
2^4


help
Visualize
tree
Zip
array
Lupl
intuition





bad → swap

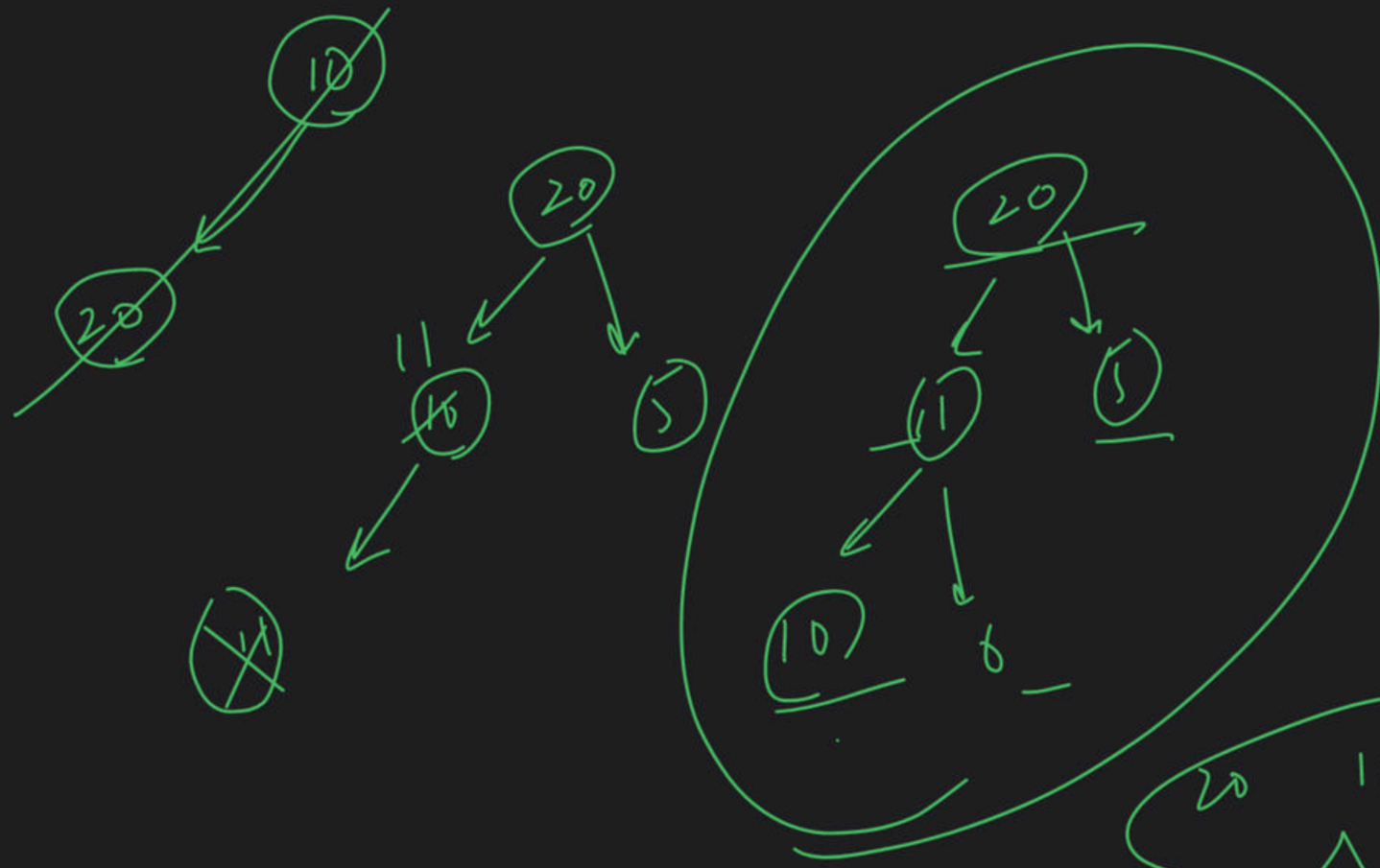
Chotta → ignore / stop

