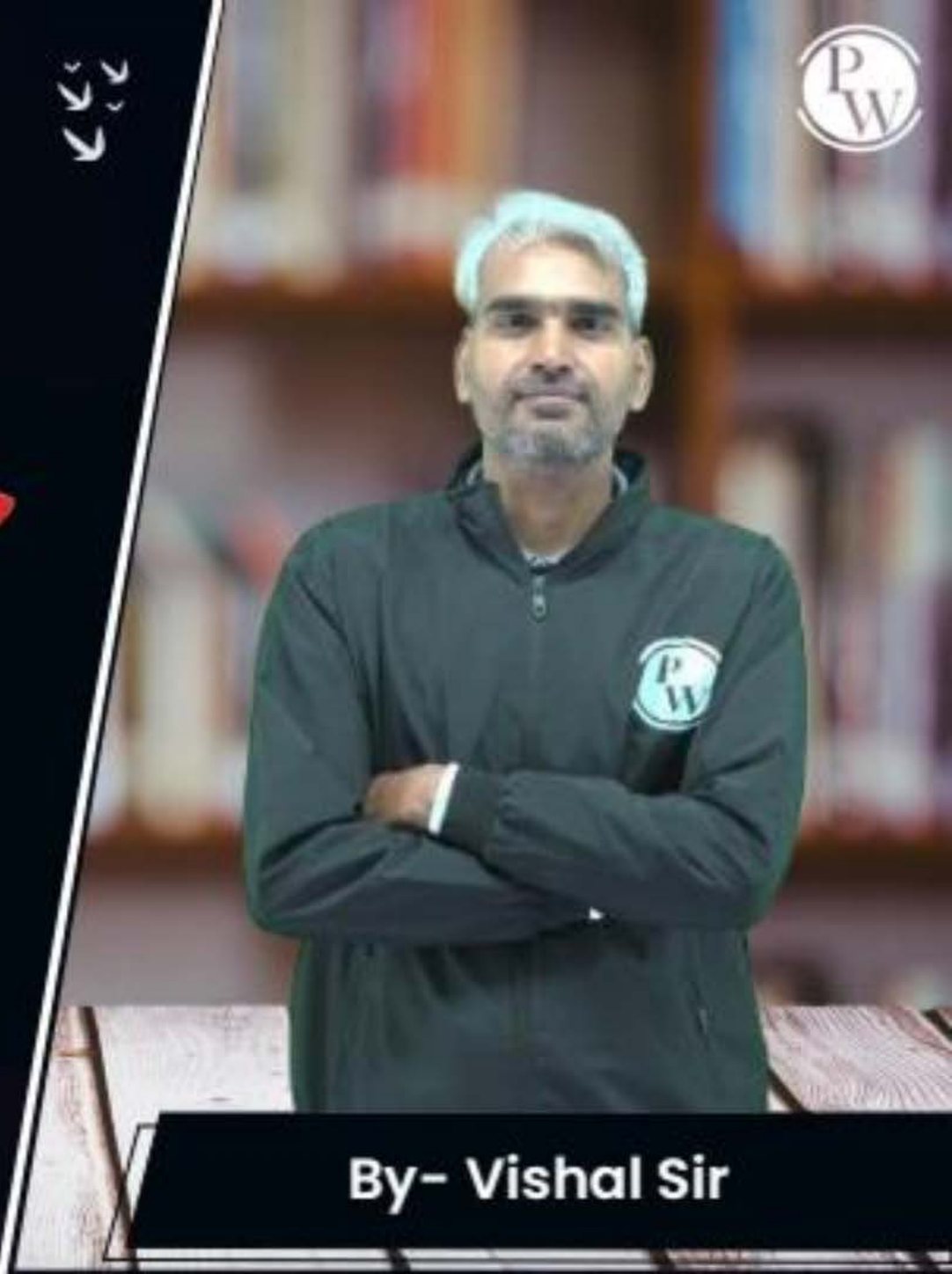
DS & AI

Database Management System

Super 1500+

Lecture No. 08



By- Vishal Sir

Recap of Previous Lecture

Topic File organization and Indexing

Slide

Topics to be Covered

Topic	File organization and Indexing

Slide

#Q.50 The following set of key {2, 3, 5, 7, 11, 17, 19, 23, 29, and 31} are inserted into an empty B+-tree of order 3. Which of the following is true after the tree has been constructed?

4 for internal node

Order = 2 for leaf node

Assume, the key in the internal node is present in Right sub-tree

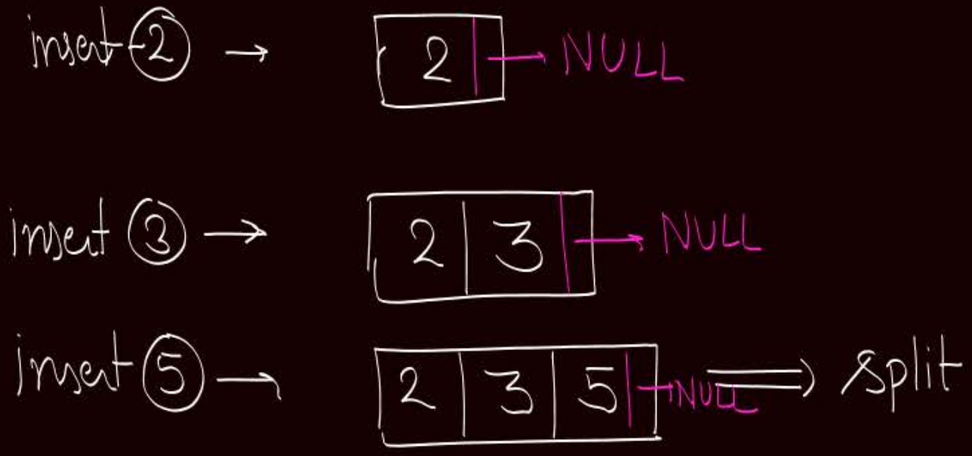
(a) The root has only one key value 19.

