DSA Homework 02

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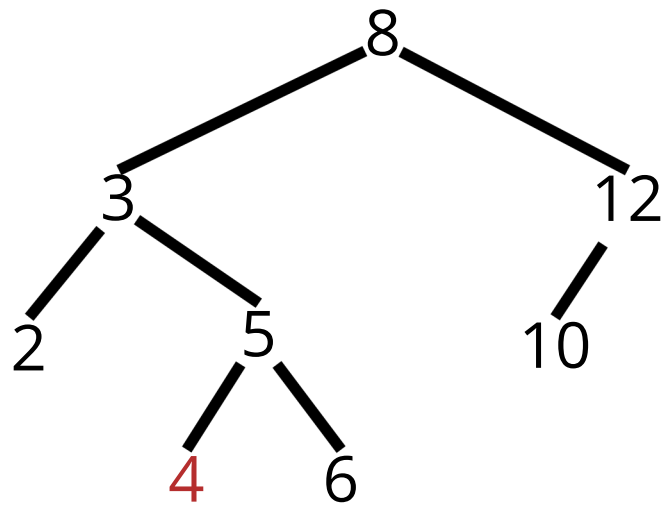
G05

Exo 1 :

Inserting 4 :

left-left imbalencing in node(6)

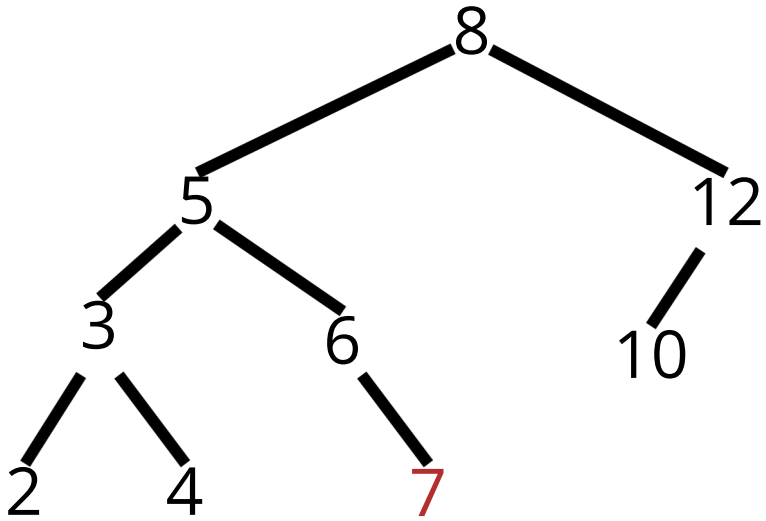
Right_rotation(6)



Inserting 7 :

right_right imbalance in node(3)

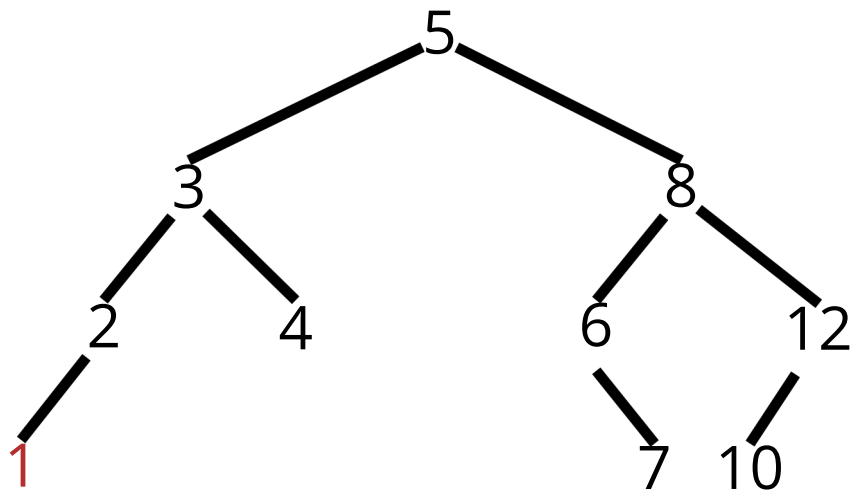
Left_rotation(3)



Inserting 1 :

left-left imbalance in node(8)

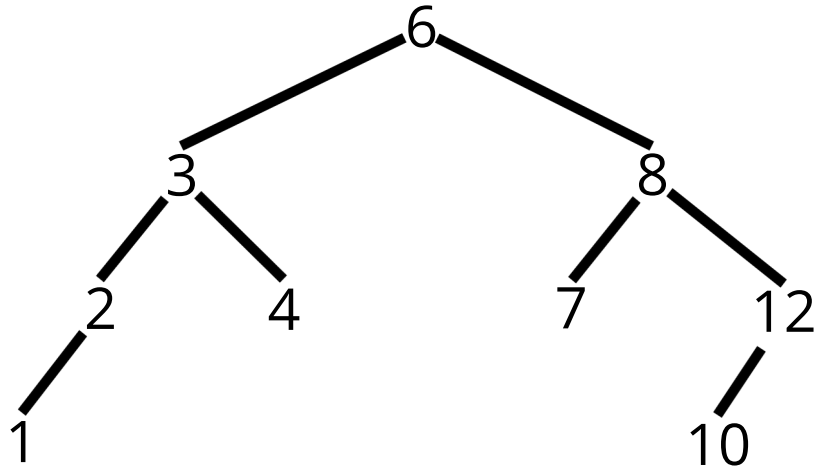
Right_rotation(8)



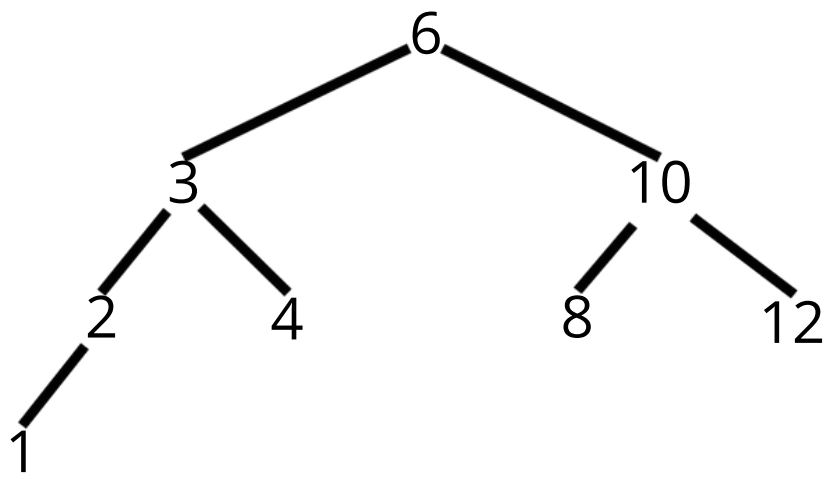
b)

Deleting 5 :

choose the maximum from the left subtree to replace with (4)=> remove (4) from the left subtree (recursively)=>left_left imbalance in node(3)=>right_rotation(3)