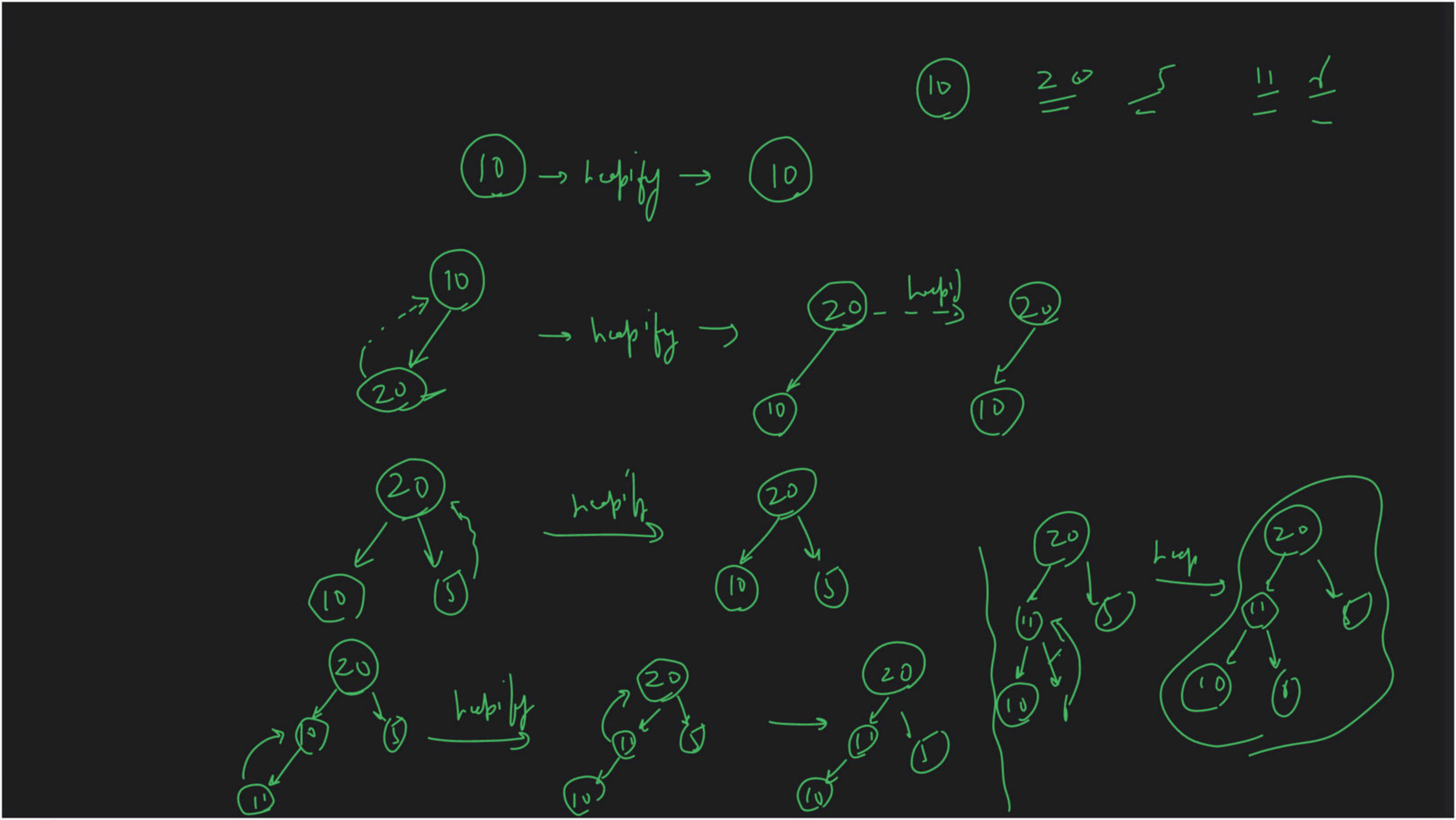
insertion

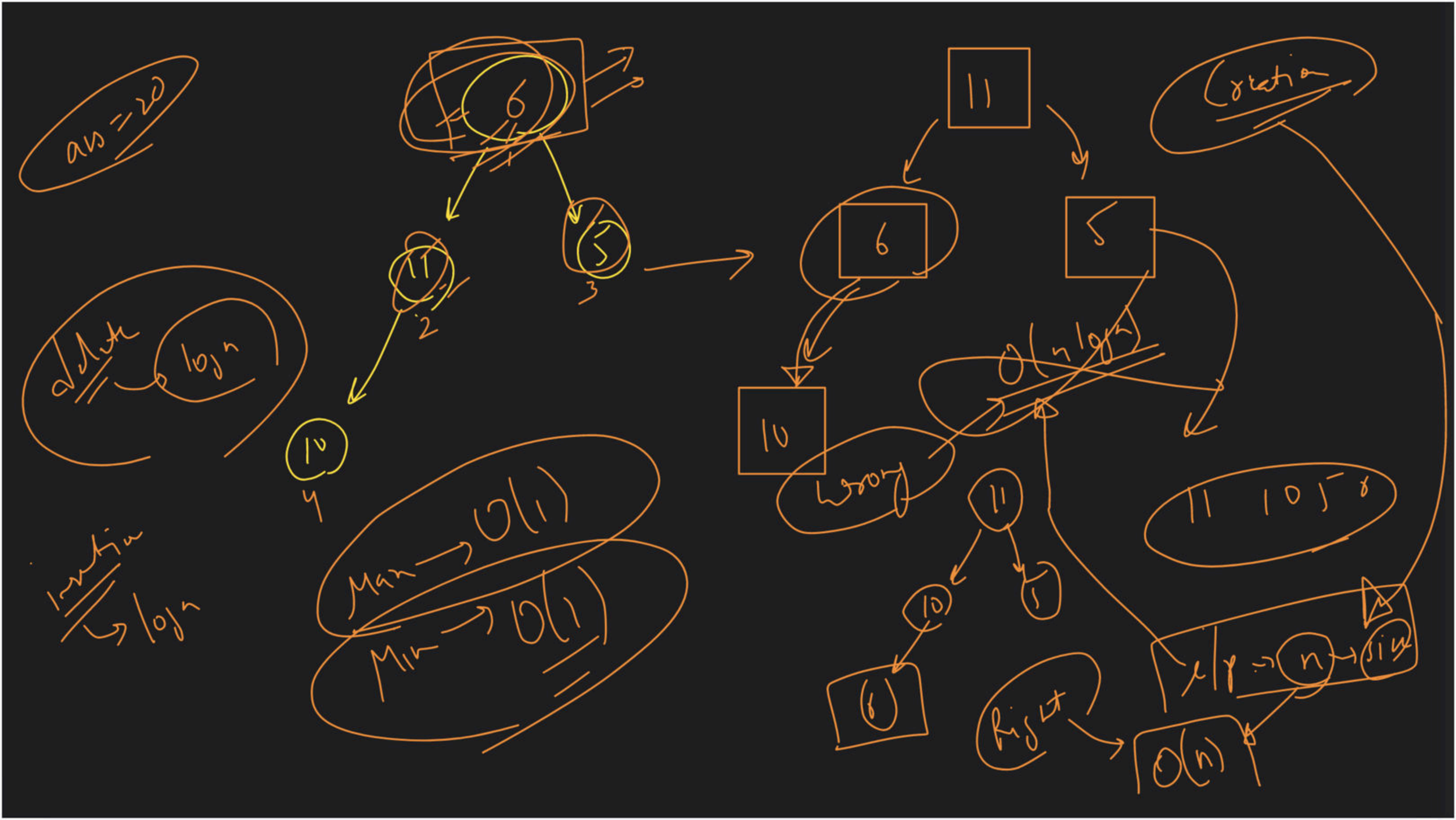
(1) insert 75 at the vacant/available position

