

AVL Tree Insertion

Elements will be inserted: 20, 30, 8, 47, 39, 18, 40, 77

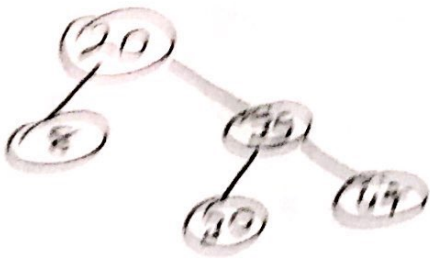
20: (20)

20, 30: (20)
 (30)

20, 30, 8: (20)
 (8) (30)

20, 30, 8, 47: (20)
 (8) (30)
 (47)

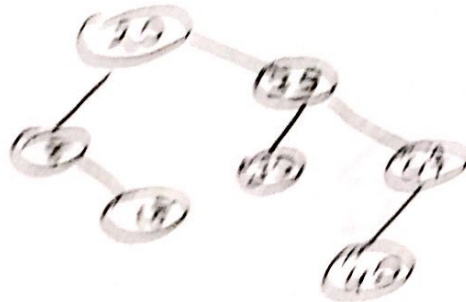
20, 30, 8, 47, 39: (20)
 (8) (30) (+2)
 (47) (-1)
 (39)
 (30) (39) (47)
 (30) (47)



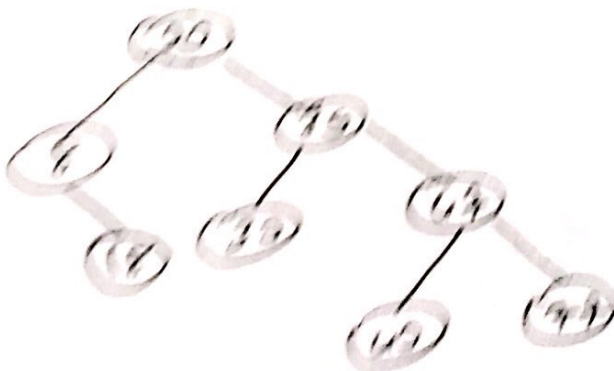
20, 20, 8, 49, 35, 18!



20, 30, 8, 49, 25, 18, 40!

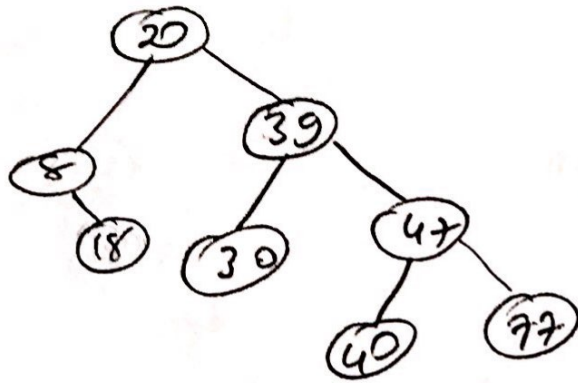


20, 30, 8, 49, 35, 18, 40, 39!

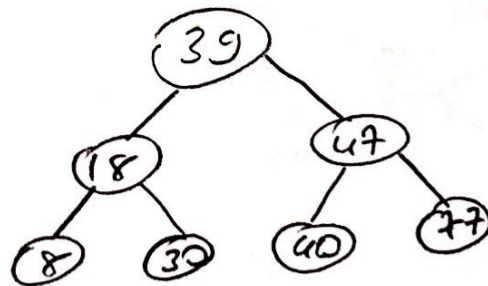
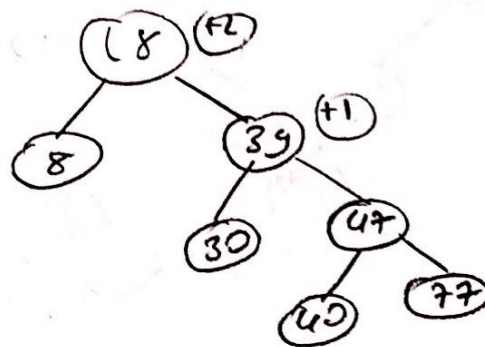


AVL Tree Removal

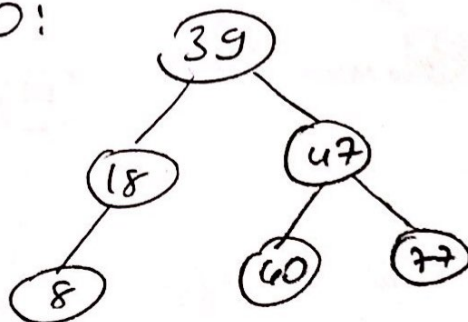
Tree:



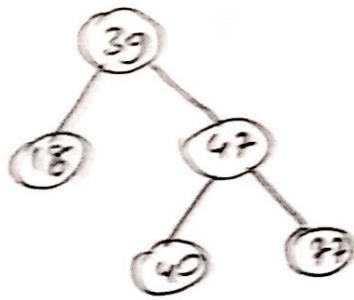
Remove 20:



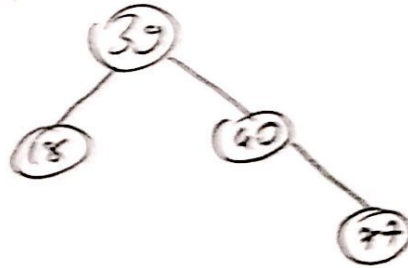
Remove 30:



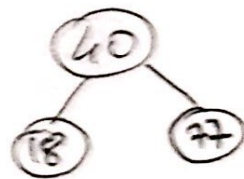
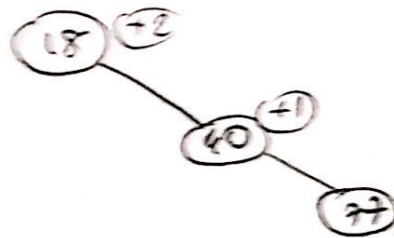
Remove 8:



Remove 47:



Remove 39:



Remove 18:



Remove 40:



Remove 77: — (Empty)

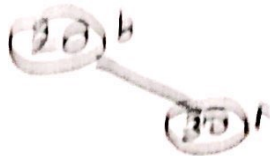
Red-Black Tree Insertion

Elements will be inserted: 20, 30, 8, 47, 39, 18, 40, 77
b: black r: red

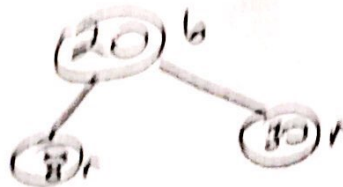
20:



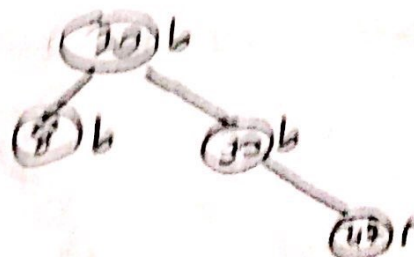
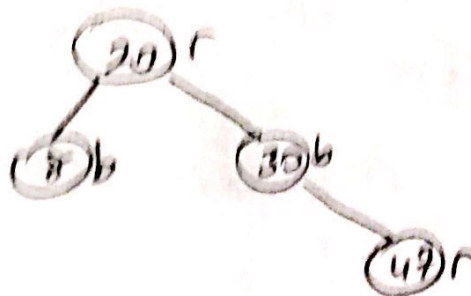
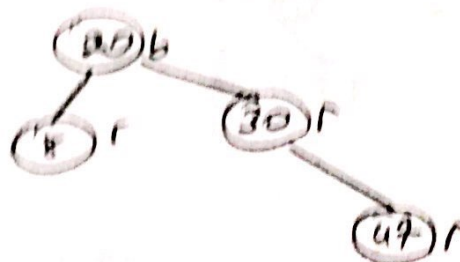
20, 30:



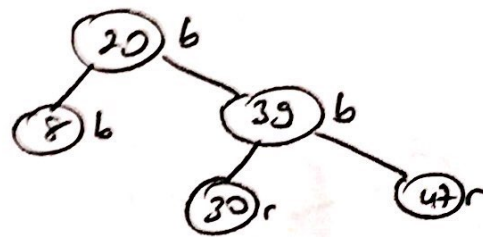
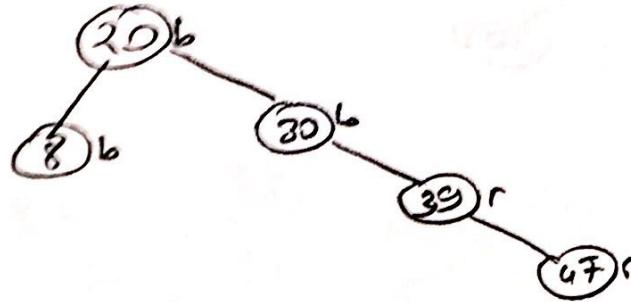
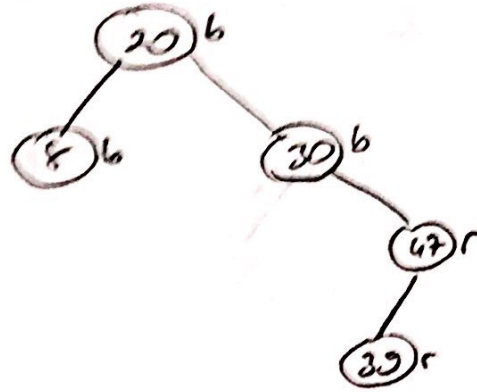
20, 30, 8:



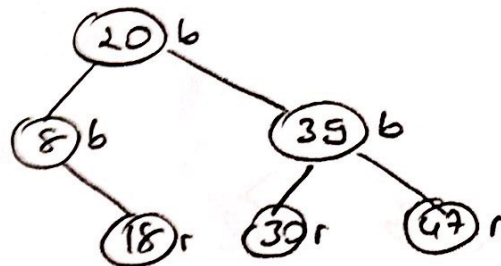
20, 30, 8, 47:



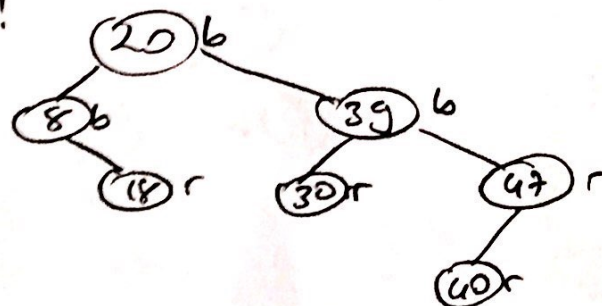
20, 30, 8, 47, 39:

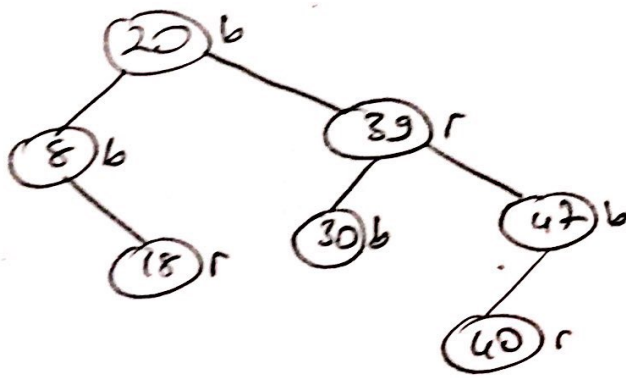


20, 30, 8, 47, 39, 18:

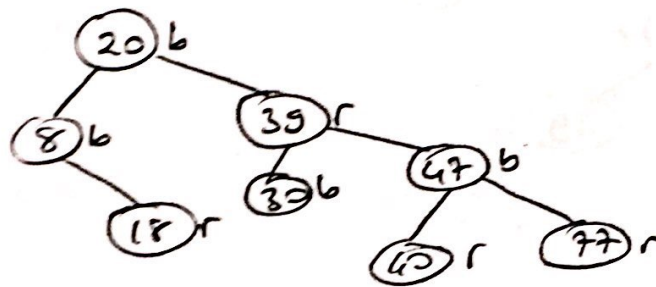


20, 30, 8, 47, 39, 18, 40:



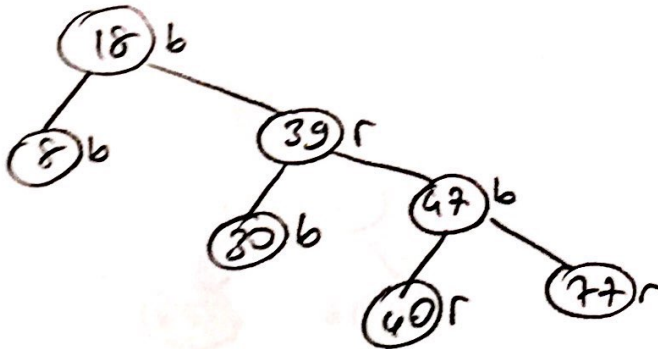


20, 30, 8, 47, 39, 18, 40, 77:

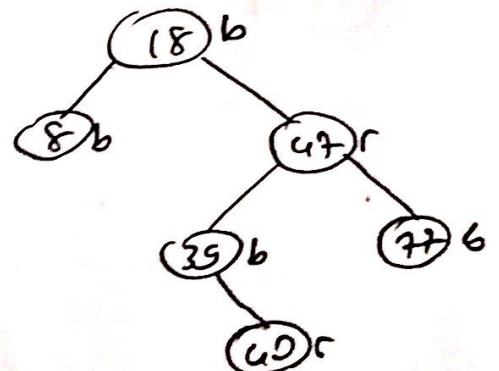
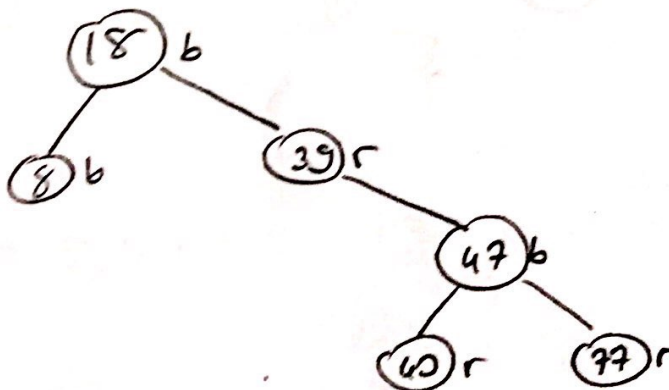