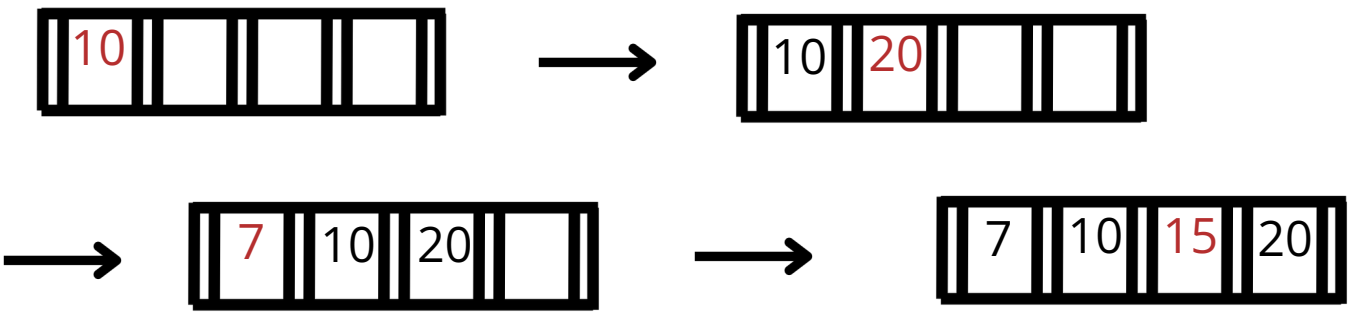


Deleting 7 :

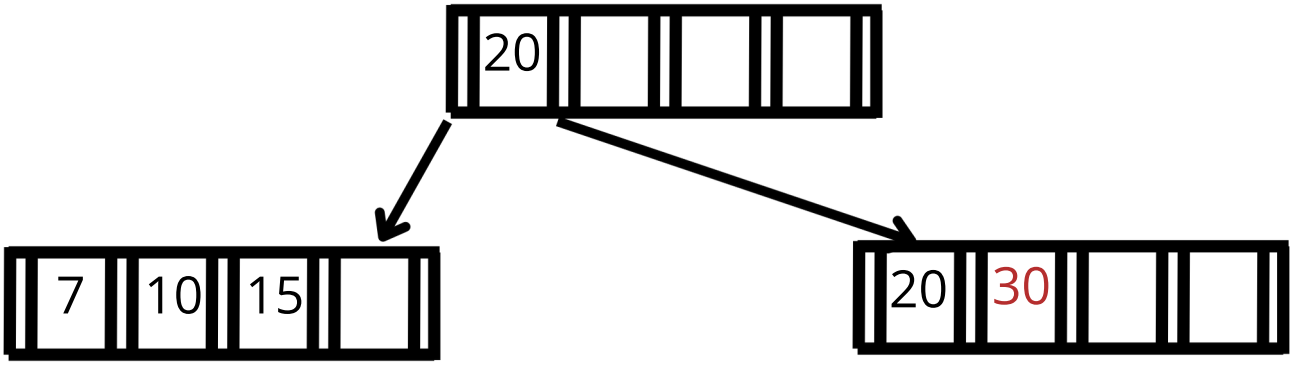


Exo 2 :

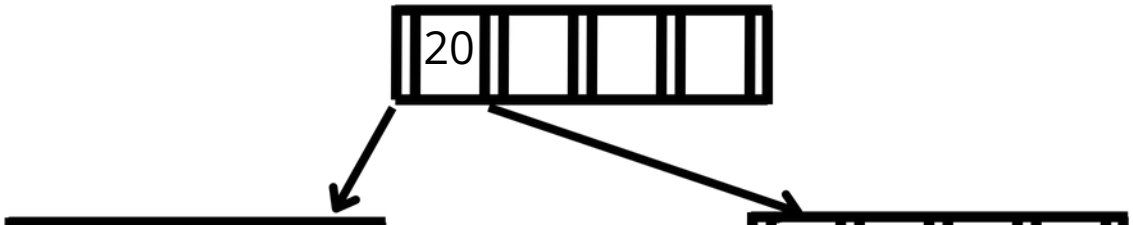
Insert(10,20,7,15)=>

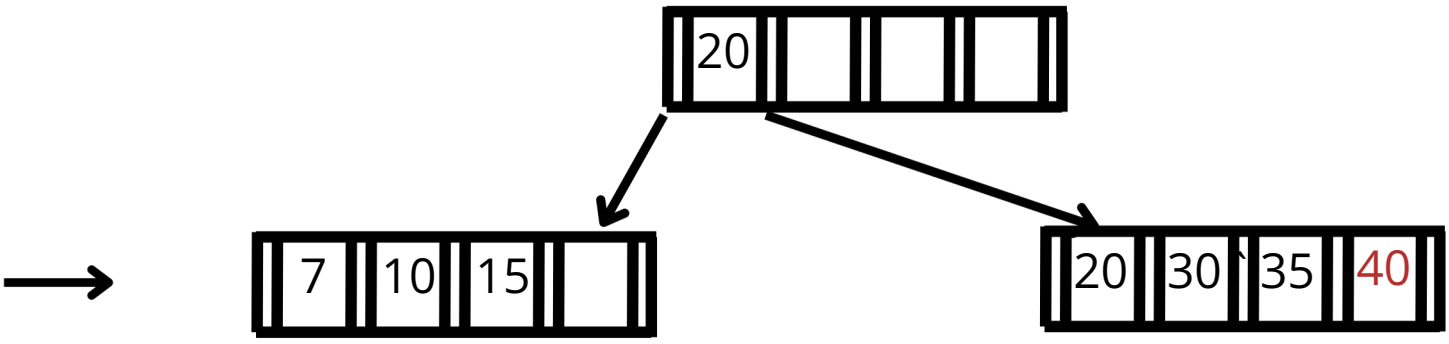


Insert(30)=> overflow => split with the parent(20)