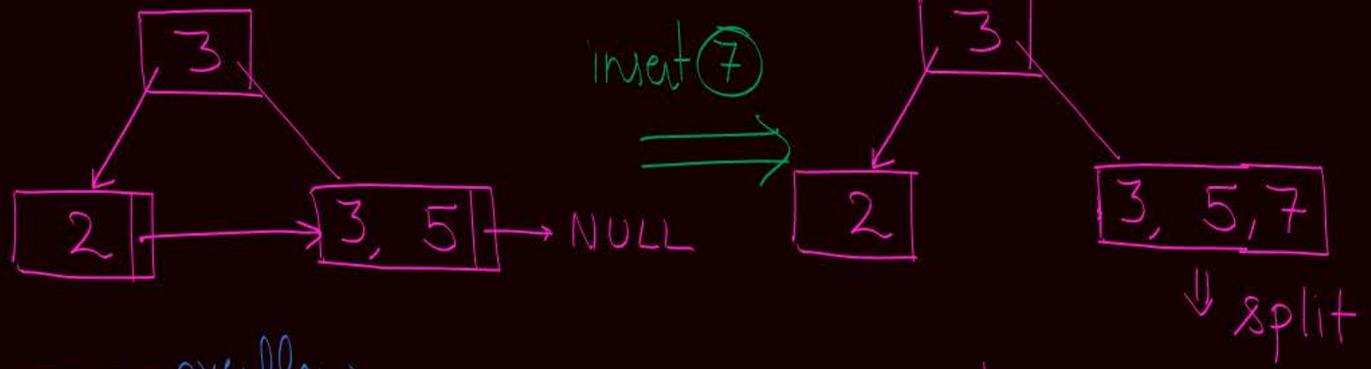
(b) The root has two key values 17 and 19.

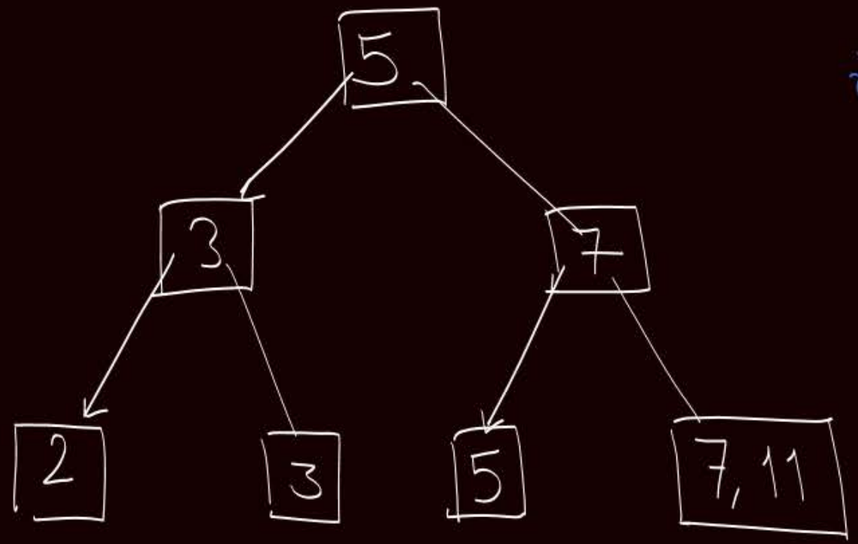
(c) The root has only one key value 11.

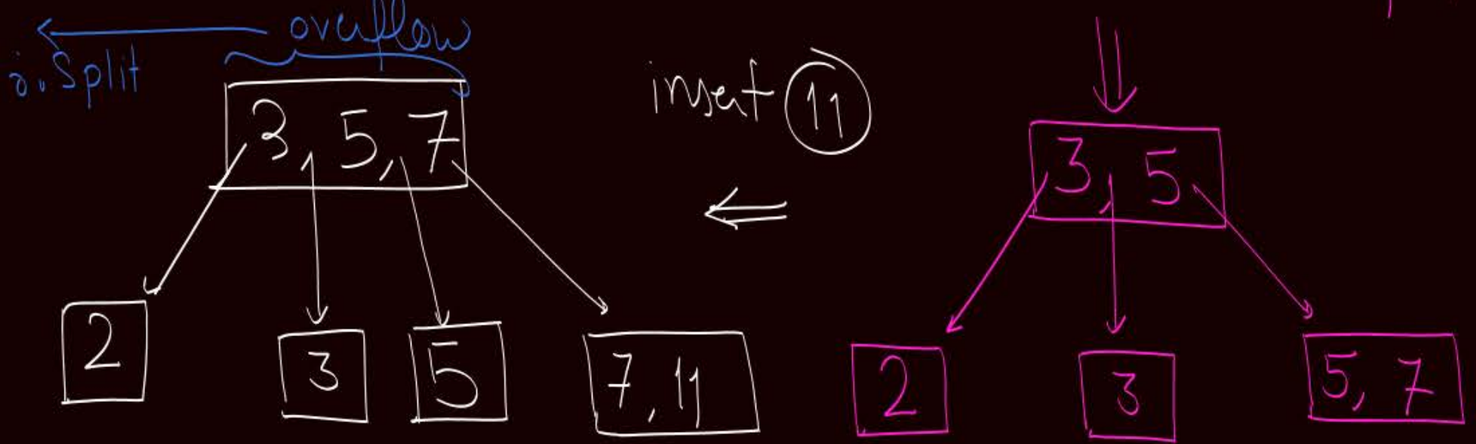
(d) Key value 31 is alone in a leaf node

