CSE222-SPRING2020-HW7

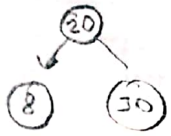
Ferdi SÖNMEZ
161044046

1) AVL TREE =

insert → 20

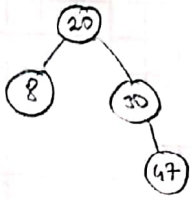
insert → 30

insert → 8

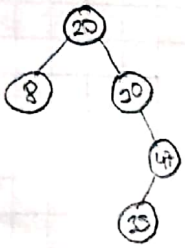


AVL Tree insert

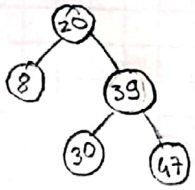
insert → 47



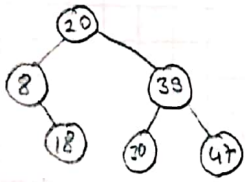
insert → 39



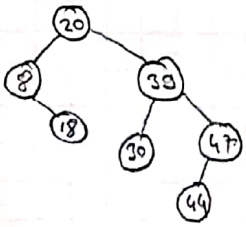
Left Rotate ⇒



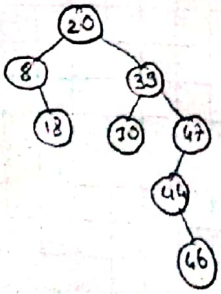
insert → 18



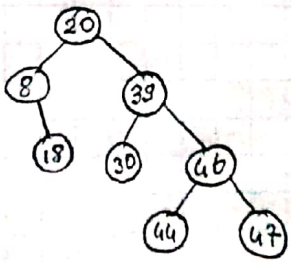
insert → 44



insert → 46



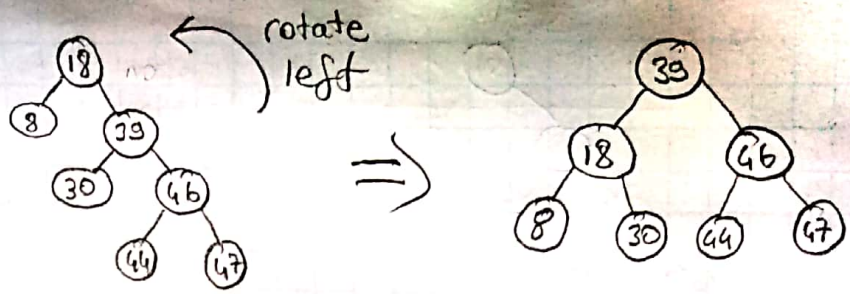
Right Rotate ⇒



CamScanner ile tarandı

Delete = 20

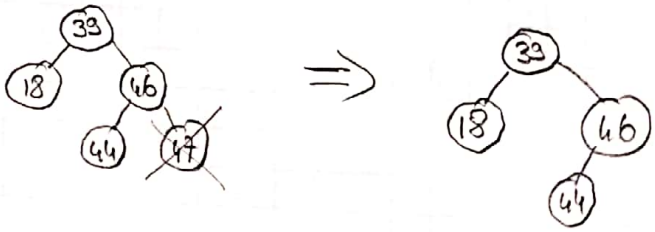
(Find largest node in left subtree)



Delete = 30

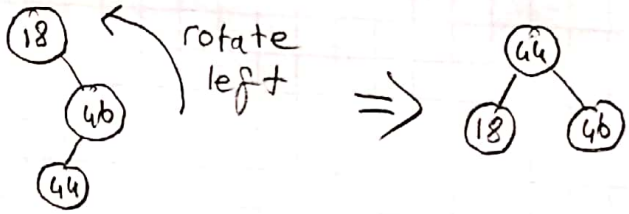
Delete = 8

Delete = 47

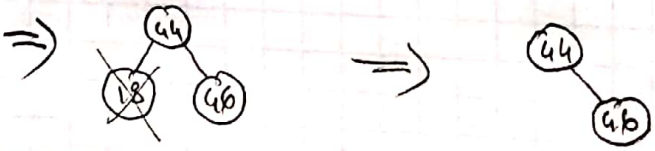


Delete = 39

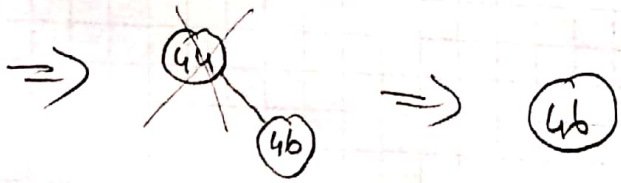
(Find largest node in left subtree) = 18