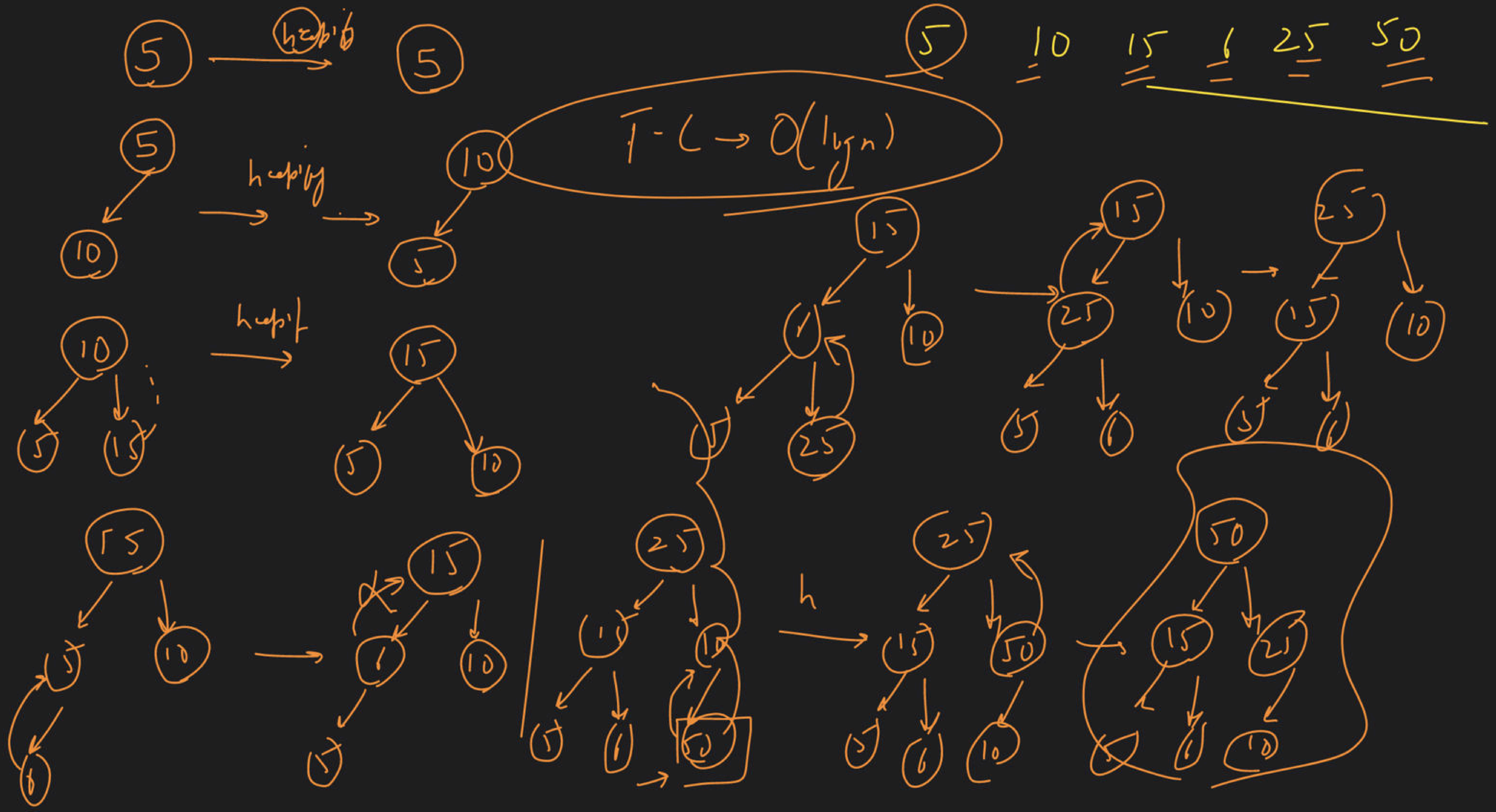
(2) Correct position

10 20 5 11 6




10
10 → heapify → 10
10
20
→ heapify →
20
10
heapify
20
10
20
heapify
20
10
5
20
10
5
heapify
20
9
5
11
heapify
20
11
5
10
20
11
5
10
20
11
5
10
heap
20
11
10
1


ans = 20
6
11
5
2
3
4
Max → O(1)
Min → O(1)
Insertion
O(log n)
11
6
5
10
O(n log n)
Worst
11
10
1
6
Right
O(n)
n
sim