2, 3, 5, 7, 11, 17, 19, 23, 29, 31









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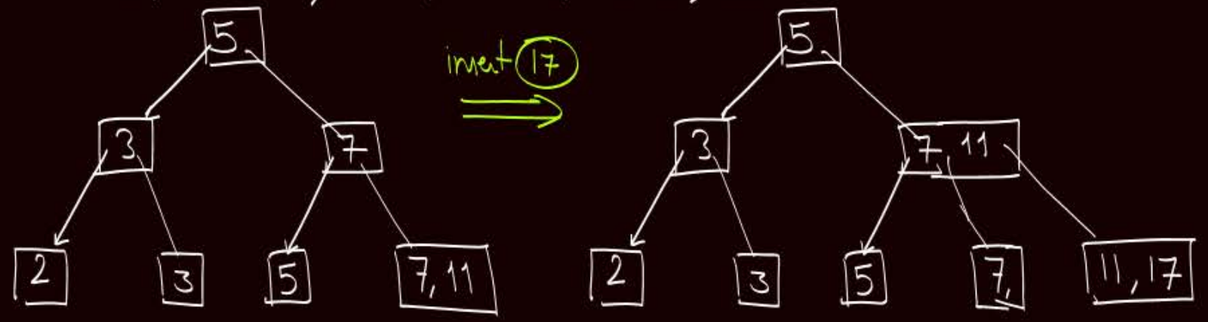
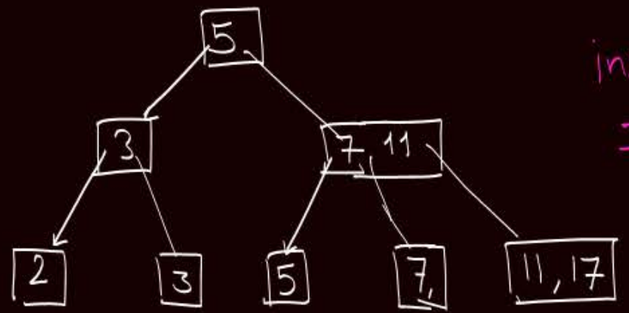
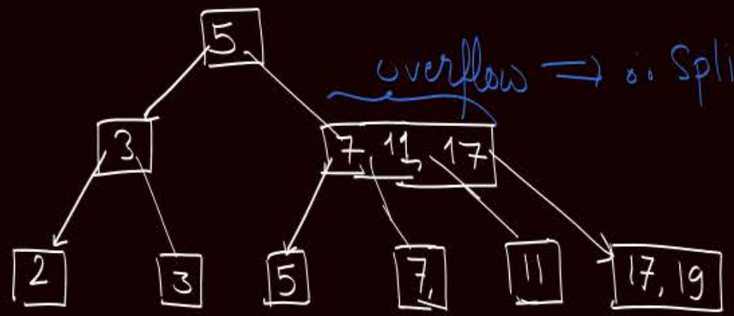


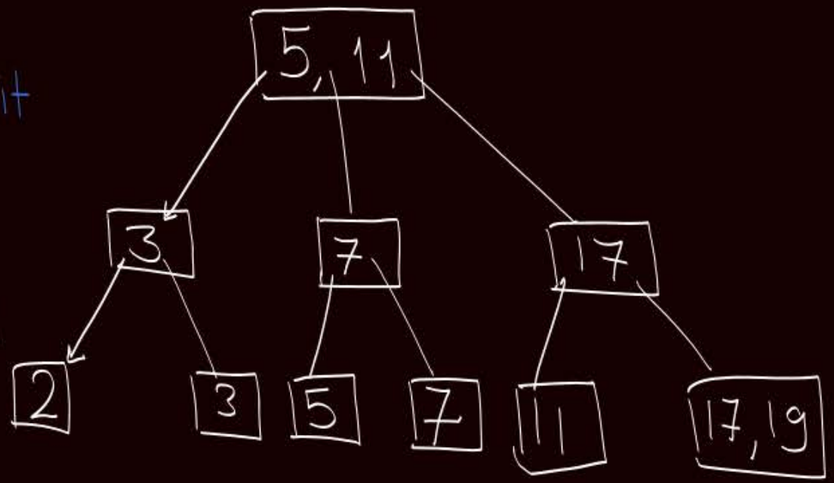
insert (17)



insert (19)