Delete = 18



Delete = 44



Delete = 46 ⇒

AVL Tree Delete

CamScanner ile tarandı

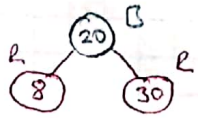
Red/Black Tree

Red/Black Tree insert

insert = 20 ⇒

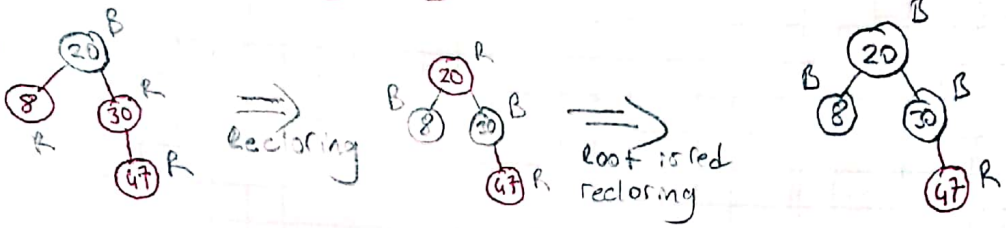
insert = 30 ⇒

insert = 8 ⇒

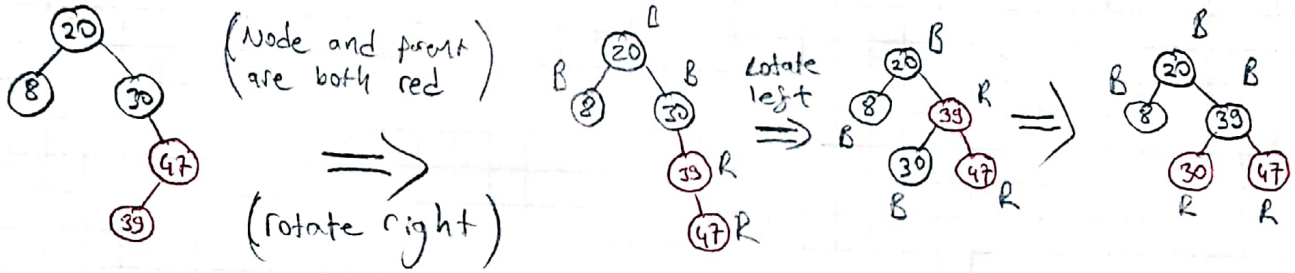


insert = 47 ⇒

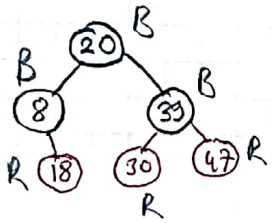
(Node and parent are both red)