Red-Black Tree Removal

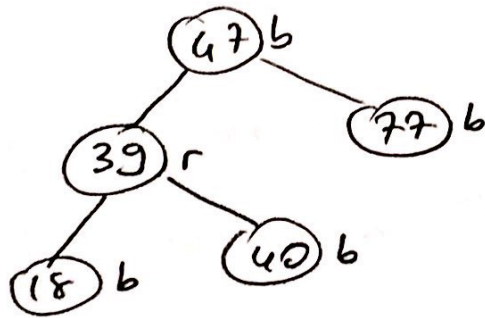
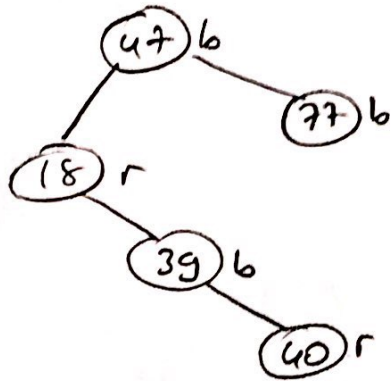
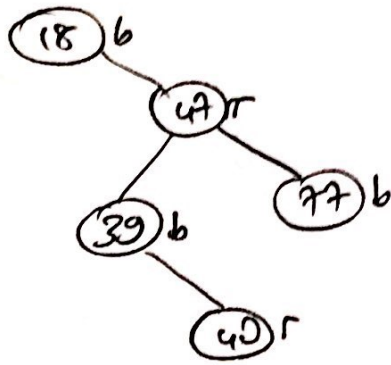
20:



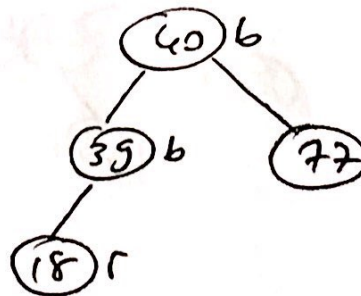
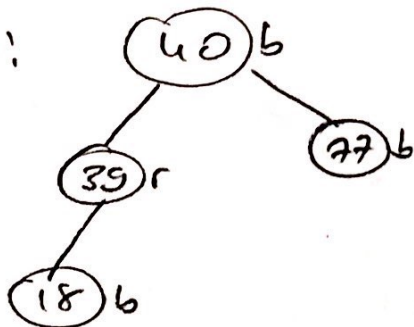
20:



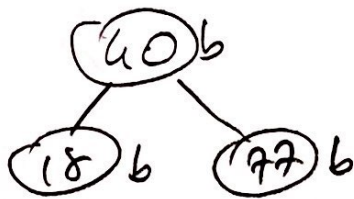
8:



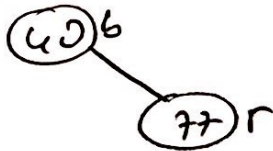
47:



39:



(18):



40:



77: - Empty

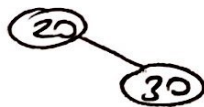
2-3 Tree Insertion

Elements will be inserted: 20, 30, 8, 47, 39, 18, 40, 77

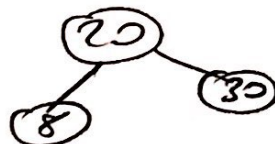
20:



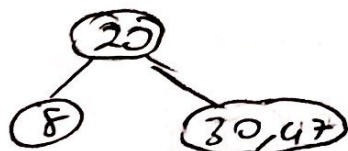
20, 30:



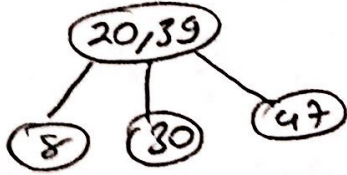
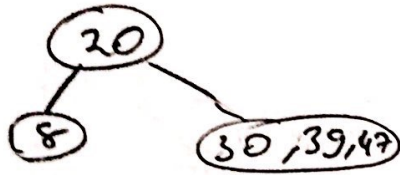
20, 30, 8:



20, 30, 8, 47:



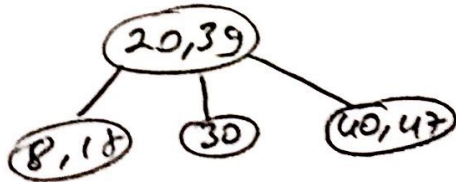
20, 30, 8, 47, 39!



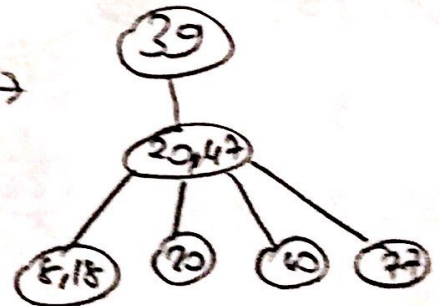
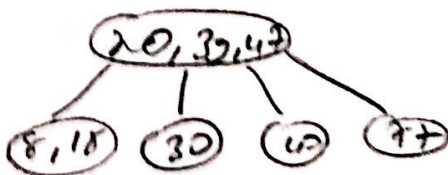
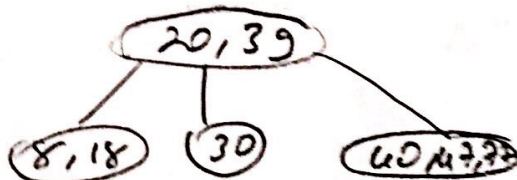
20, 30, 8, 47, 39, 18!