overflow ⇒ ∴ Split



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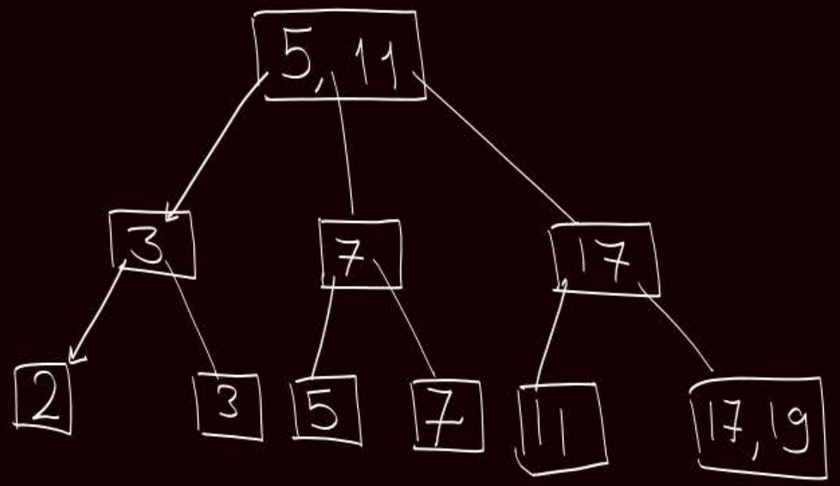
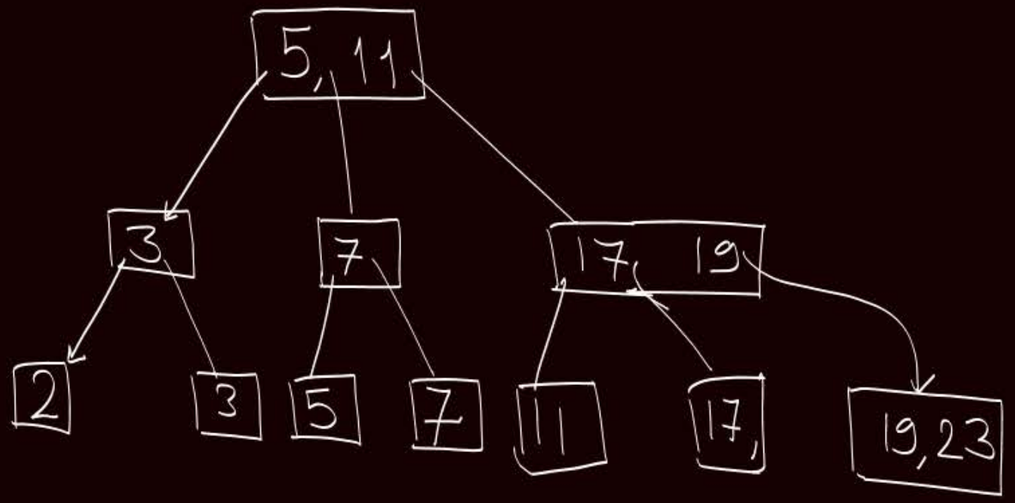


insert 23



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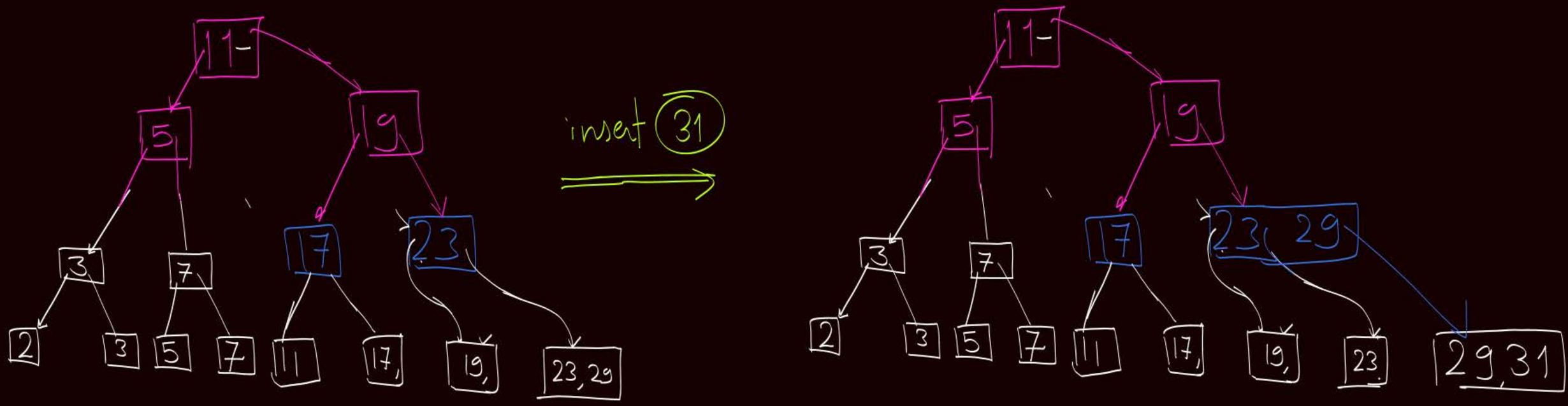

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Max Child pointer = 4
Max Keys = 4-1 = 3

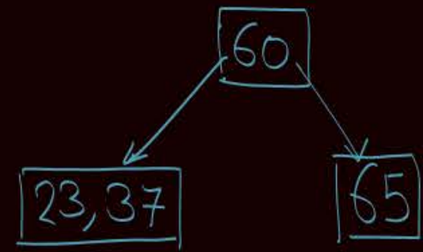
#Q.51 values 23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, and 78 are inserted in the given order in a B-tree of order = 4. The number of time the node of B tree splits during insertion is (assume that left biasing is used)_____