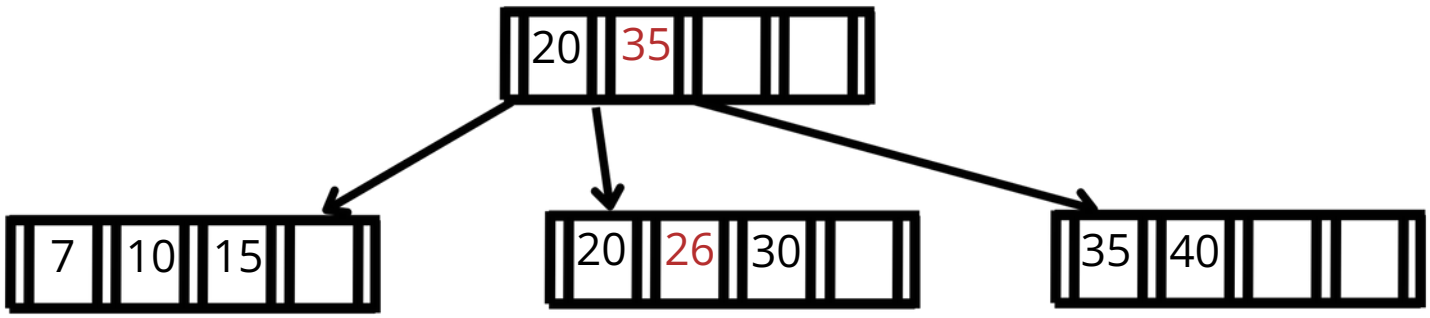


Insert(35,40)=>

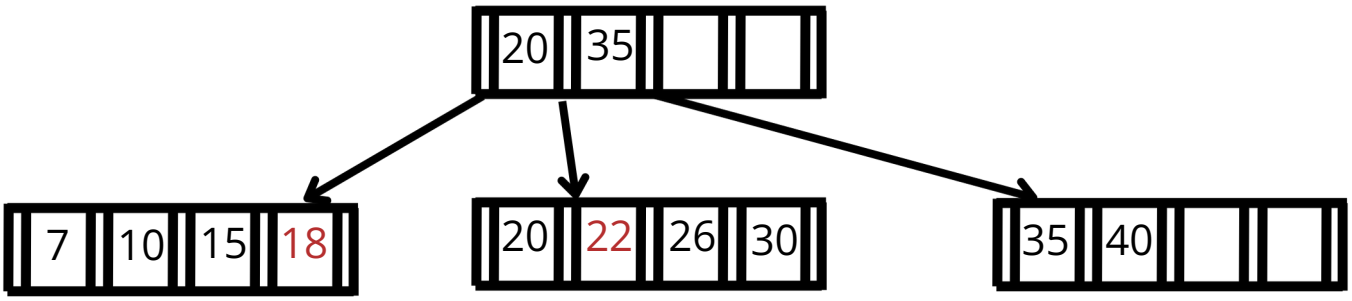




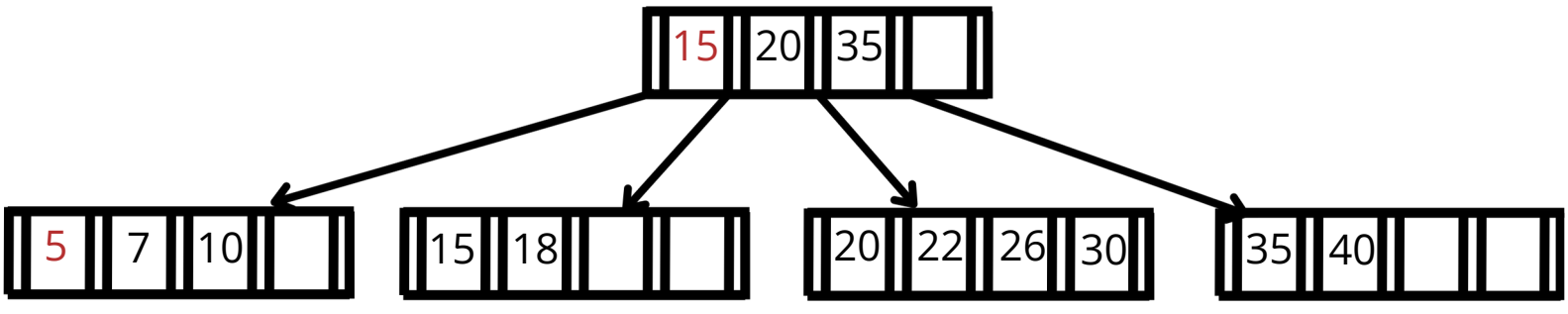
Insert(26)=> overflow => split



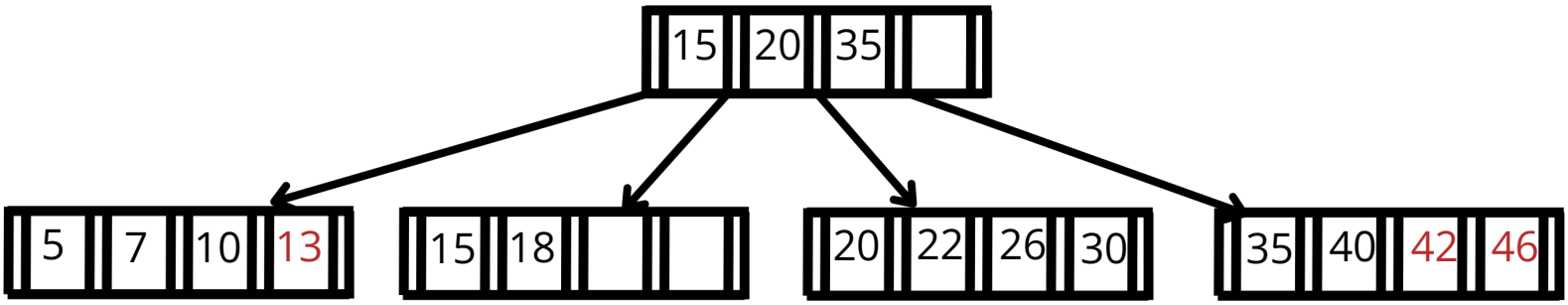
Insert(18,22)=>