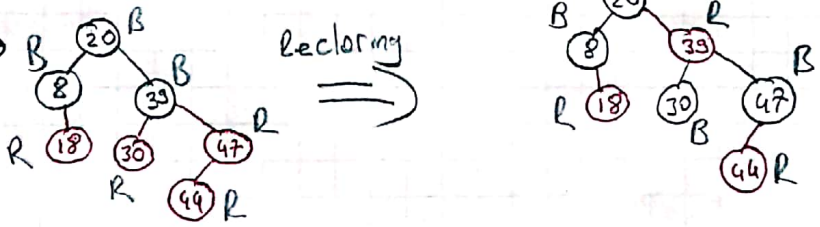
insert = 39 ⇒



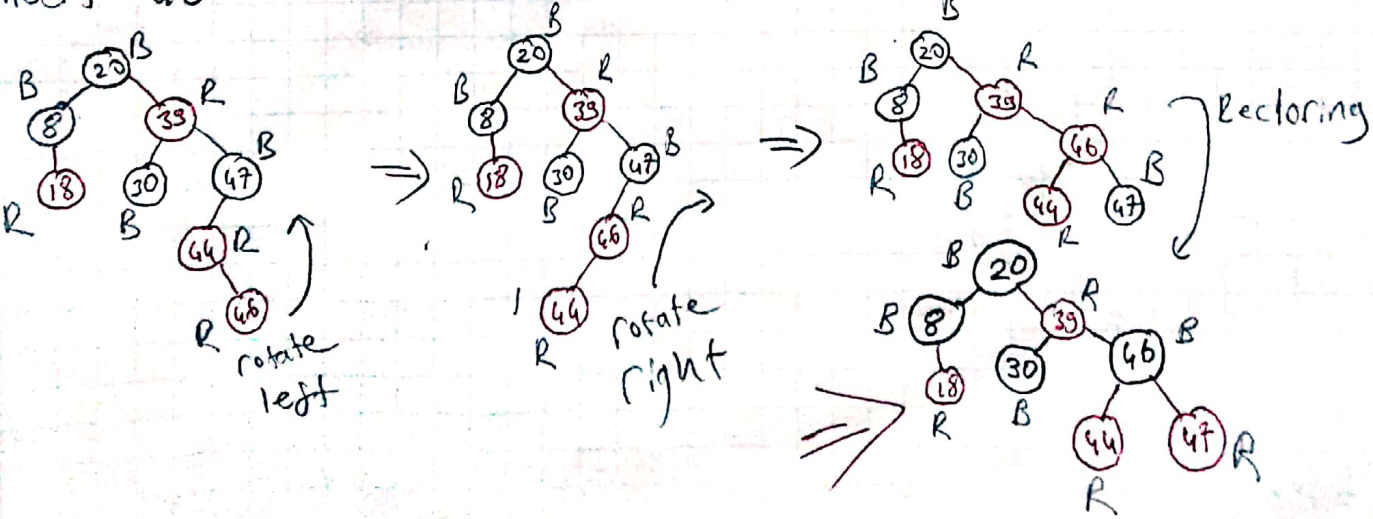
insert = 18 ⇒



insert = 44 ⇒



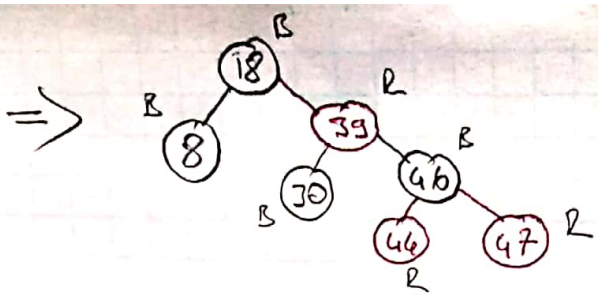
insert = 46



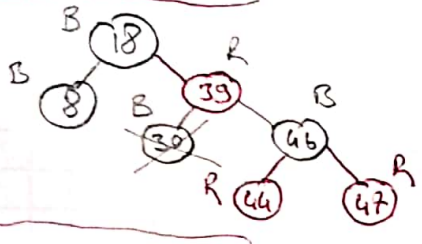
CamScanner ile tarandı

Delete = 20

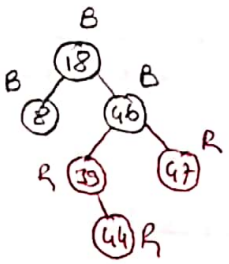
(Find largest node in left subtree) = 18