More Keys in left hand side node after splitting

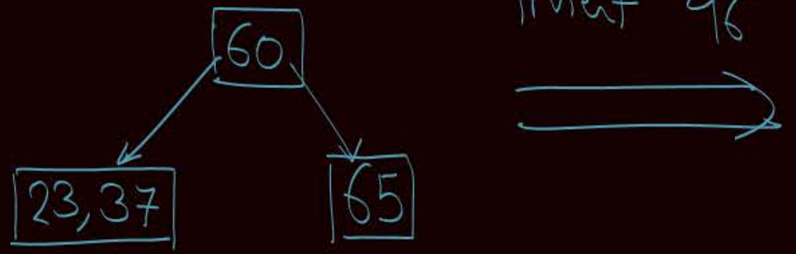
Max keys = 3

23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78

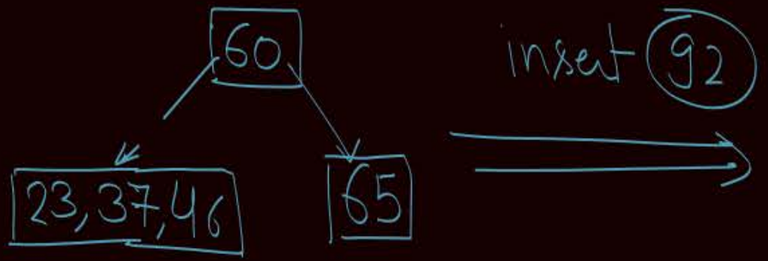
insert 23, 65, 37 => [23, 37, 65] —insert 60→ [23, 37, 60, 65] (overflow) —Split→