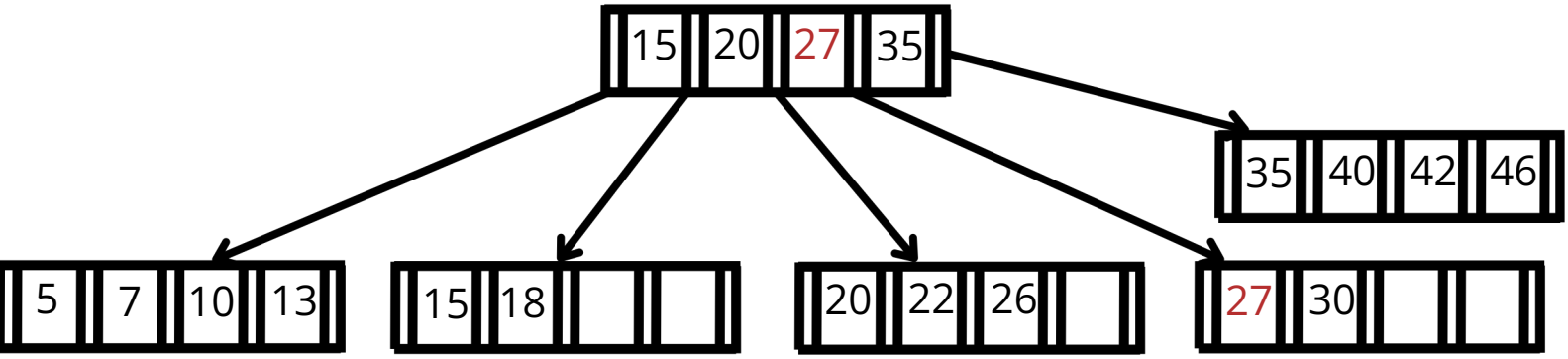
Insert(5)=>overflow=>split



Insert(42,46,13)=>

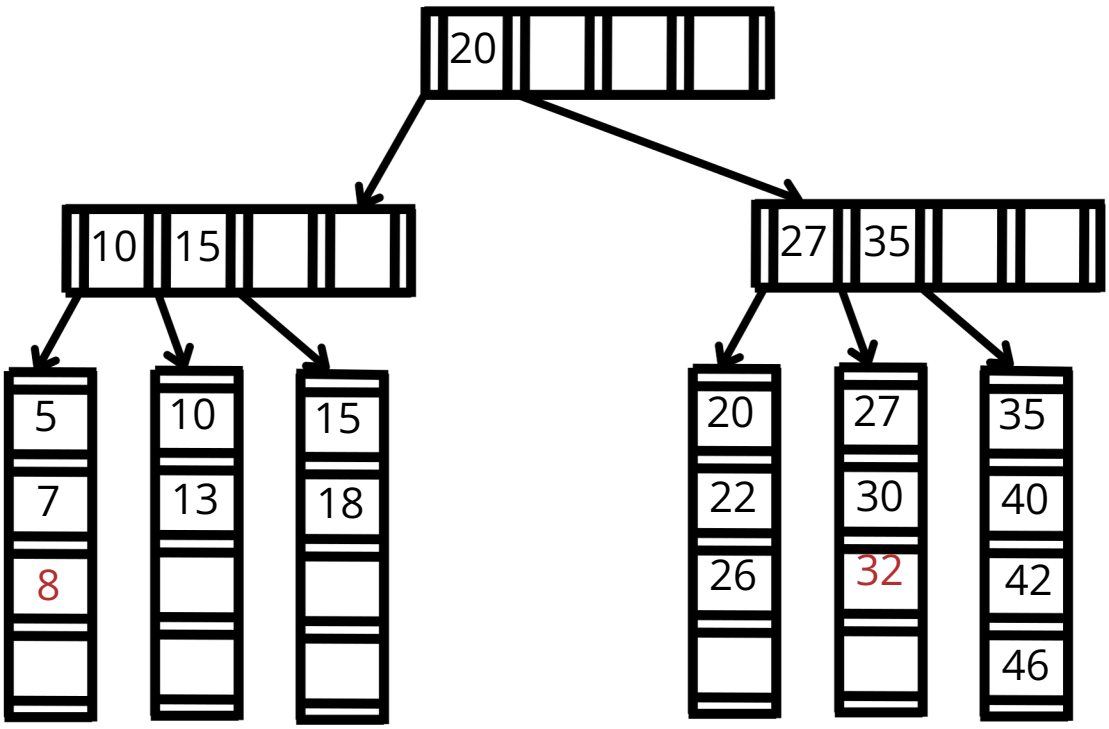


Insert(27)=>overflow=>split

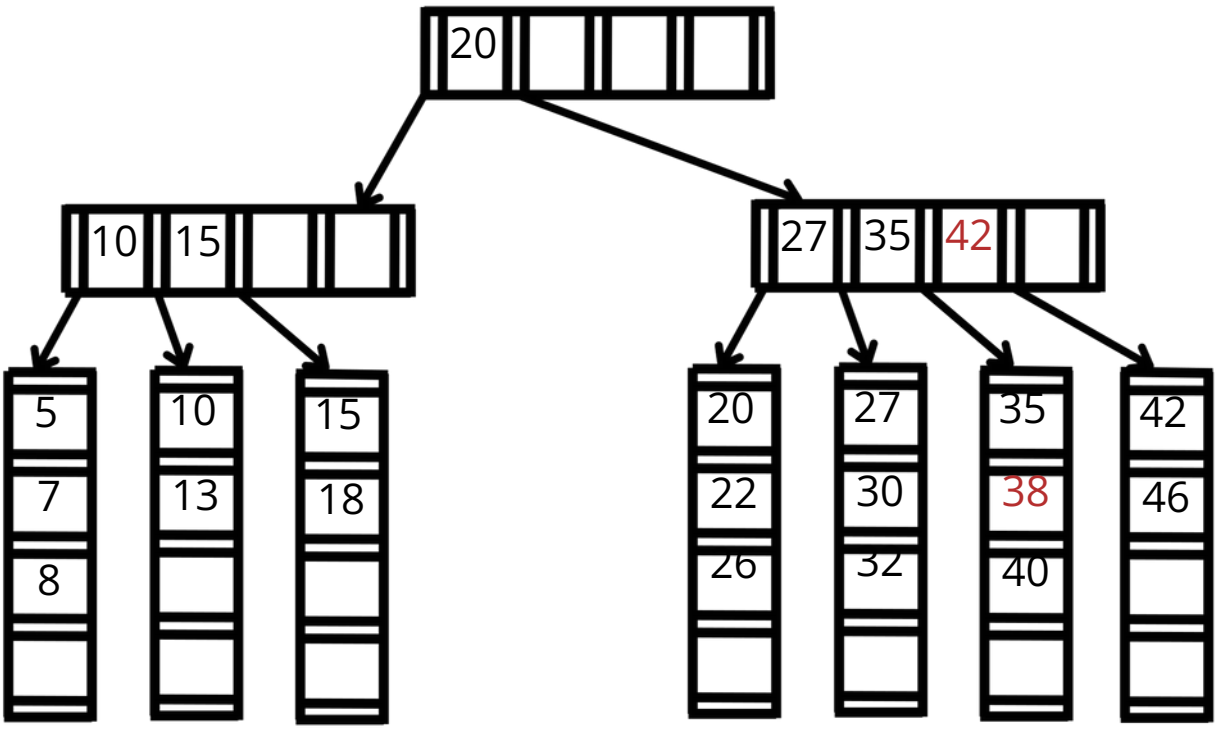


Insert(8)=>overflow=>split leaves=>split internal nodes with root(20)