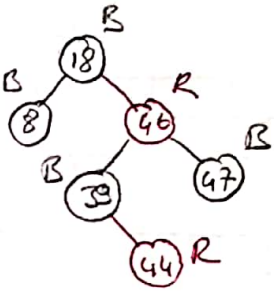
Delete = 30



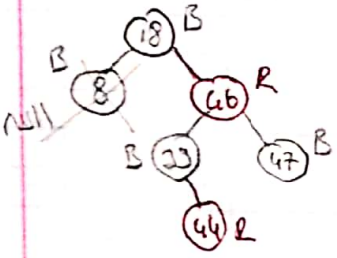
Rotate left



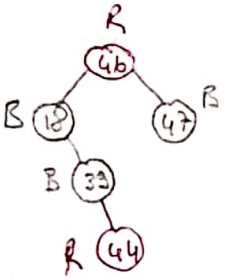
Recoloring

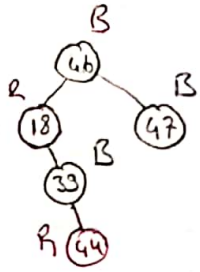


Delete = 8

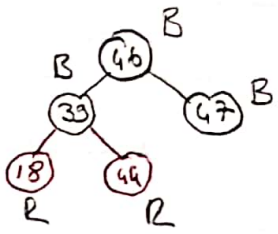


Rotate left

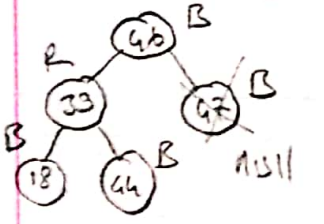




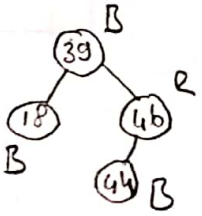
Rotate Left



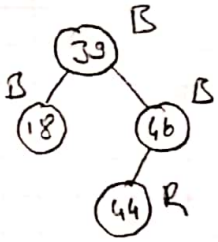
Delete = 47



Rotate Right



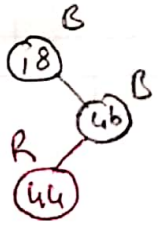
Recoloring



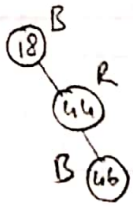
Delete = 39

(Find largest node in left subtree)