heapify
heapify
heapify
T·C → O(log n)
5 10 15 6 25 50

Deletion

delete

root

60

50

20

30

2

3

1

2i

2i+1

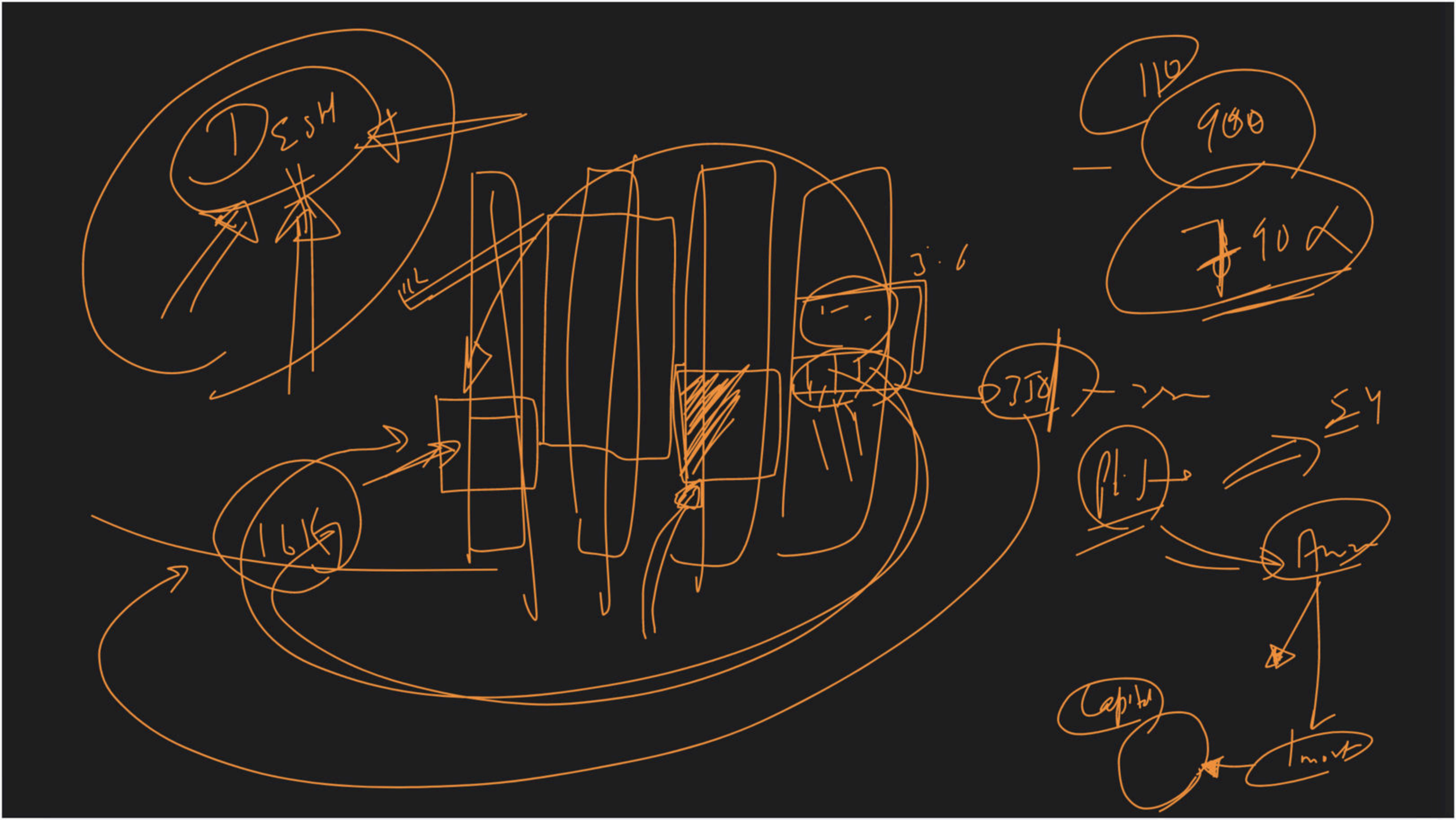