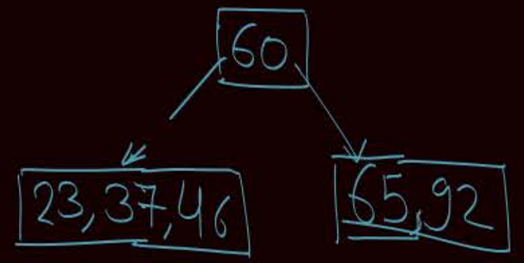


—insert 46→



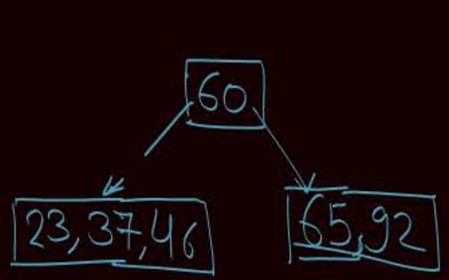
—insert 92→



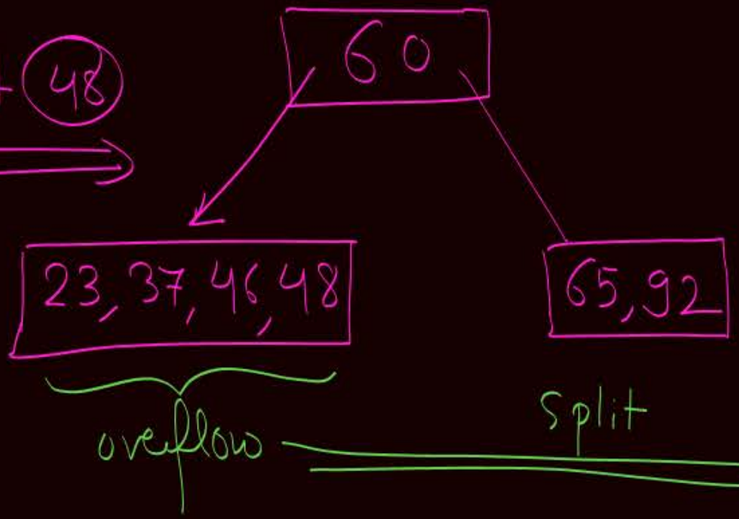


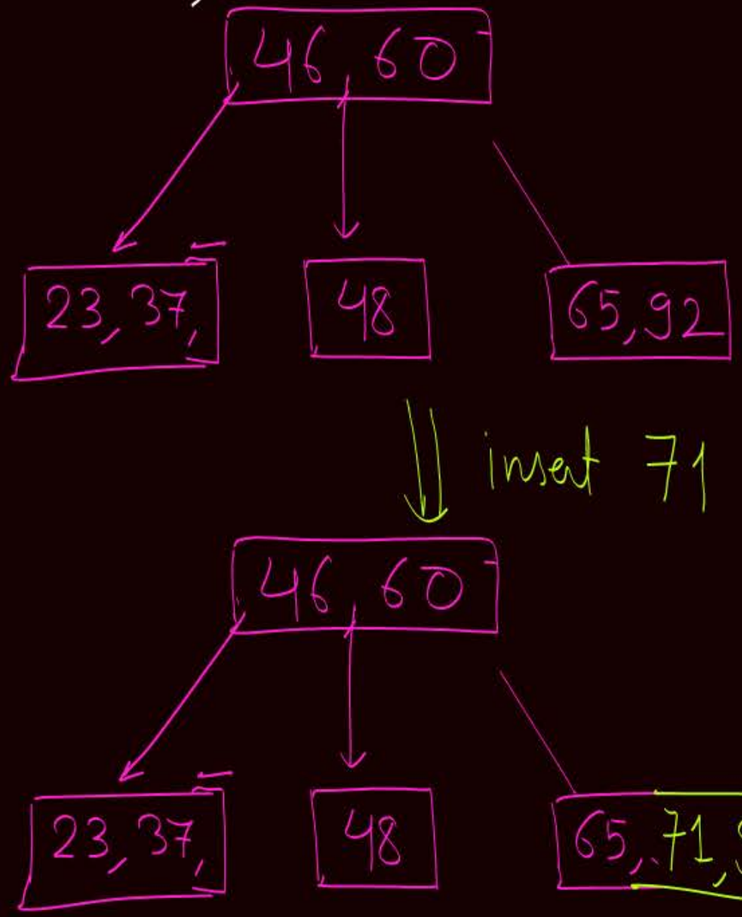
Max keys = 3

23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78



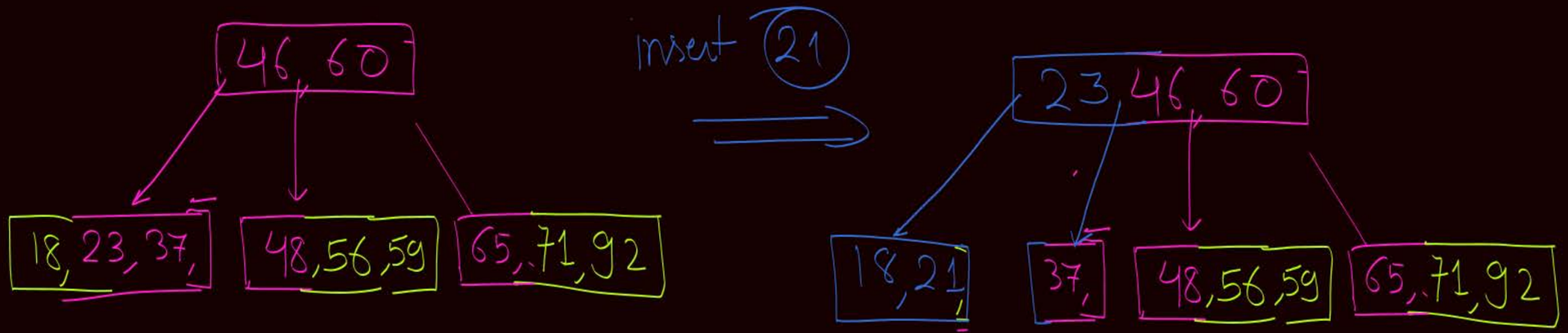
insert 48





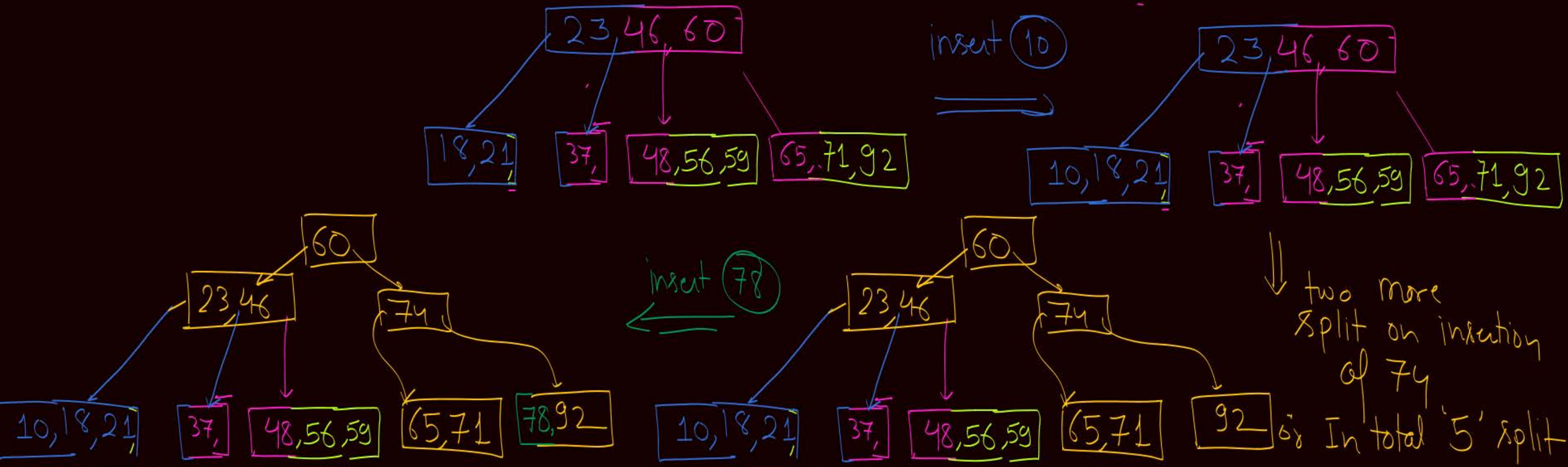
Max keys = 3

23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78



Max keys = 3

23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78



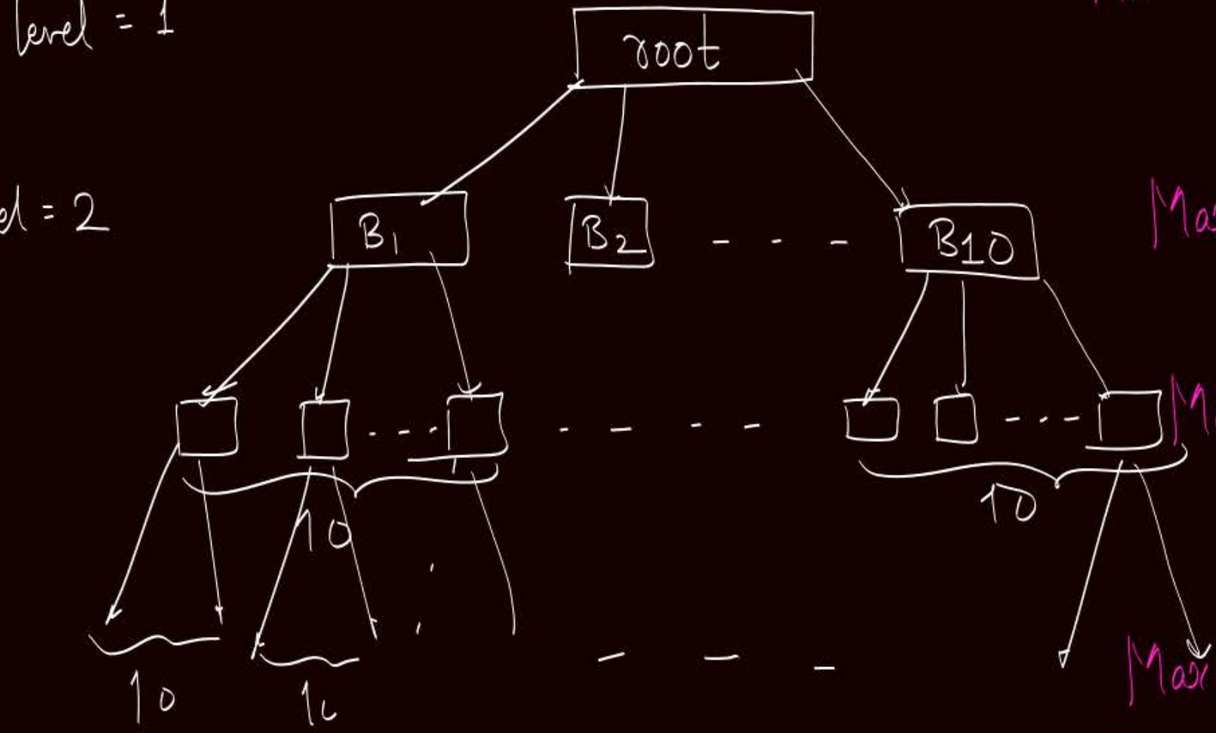
Max No of Child pointer = 10

Max No. of keys = Max No of record pointer = 10 - 1 = 9

#Q.52 Consider the B tree of order 10. Assume that the number of levels in the tree is four including root. The maximum number of record pointers that can be stored in B tree is _____ Ans - 9999

Maximum no of record pointers will be there if each node is full.