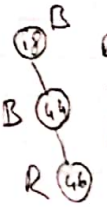
=



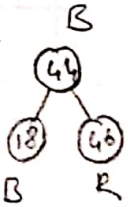
Rotate Right



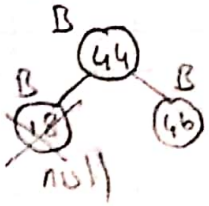
Recoloring



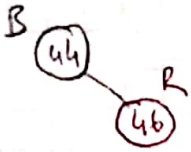
Rotate left



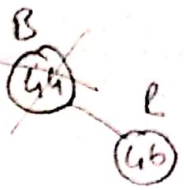
Delete = 18

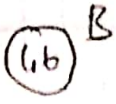


Recoloring



Delete = 44





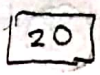
Red/Black Tree Delete

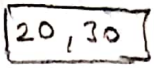
Delete = 46

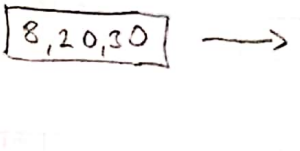
CamScanner ile tarandı

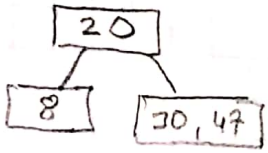
2-3 Tree =>

2-3 Tree insert

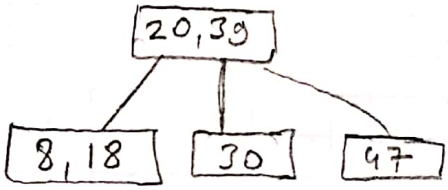
insert = 20 ⟶ 

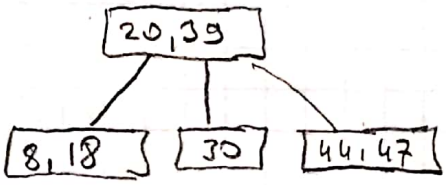
insert = 30 ⟶ 

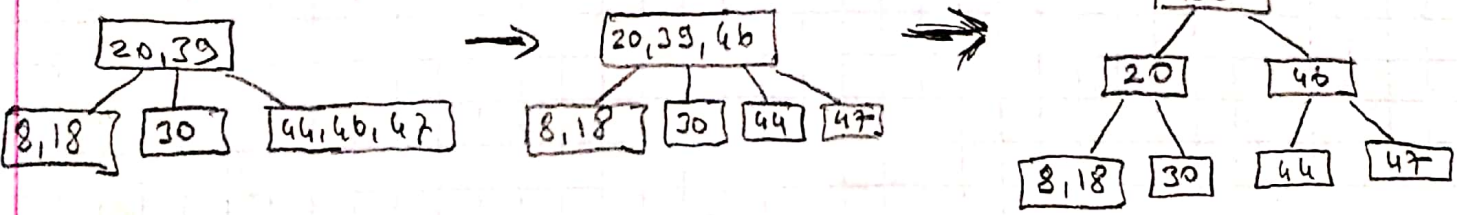
insert = 8 ⟶ 

insert = 47 ⟶ 

insert = 39 ⟶

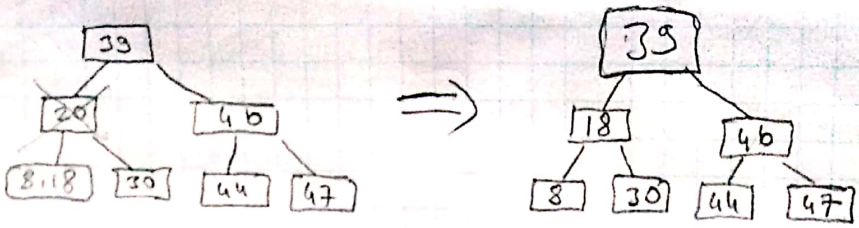
insert = 18 ⟶ 

insert = 44 ⟶ 

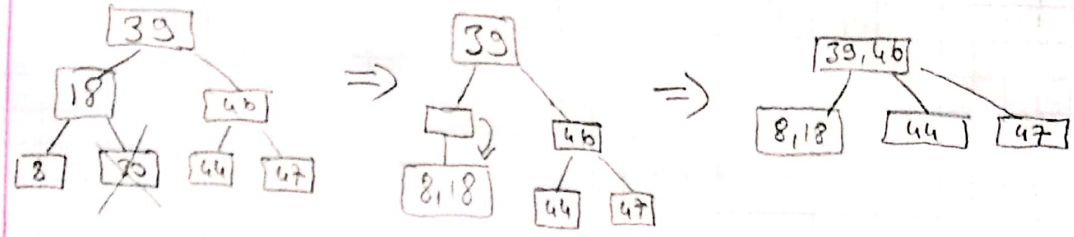
insert = 46 ⟶ 

CamScanner ile tarandı

Delete = 20



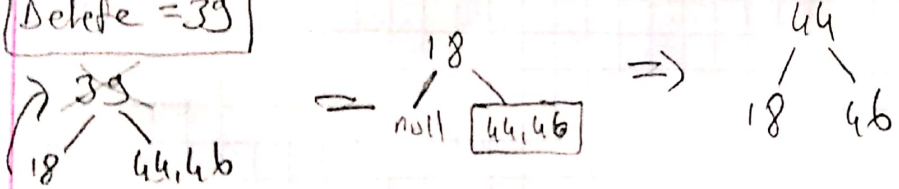
Delete = 30



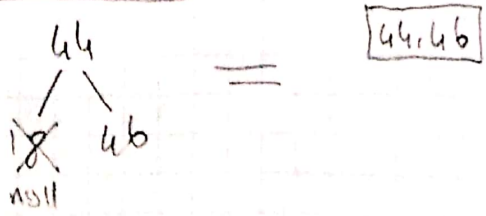
Delete = 8

Delete = 47

Delete = 39



Delete = 18



2-3 Tree Delete

Delete = 44 ⟶ 46

Delete = 46 ⟶ null

CamScanner ile tarandı

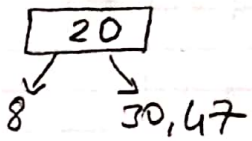
B-Tree with order 4

insert = 20 ⟶ [20]

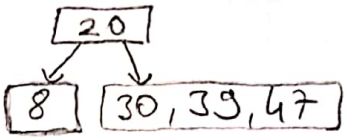
insert = 30 ⟶ [20,30]

insert = 8 ⟶ [8,20,30]