replace

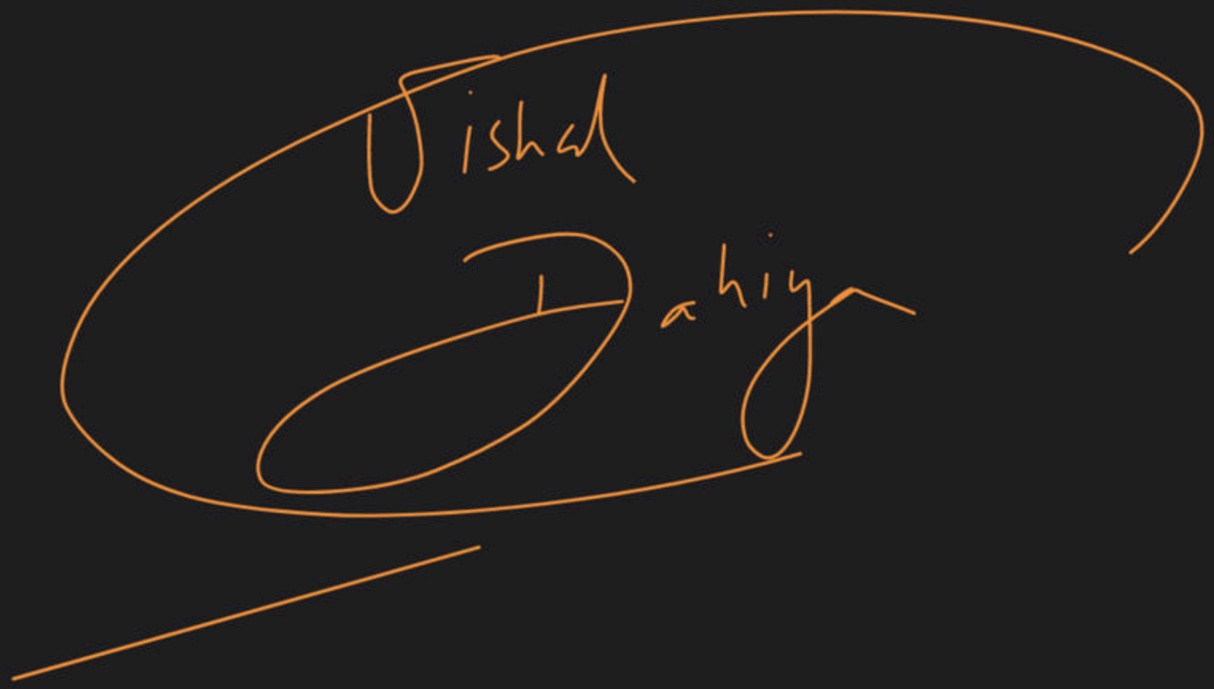
root

last node

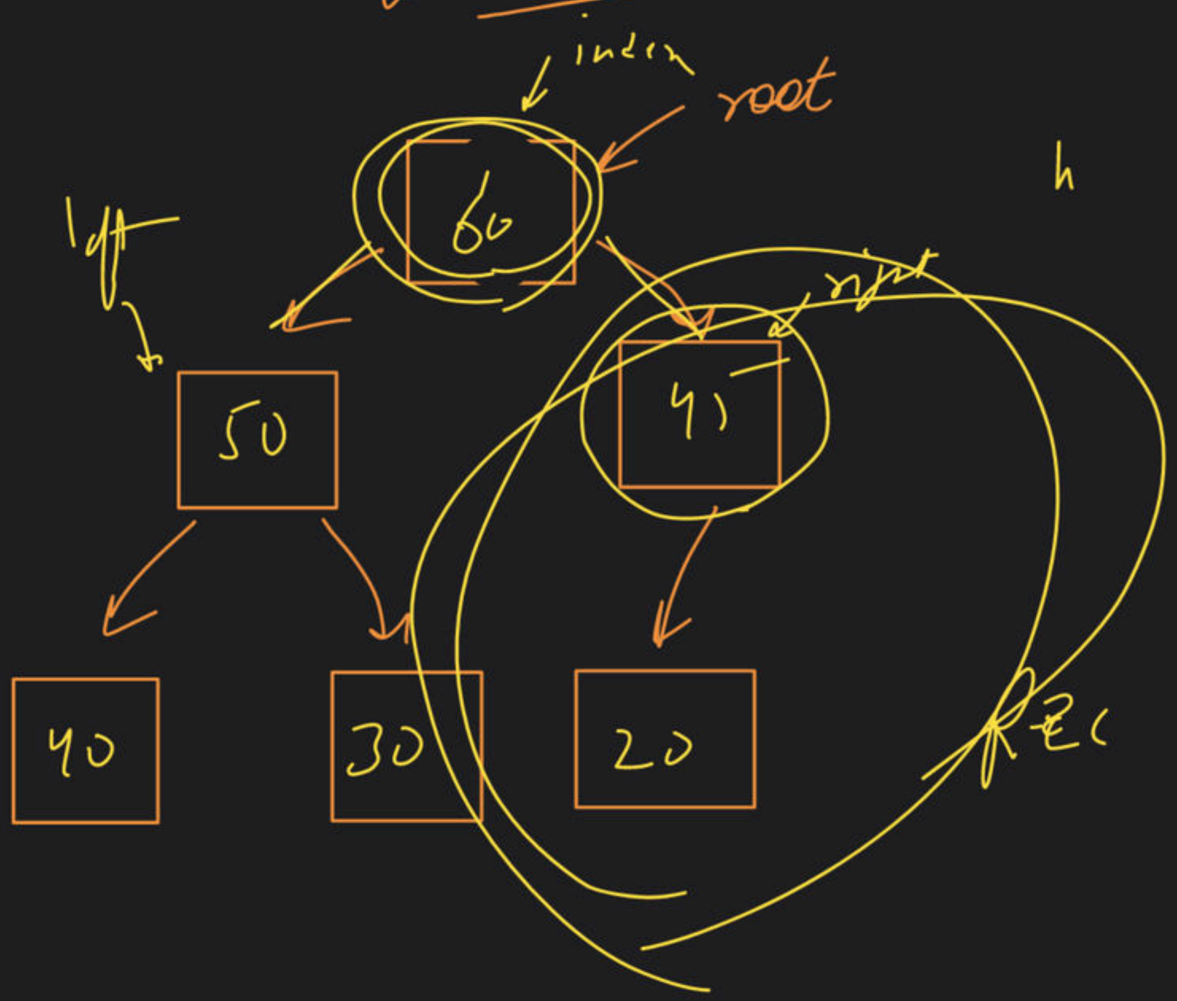
not