i.e. When Node occupancy is maximum



Max No. of nodes at level 1 = 1

Max No. of nodes at level 2 = 1 * 10 = 10
= 10

Max No. of nodes at level 3 = 10 * 10 = 100

Max No. of nodes at level 4 = 100 * 10
= 1000

∴ Maximum no. of nodes in a Btree of level 4
= 1 + 10 + 100 + 1000
= 1111 → Each Can Contain Max '9' record pointers

∴ Max No. of record pointers = 1111 * 9
= 9999

#Q.53 Consider the B tree of order 10. Assume that the number of levels in the tree is four including root. The minimum number of record pointers that can be stored in B tree is ____ Ans = 249

No. of record pointer will be minimum in the tree, when node occupancy of each node is minimum

Max. no. of child pointer = 10

* Min. no. of child pointer necessary = $\lceil \frac{10}{2} \rceil = 5$ {for non-root node}

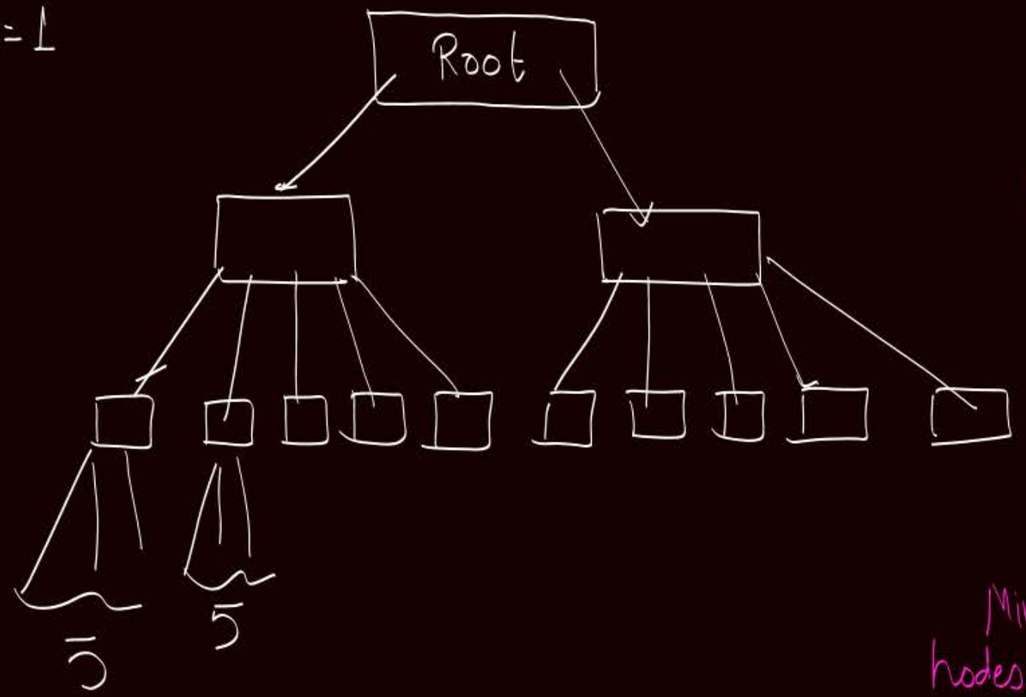
* Min no. of child ptr. necessary for root = "2"

level = 1

level (2)

level (3)

level (4)