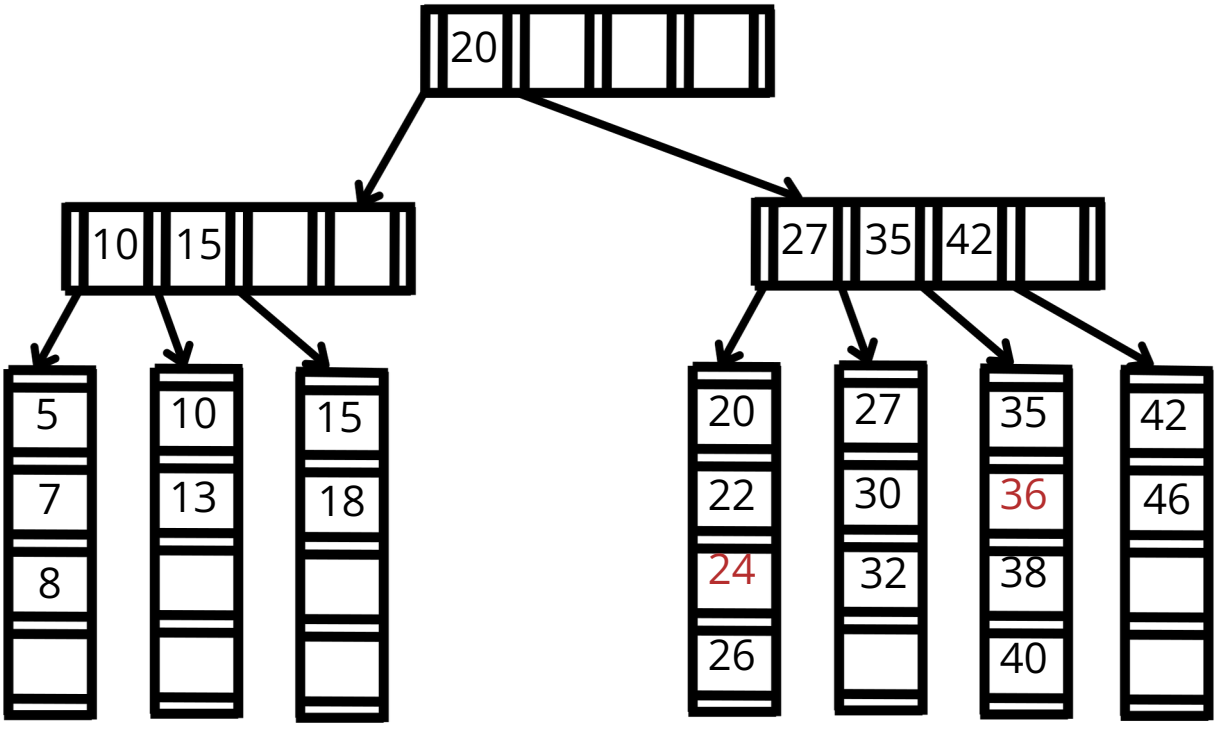
Insert(32)=>



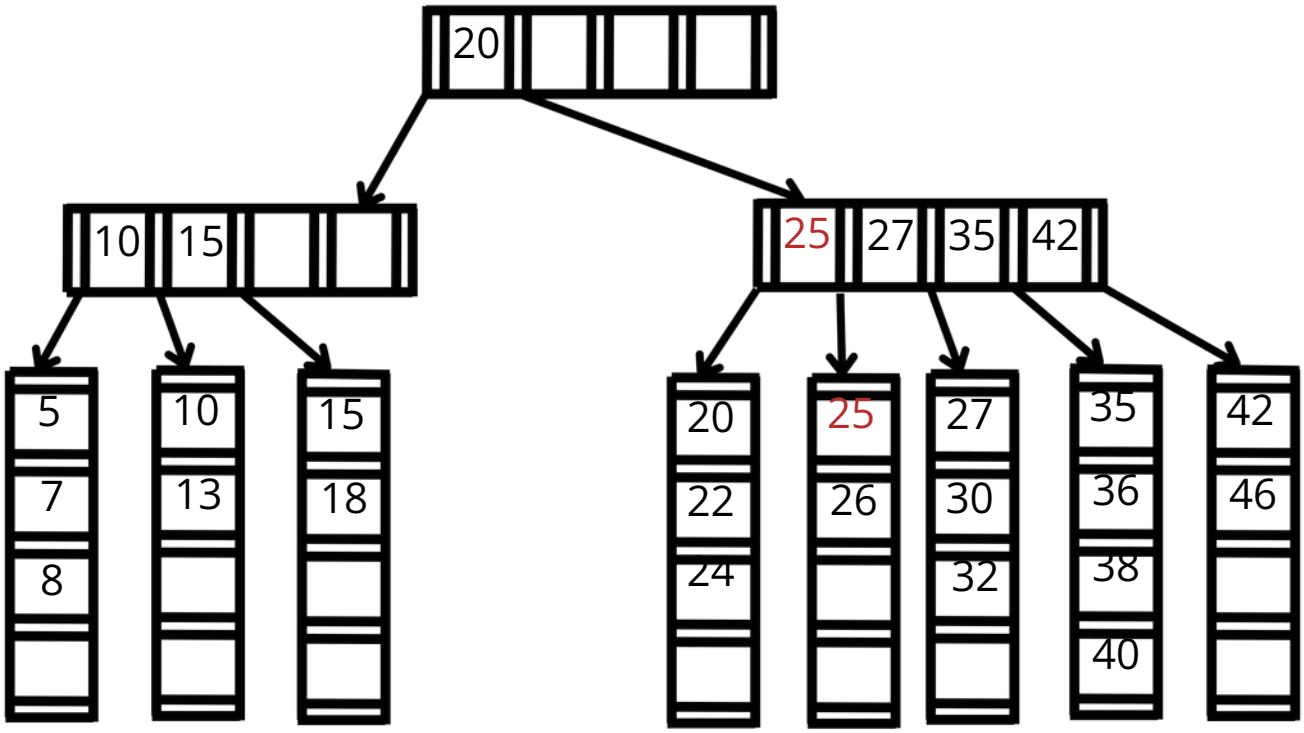
Insert(38)=>overflow=>split



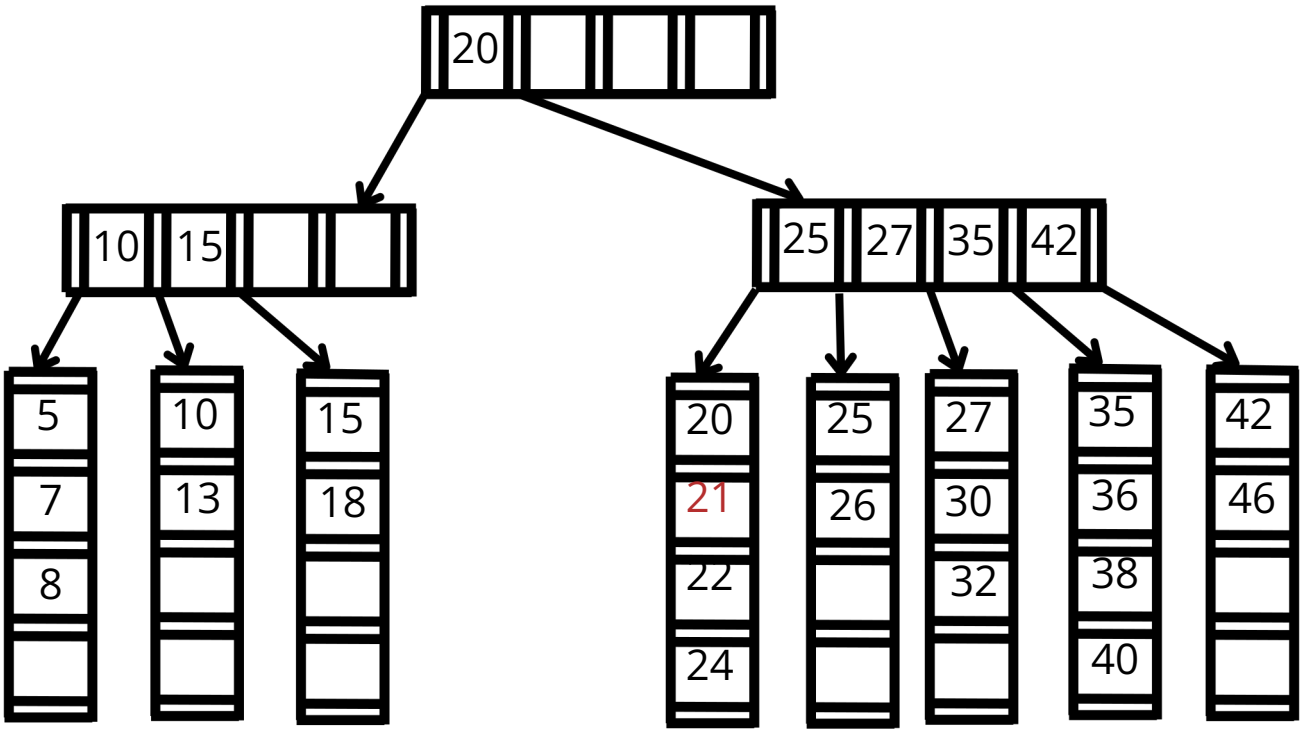