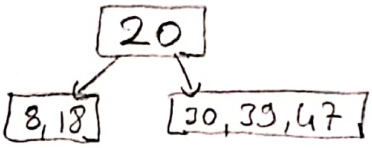
insert = 47 ⟶ [8,20,30,47] ⇒



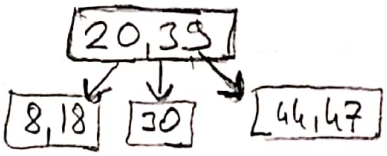
insert = 39

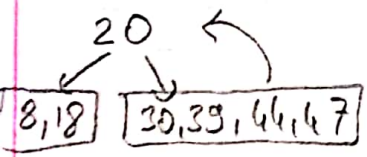


insert = 18



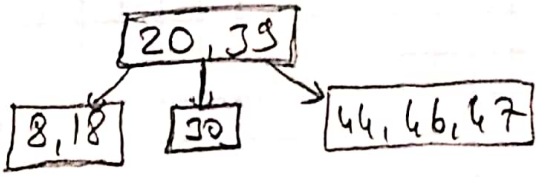
insert = 44 ⇒





B-Tree with 4 insert

insert = 46



CamScanner ile tarandı

$\boxed{\text{Delete} = 20} \Rightarrow$ ~~20~~, 39 $\Leftrightarrow$ 39

8, 18   30   44, 46, 47   8, 18   30   44, 46, 47

$\boxed{\text{Delete} = 30} \Rightarrow$ 39 $\Leftrightarrow$ 18, 44

8, 18   ~~30~~   44, 46, 47   8   39   46, 47

$\boxed{\text{Delete} = 8} \Rightarrow$ 18, 44 $\Rightarrow$ 44

~~8~~   39   46, 47   18, 39   46, 47

$\boxed{\text{Delete} = 47} \rightarrow$ 44 $\Rightarrow$ 44

18, 39   46, ~~47~~   18, 39   46

$\boxed{\text{Delete} = 39} \rightarrow$ 44 = 44

18, ~~39~~   46   18   46

$\boxed{\text{Delete} = 18} \rightarrow$ 44 = $\boxed{44, 46}$

~~18~~   46

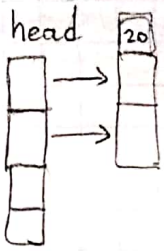
$\boxed{\text{Delete} = 44} \rightarrow$ ~~44~~, 46 $\rightarrow$ $\boxed{46}$