Min No of node at level 1 = 1

Root node must Contain minimum 1 record

Min. No of node at level 2 = 1 * 2 = 2

Min no of node at level 3 = 2 * 5 = 10

Min no of nodes at level 4 = 10 * 5 = 50

Each one of them must Contain minimum $\lceil \frac{p}{2} \rceil - 1 = \lceil \frac{10}{2} \rceil - 1 = 4$ records

∴ Min No of Records necessary $= (1 * 1) + (62 * 4)$

1 root with 1 record

non-root node each with minimum 4 records

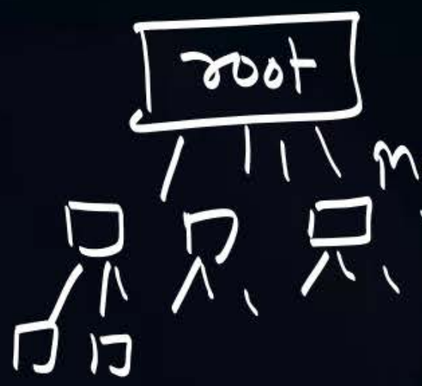
$= 249$

Record pointers will be only at leaf level.

- Max no. of child pointer in an internal node = 10
- Max no. of record pointer in leaf node = Max. no. of keys in leaf node = 10

#Q.54 Consider the B+tree of order 10. Assume that the number of levels in the tree is four including root. The maximum number of record pointers that can be stored in B+tree is Ans = 10000

∴ We need to count maximum No. of nodes at leaf level only.



1 node at root

Max 10 children = Max No. of node at level 2 = 1 * 10 = 10

Max 10 children of each node a previous level → Max No. of nodes at level-3 = 10 * 10 = 100

Max 10 children of each node at previous level → Max. No. of nodes at level-4 = 100 * 10 = 1000

In a B+ tree of level 4 and order = 10,

We can have maximum '1000' nodes at leaf level.

And each node at leaf level can have maximum '10' record Pointer

∴ Maximum no. of Record Pointers = (1000) × (10) = 10,000

(1000): Max No of nodes at leaf

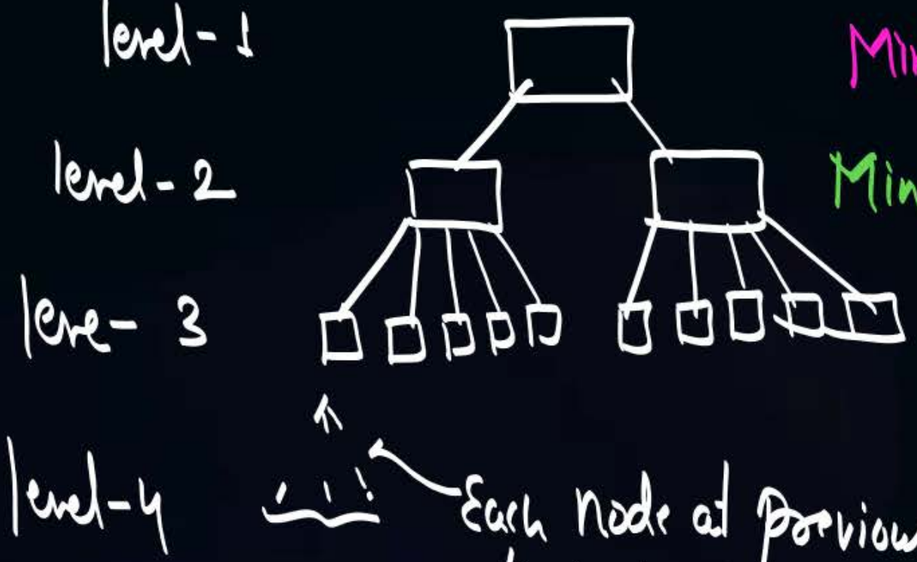
(10): Maximum No. of record ptr in each leaf node

Min no. of child ptr of a root node = 2

Min. no. of child ptr at non-root internal node = $\lceil \frac{10}{2} \rceil = 5$

#Q.55 Consider the B+tree of order 10. Assume that the number of levels in the tree is four including root. The minimum number of record pointers that can be stored in B+tree is _____

Min. No. of keys at non-root leaf node = $\lceil \frac{\text{order}}{2} \rceil = \lceil \frac{10}{2} \rceil = 5$



Min No. of nodes at level 1 = 1

Min. no. of nodes at level-2 = 1 * 2 = 2

Min no. of nodes at level-3 = 2 * 5 = 10

Min. No. of nodes at level-4 = 10 * 5 = 50

* Minimum '50' nodes at leaf level.
* and each node at leaf level must have minimum $\lceil \frac{10}{2} \rceil = 5$ record pointers.

∴ Min. no. of record pointers in a B+ tree of order = 10 and level = 4

$= \underbrace{50}_{\text{Min 50 nodes}} * \underbrace{5}_{\text{each with min '5' record Pointers}} = 250$

2 mins Summary

Topic File organization and Indexing

Slide


THANK - YOU
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