Insert(24,36)=>



Insert(25)=>overflow=>split

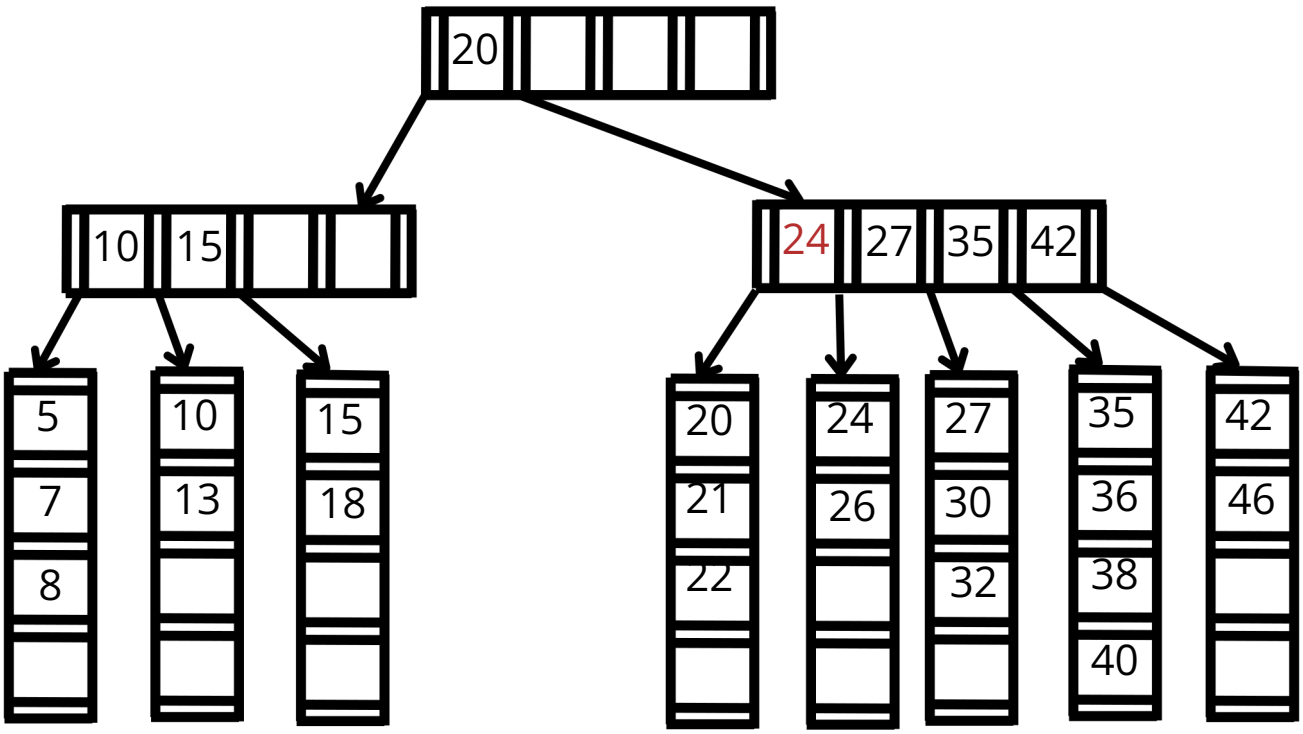


Insert(21)=>

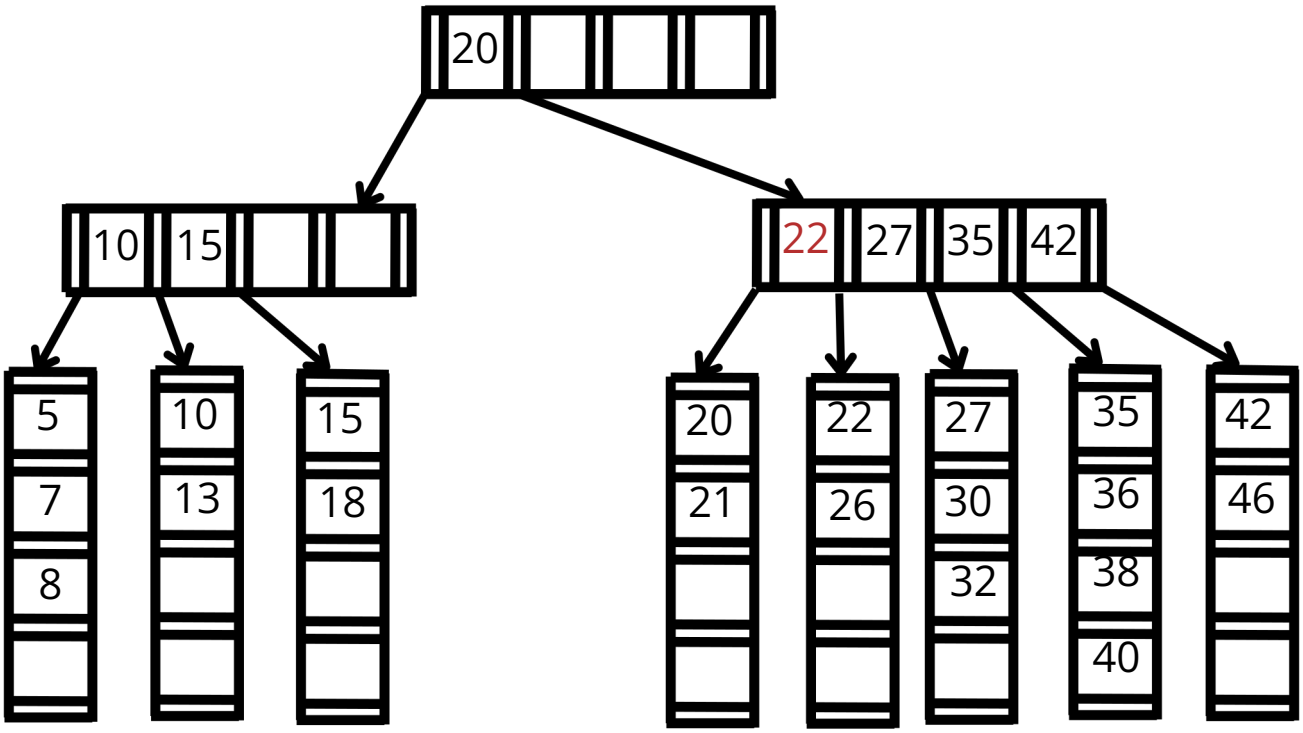


I.2.