B-Tree with 4 Delete

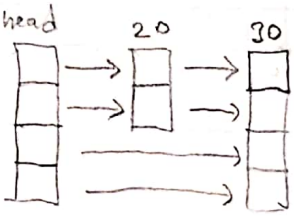
CamScanner ile tarandı

Skip-List ⇒

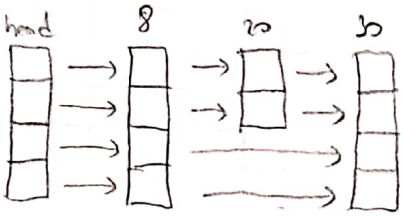
insert = 20 →



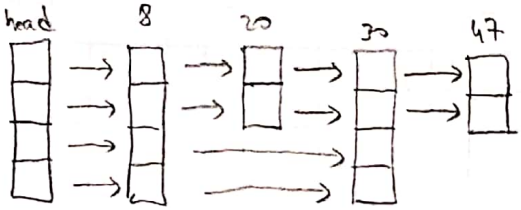
insert = 30



insert = 8

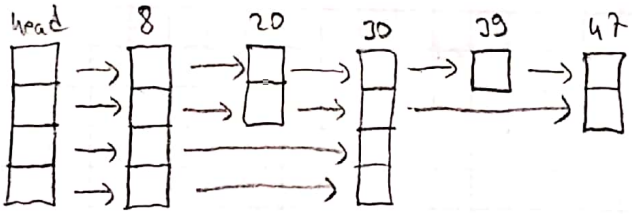


insert = 47

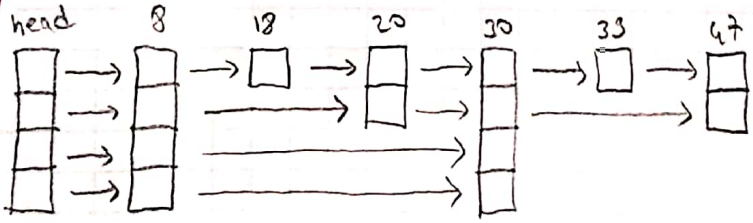


Skip-List insert

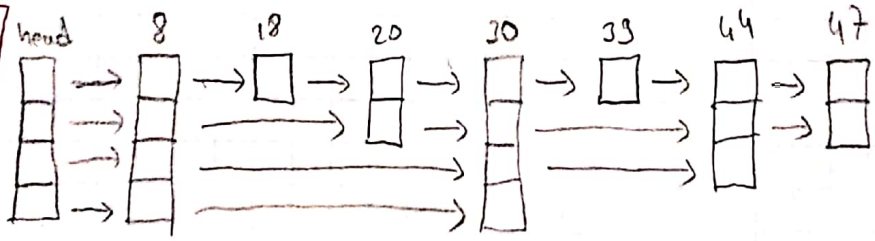
insert = 39



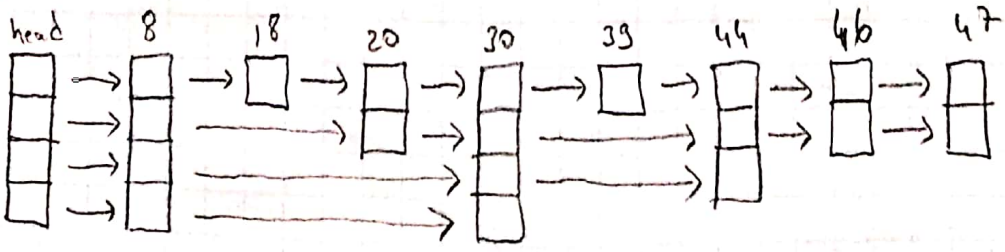
insert = 18



insert = 44

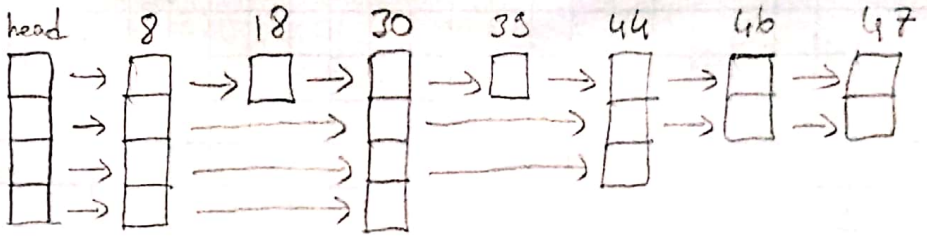


insert = 46

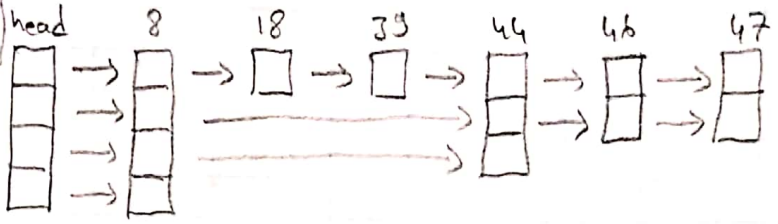


CamScanner ile tarandı

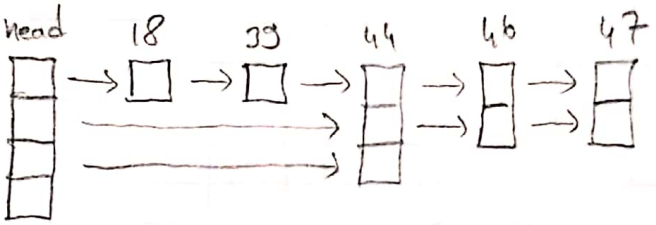
Delete = 20



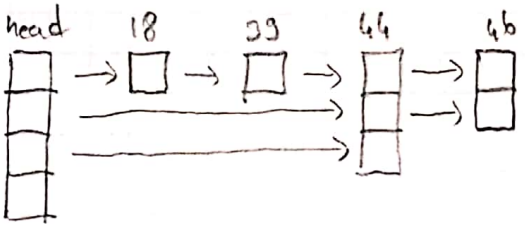
Delete = 30



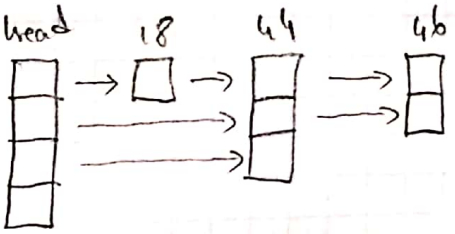
Delete = 8



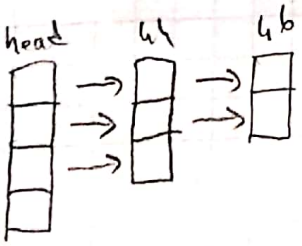
Delete = 47



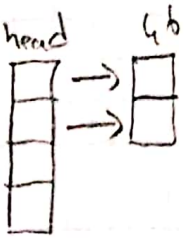
Delete = 39



Delete = 18



Delete = 44



Delete = 46

Skip-List Delete

CamScanner ile tarandı