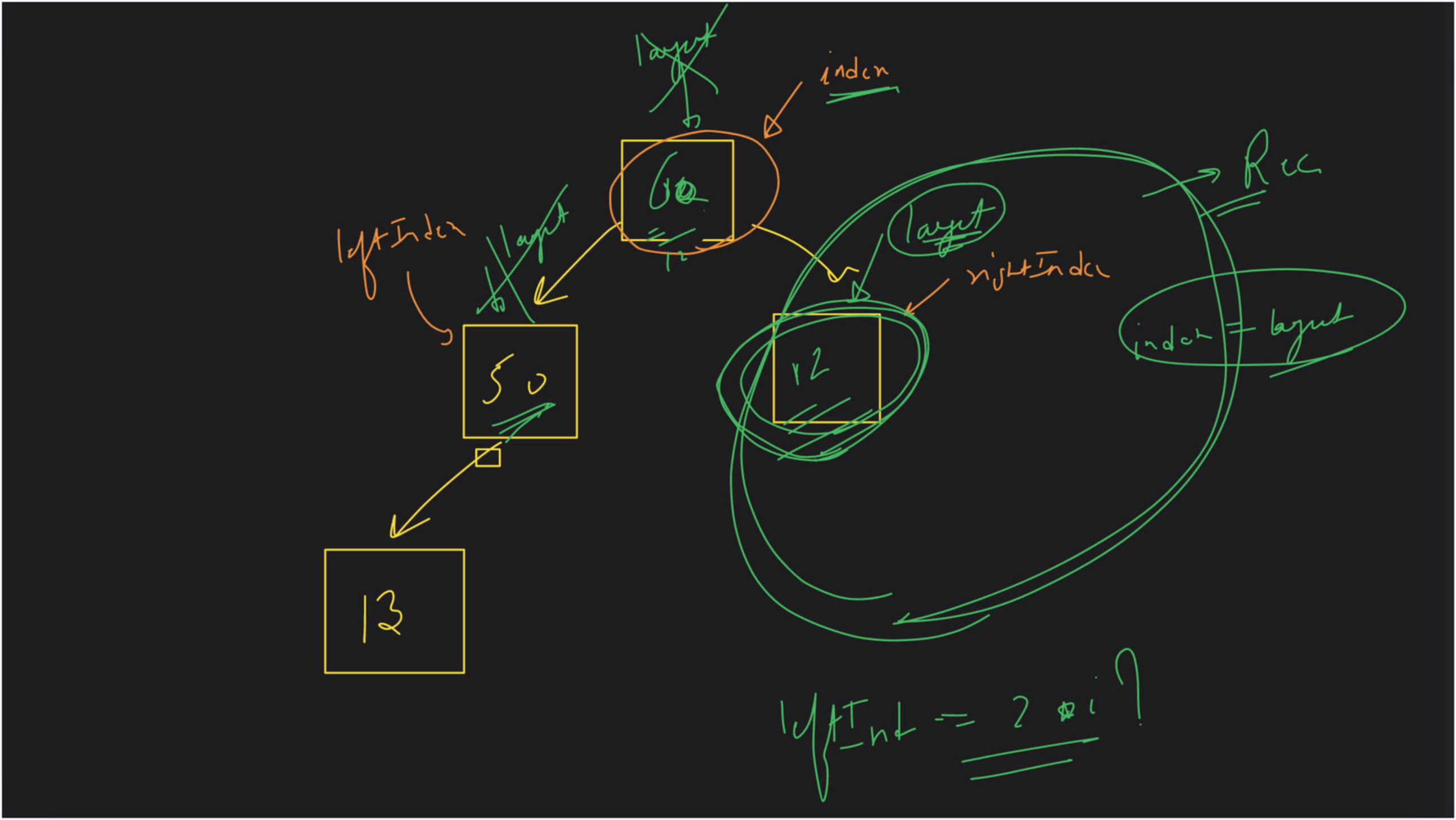
correct position

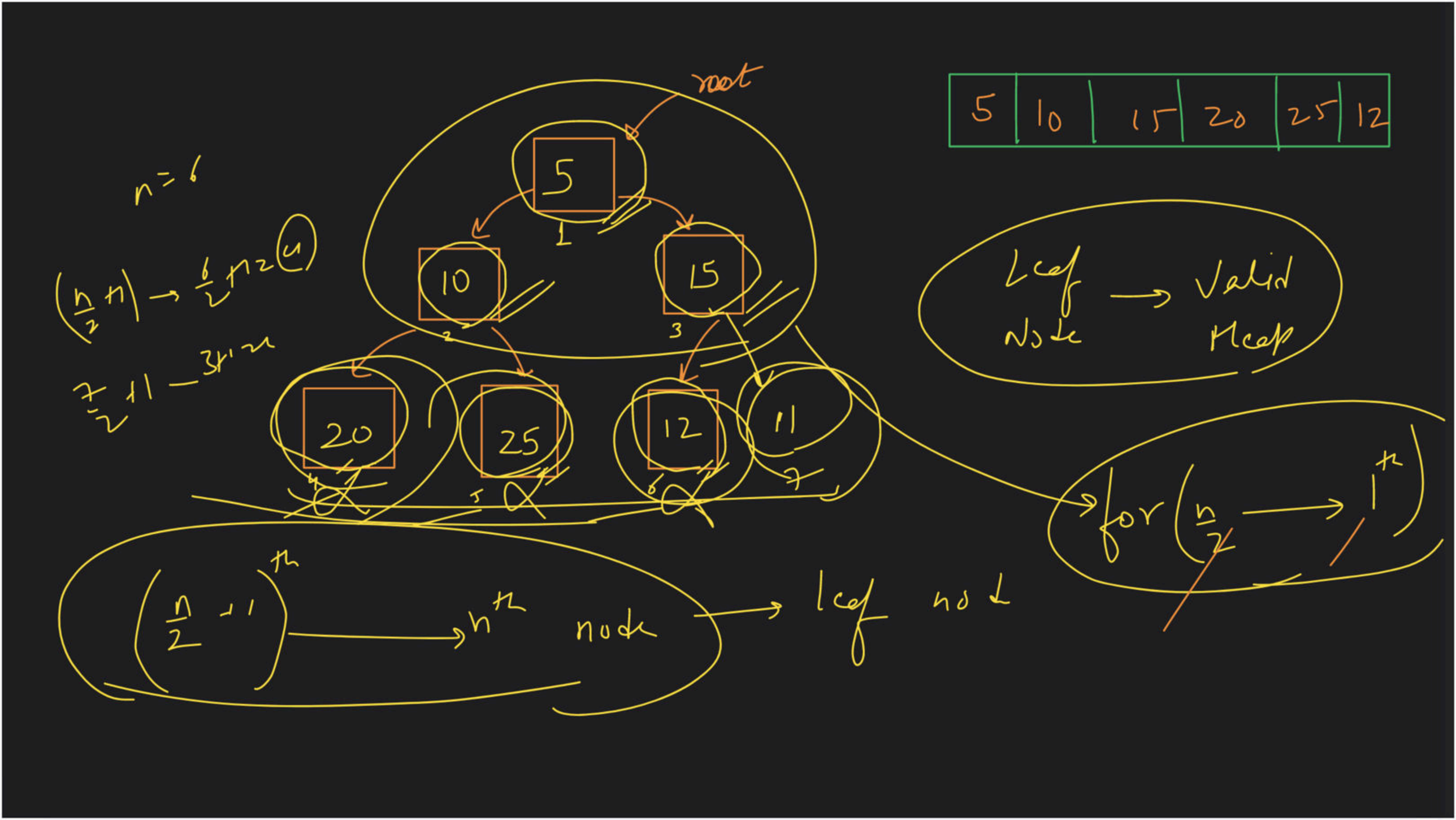

DESH

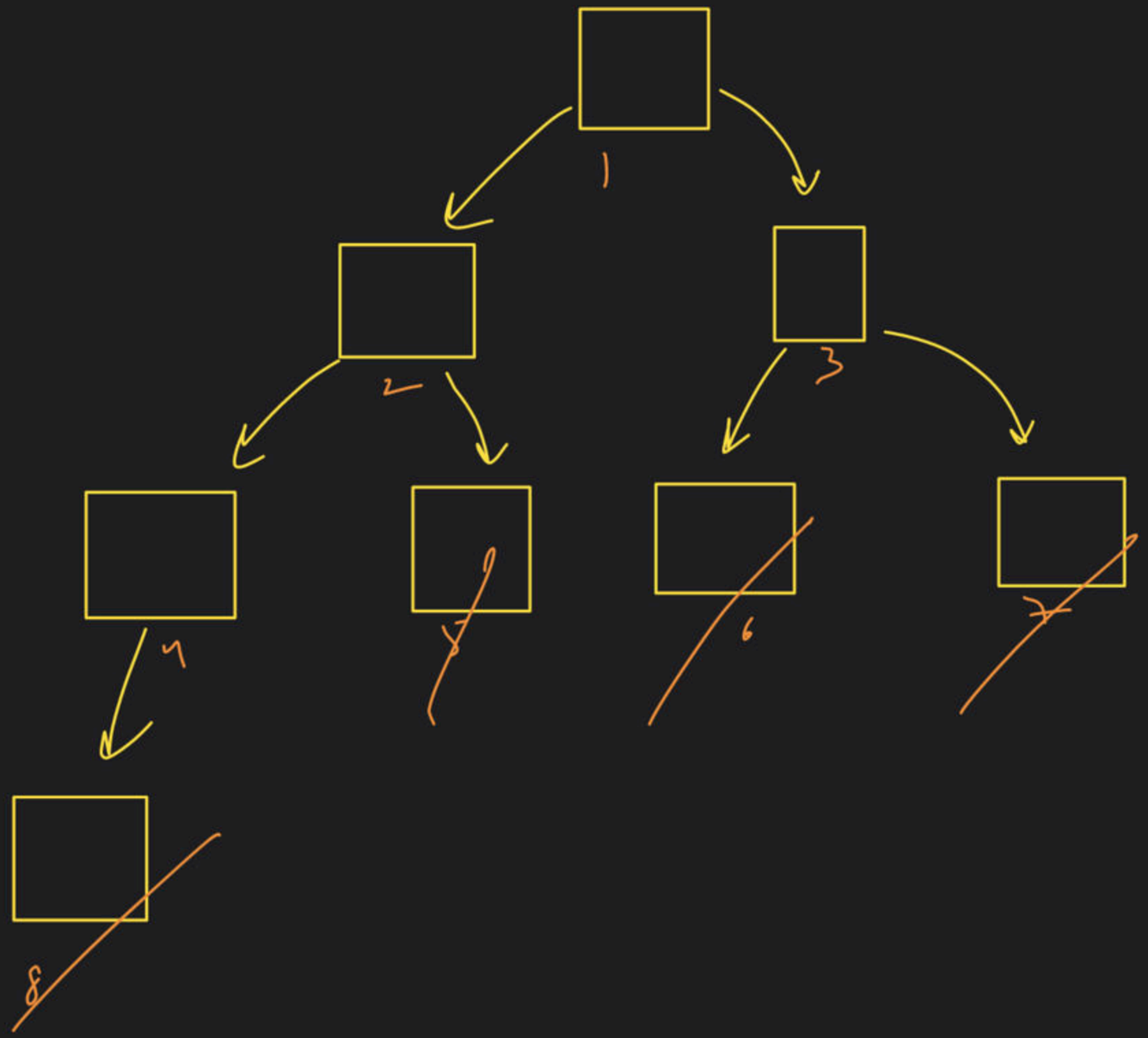

Vishal
Dahiya

heapify (arr, n, index)




layout
index
60
leftIndex
layout
50
13
12
layout
rightIndex
index = layout
Rec
leftInd = 2 * i ?