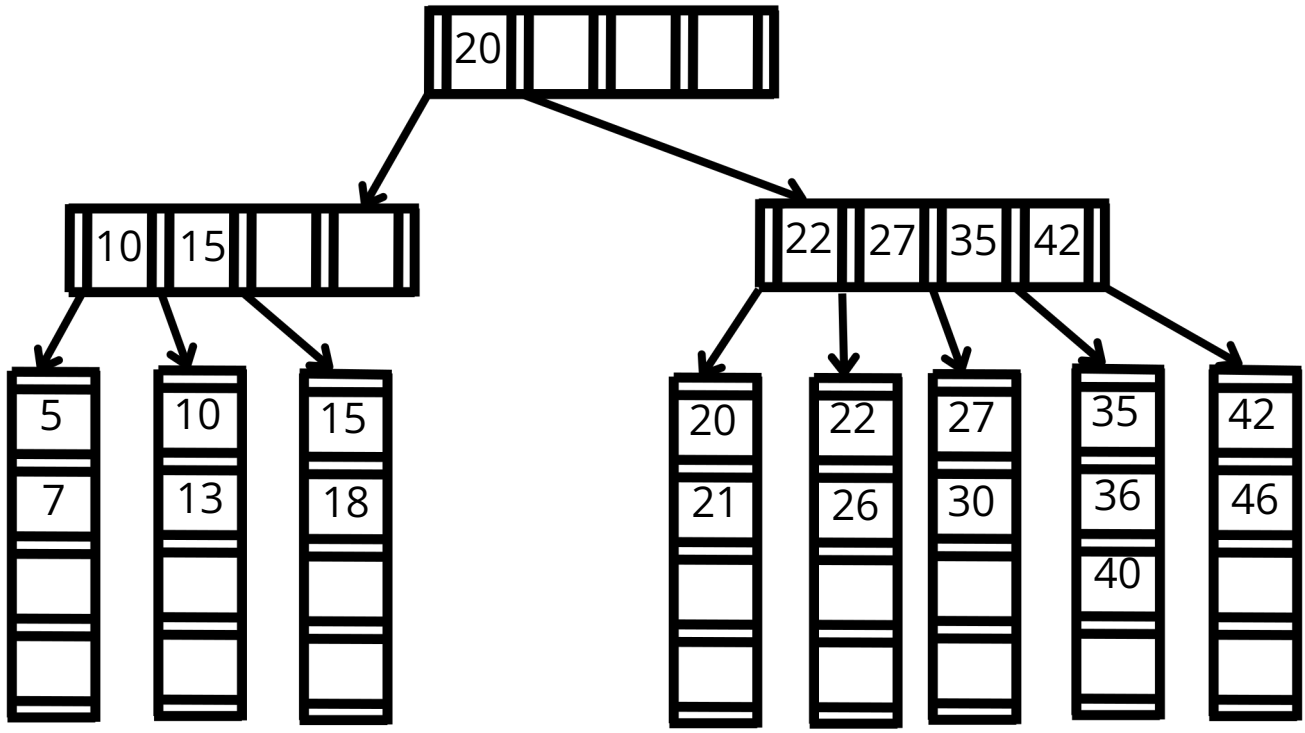
Delete(25)=>underflow=>adopt from left=>



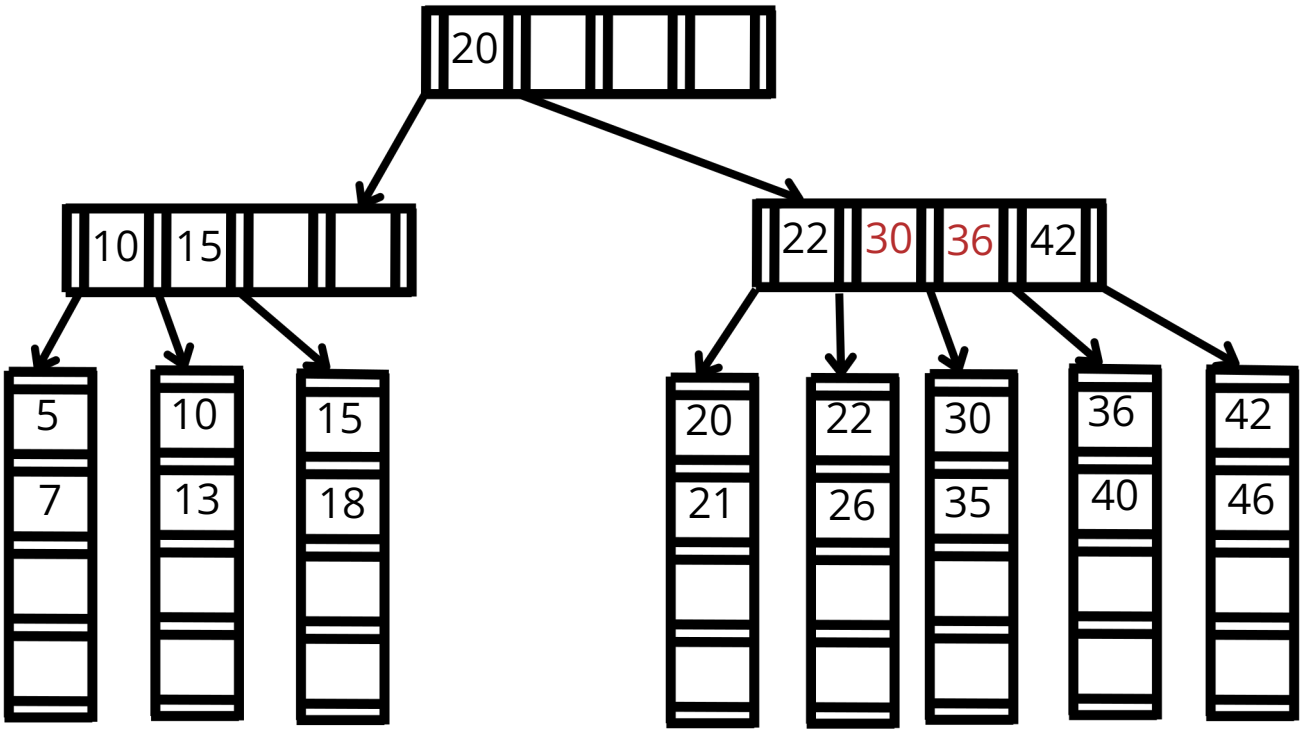
Delete(24)=>underflow=>adopt from left=>



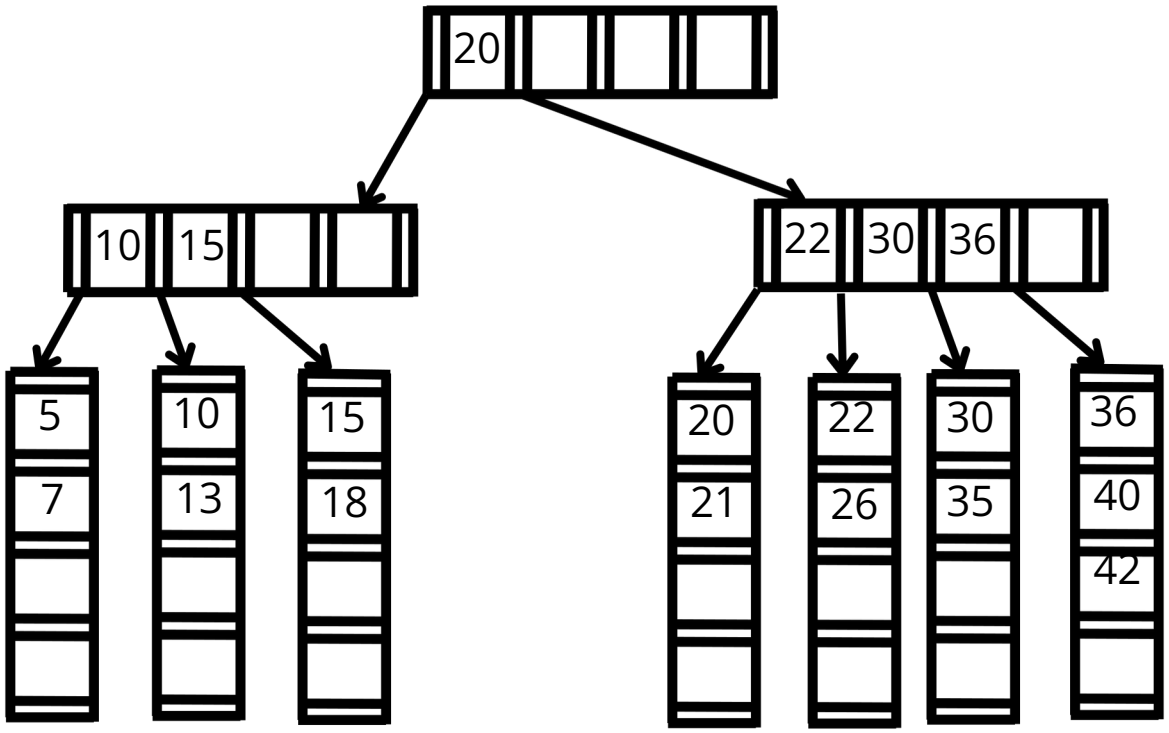
Delete(38,32,8)=>



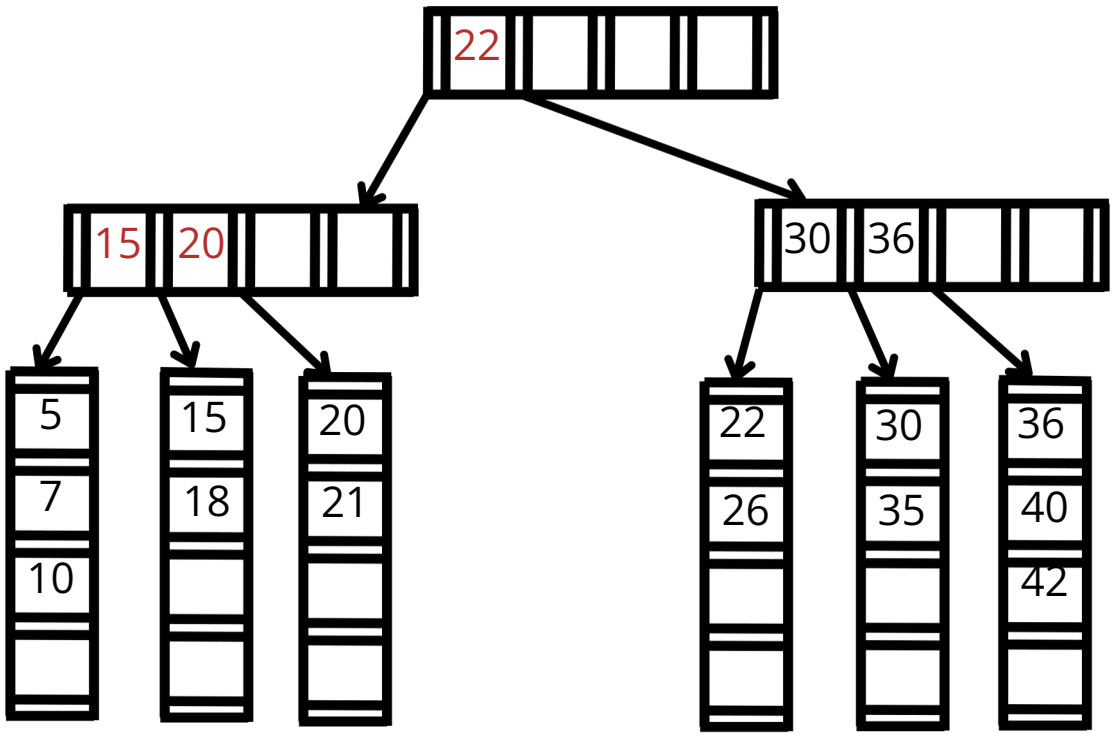
Delete(27)=>underflow=>adopt from right =>



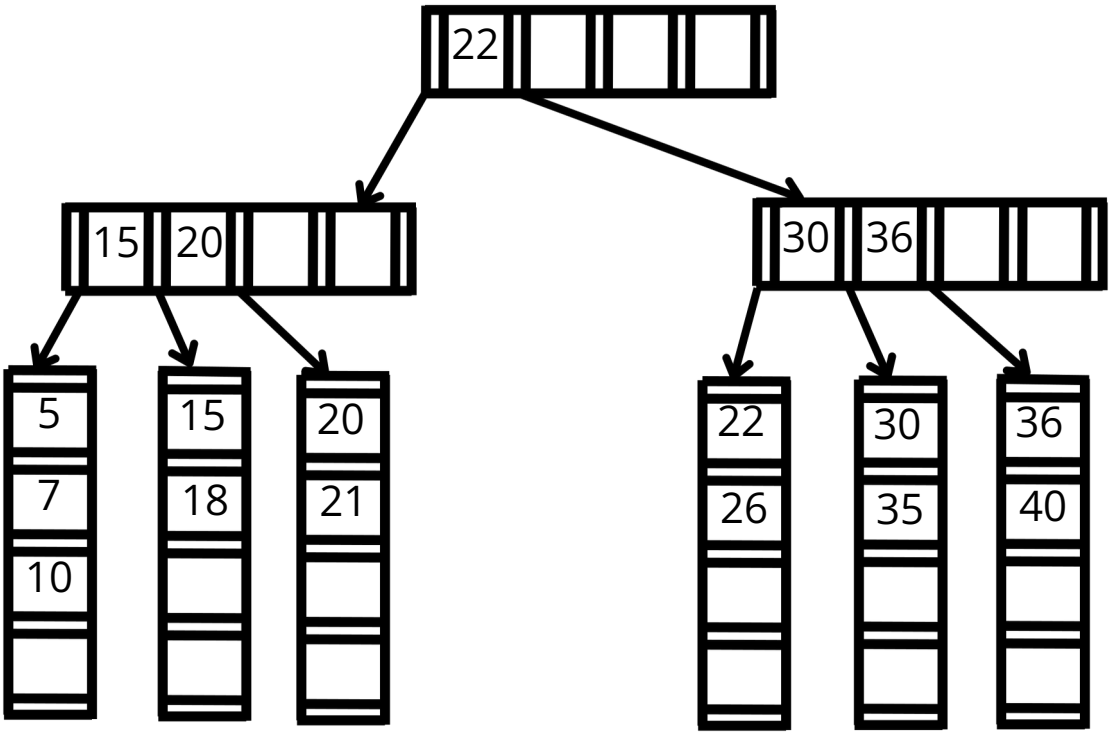
Delete(46)=>underflow=>merge with left=>



Delete(13)=>underflow=>merge leaf with left=>adopt from right internal node =>



Deleting 42 :



Finding L (Number of Records Per Leaf)

- Each leaf can store L records.
- Each record consists of 1 key and 1 data, occupying 10 + 4 = 14 bytes.
- Each leaf also has a pointer to its parent, which is 8 bytes.
- Thus, the total size per leaf is :

$$L(10 + 4) + 8 \leq 128$$
$$14L + 8 \leq 128$$
$$L \leq 120 / 14$$
$$L \leq 8.57$$

Therefore, L = 8

Finding M (Number of Keys Per Node)

- Each node can store M-1 keys.
- The size occupied by the keys is 10(M-1) bytes.
- Each node can also have M children and a pointer to its parent, which totals 8(M+1) bytes.
- Thus, the total size per node is:

$$10(M - 1) + 8(M + 1) \leq 128$$
$$10M - 10 + 8M + 8 \leq 128$$
$$18M - 2 \leq 128$$
$$18M \leq 130$$
$$M \leq 130 / 18$$
$$M \leq 7.22$$

Therefore, M=7

In summary, we have found that M=7 and L=8