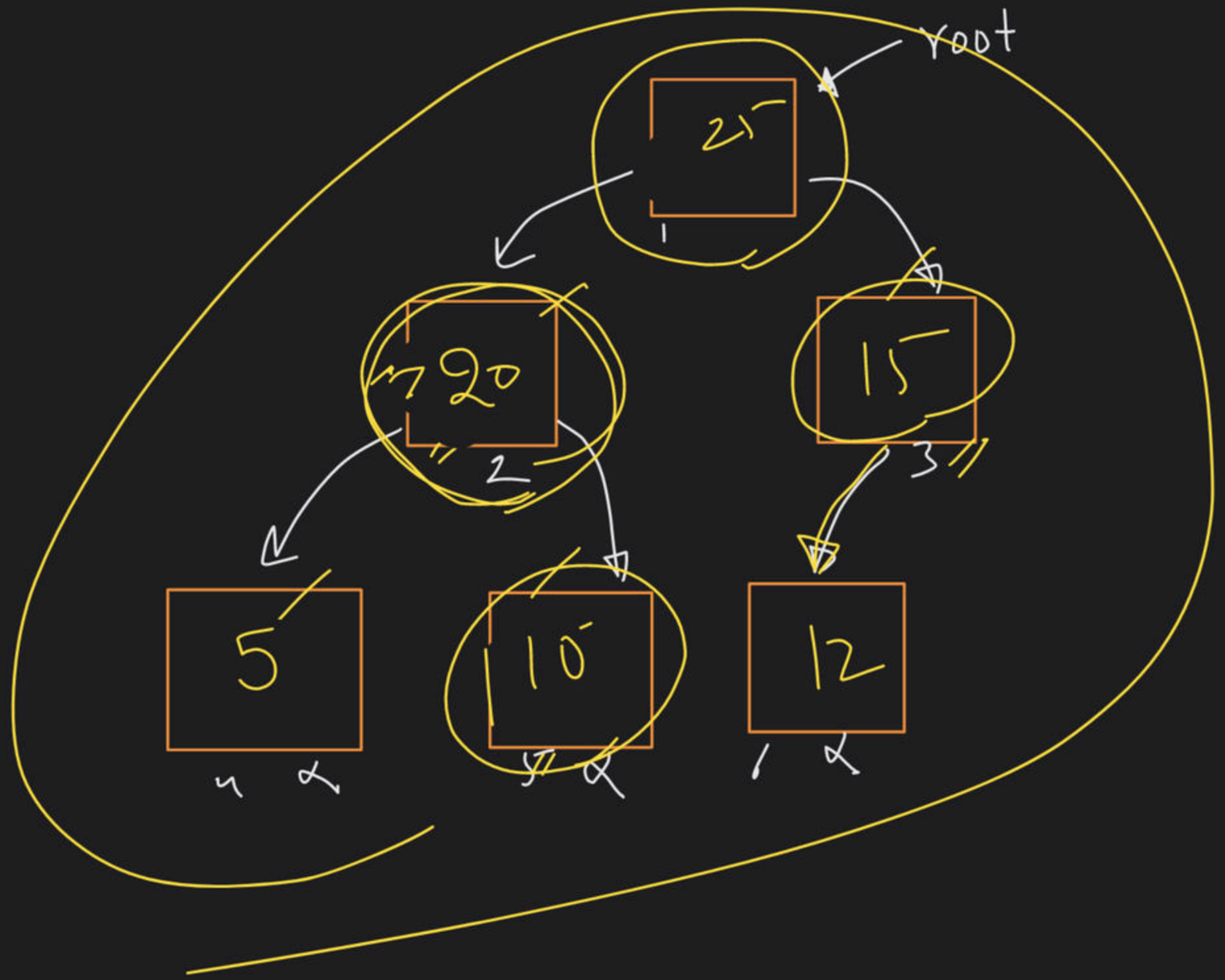

root
5
10
15
20
25
12
11
1
2
3
4
5
6
7
n = 6
5 | 10 | 15 | 20 | 25 | 12
Leaf Node → Valid Heap
for (n/2 → 1)
(n/2 + 1) → n
node → leaf node



$\frac{8}{2} + 1 \longrightarrow 5$

$\frac{4}{2} + 1 \longrightarrow 3$

$5 \longrightarrow 3$



L.N → $\frac{h}{2}+1 \rightarrow h$

$\frac{6}{2}+1 \rightarrow 4$

$3+1 \rightarrow 4$

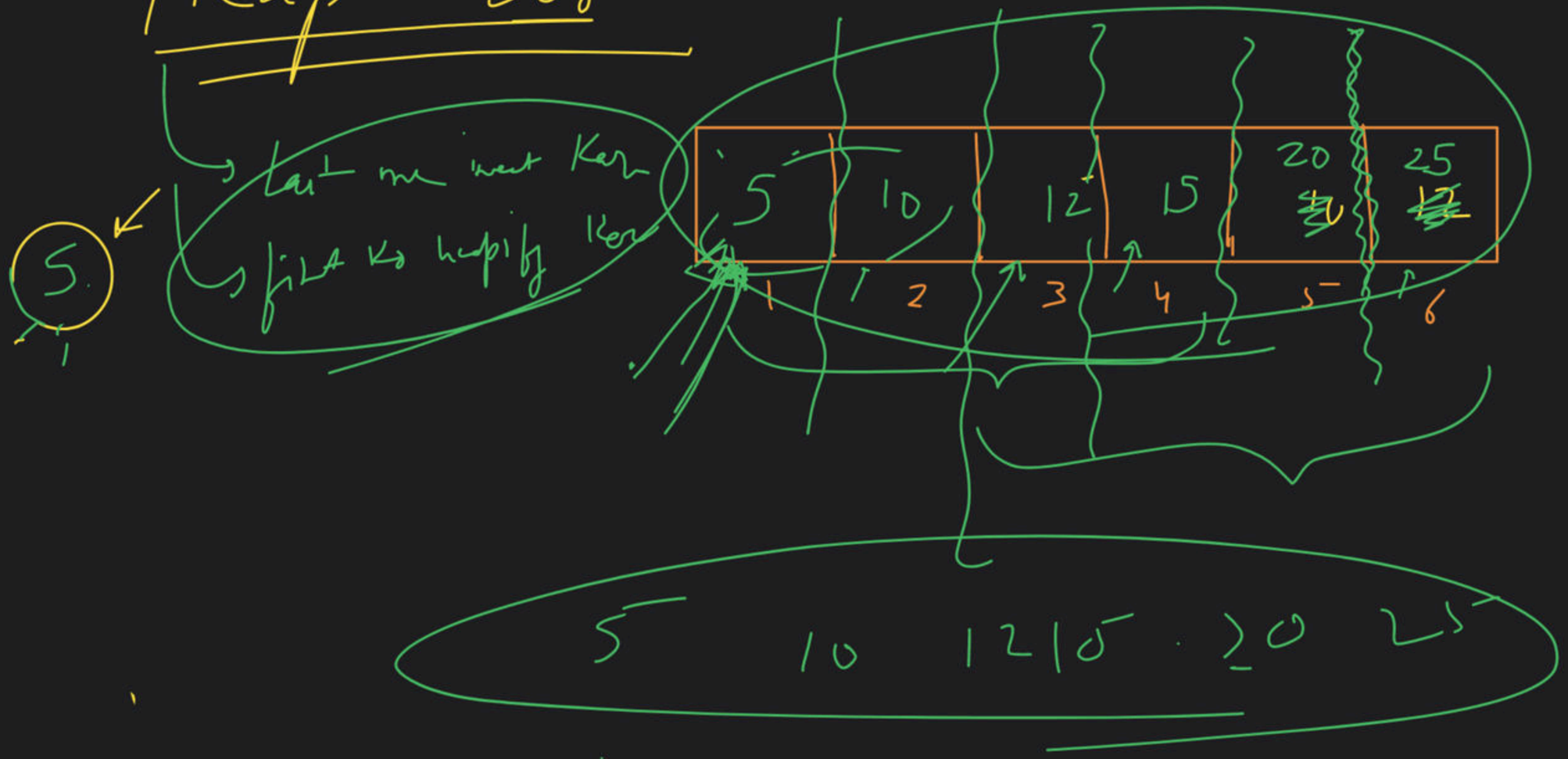
$4 \rightarrow 6$

for($\frac{h}{2} \rightarrow 1$)

for($\frac{6}{2} \rightarrow 1$)

for(3 → 1

Heap Sort


Let me insert Karke
fir Ka heapify Karo
5
5
10
12
15
20
25
20
17
1
2
3
4
5
6
5 10 12 15 20 25


Dry Run
3
2
10 5 8 2 3 4 6
1 2 3 4 5 6 7
8 5 6 2 3 4
10
sorted
6 5 4 2 3
8 10
sorted
5 3 4 2
6 8 10
sorted
4 3 2
5 8 10
3 2
4 5 6 8 10
2
3 4 5 6 8 10
sorted
2 3 4 5 6 8 10