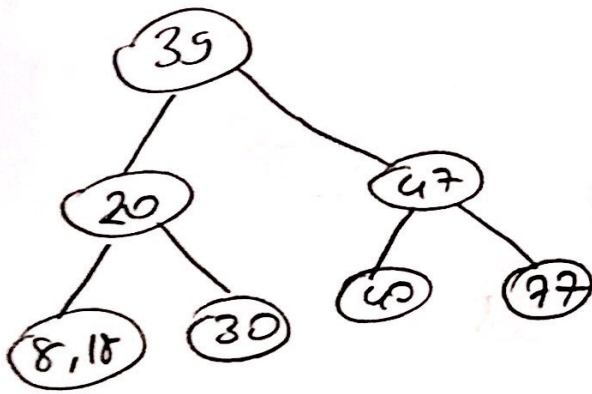


20, 30, 8, 47, 39, 18, 40!

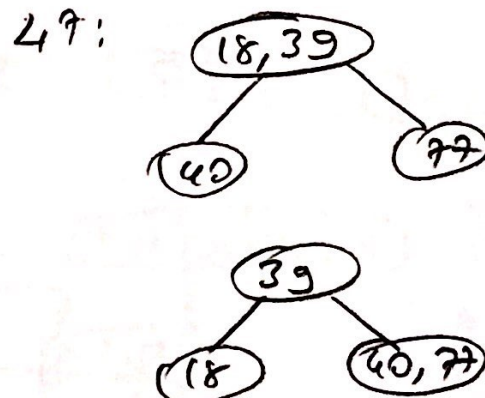
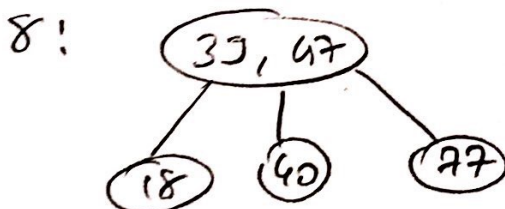
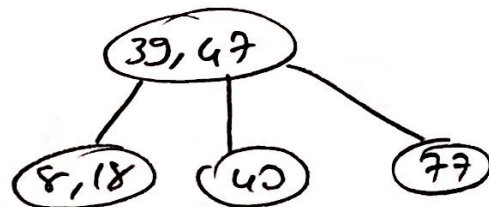
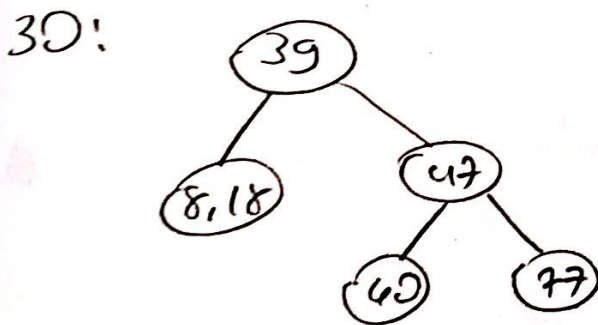
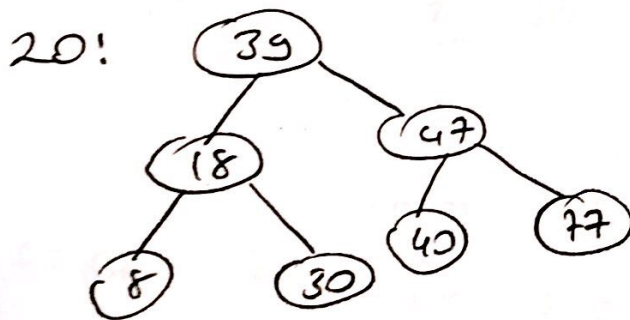


20, 30, 8, 47, 39, 18, 40, 77!

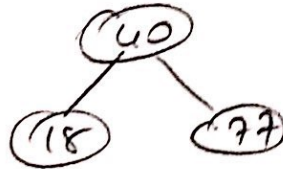




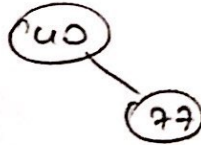
2-3 Tree Removal



39:



18:



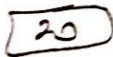
40:



77: — (Empty)

B-Tree with order 4 Insertion
Elements will be insertion: 20, 30, 8, 47, 39, 18, 40, 77

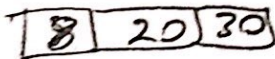
20:



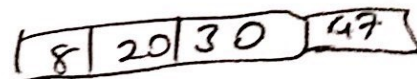
30:



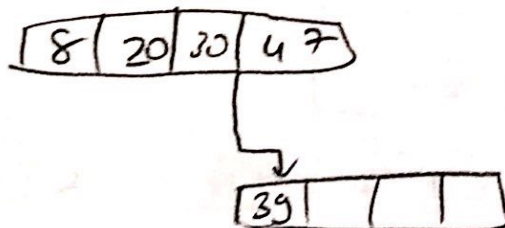
8:



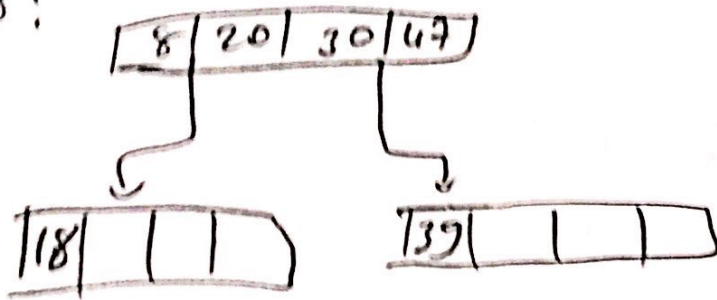
47:



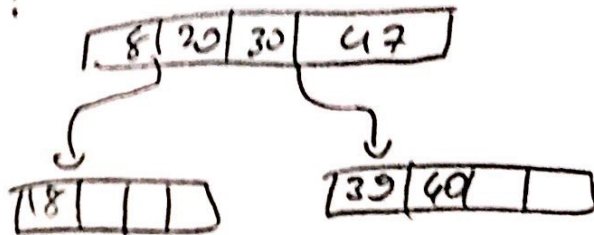
39:



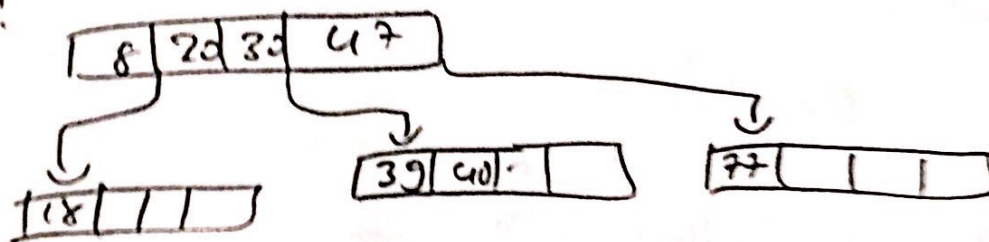
18:



40:

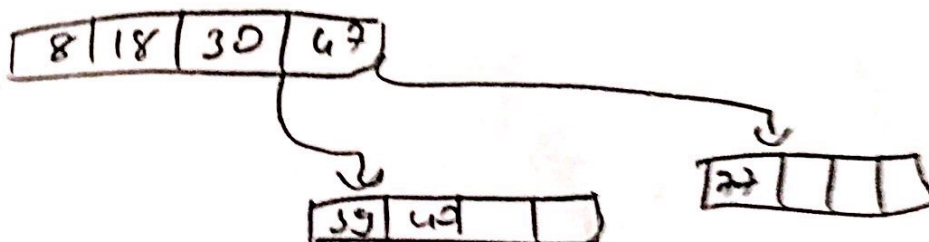


77:

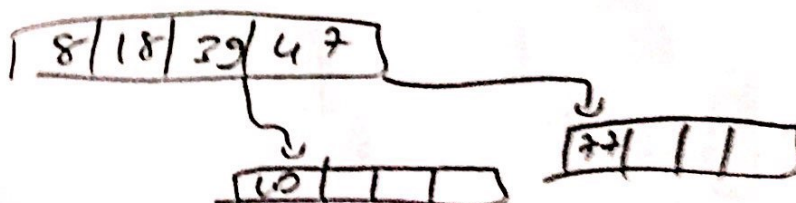


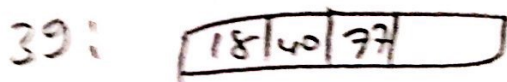
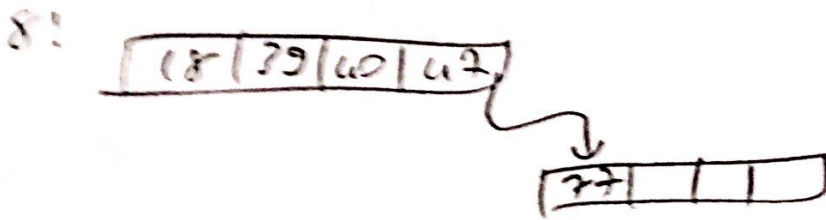
B-Tree with order 4 Removal

20:



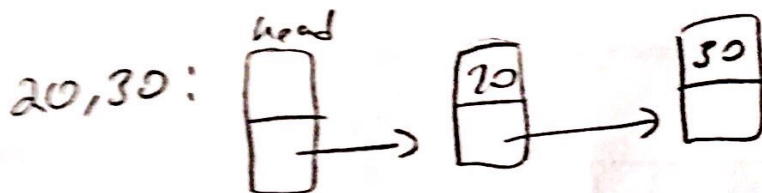
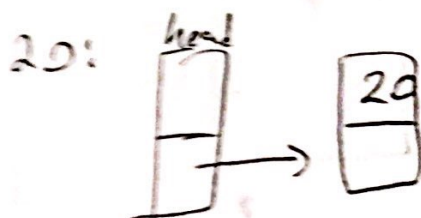
30:



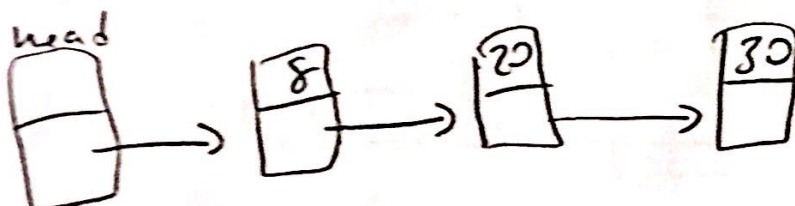


77: — (Empty)

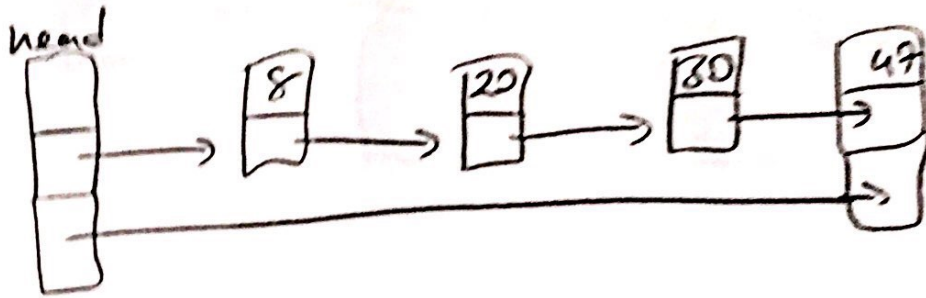
Skip-List Insertion



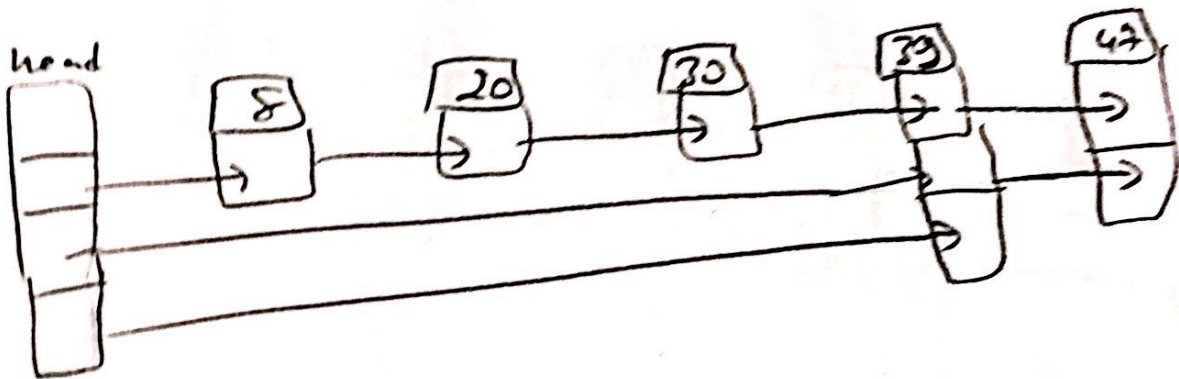
20, 30, 8:



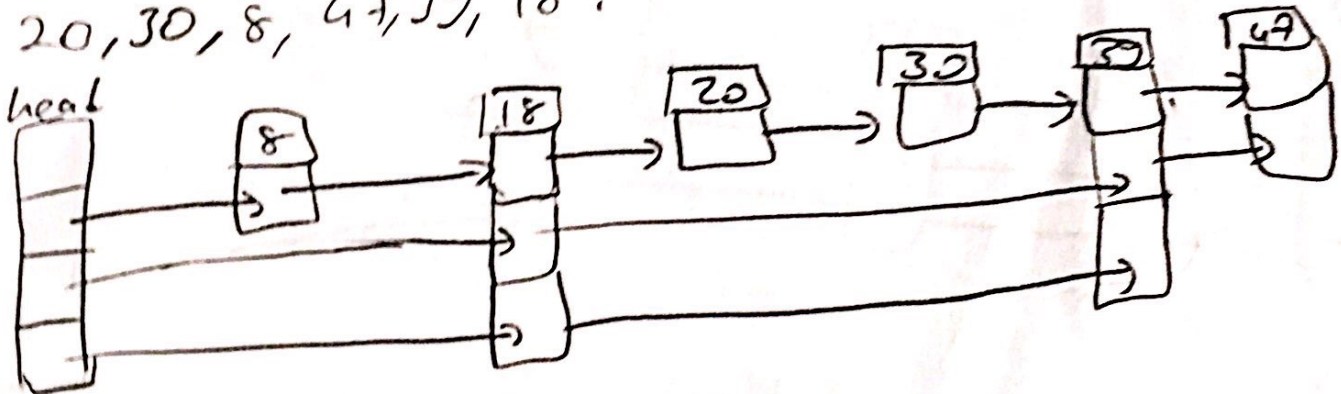
20, 30, 8, 47:



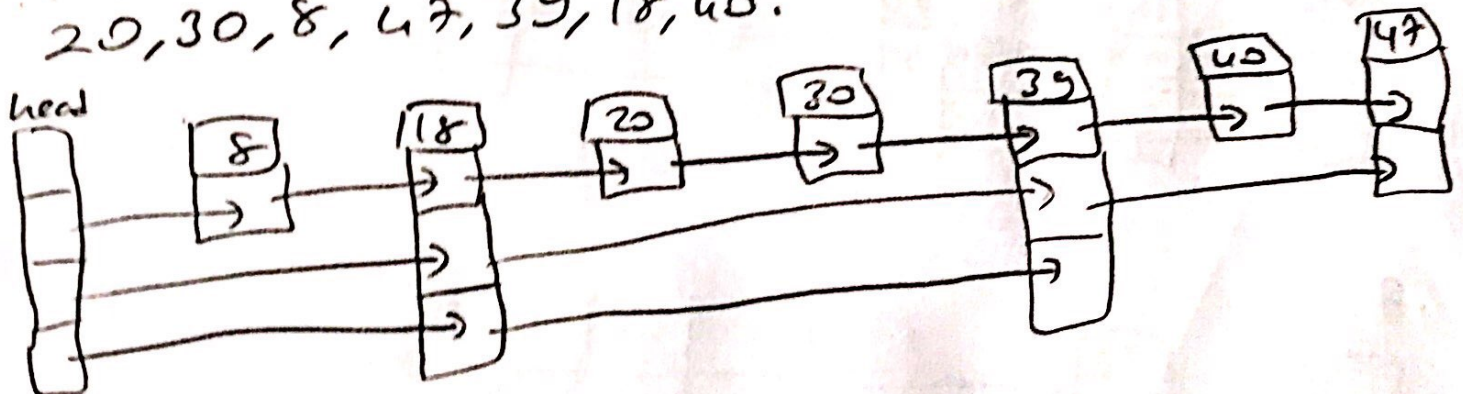
20, 30, 8, 47, 39:



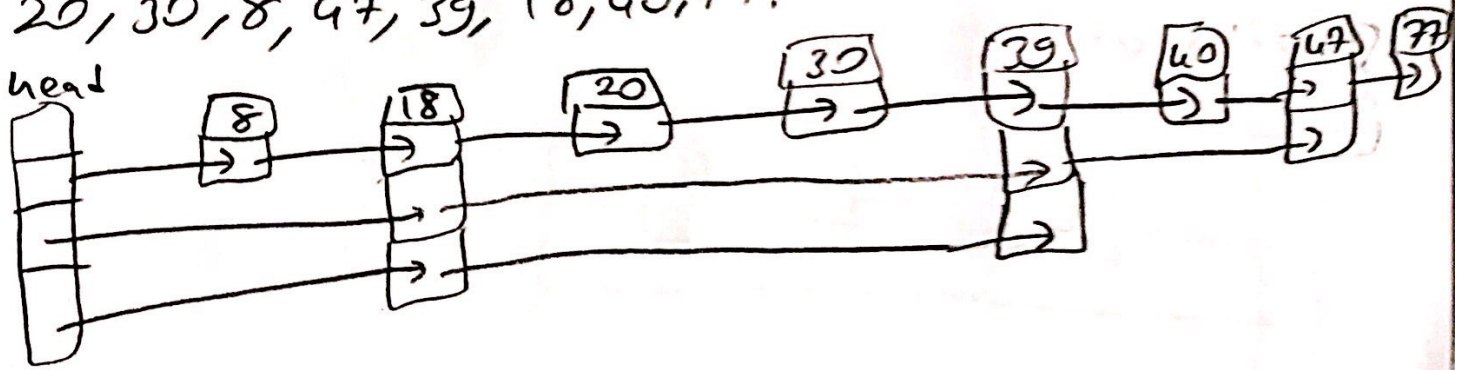
20, 30, 8, 47, 39, 18:



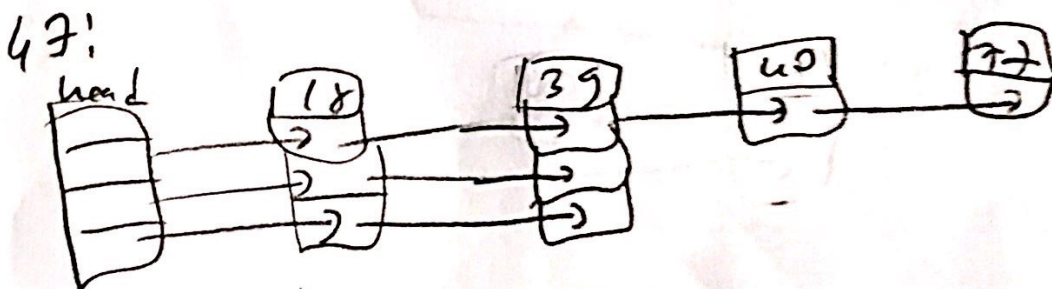
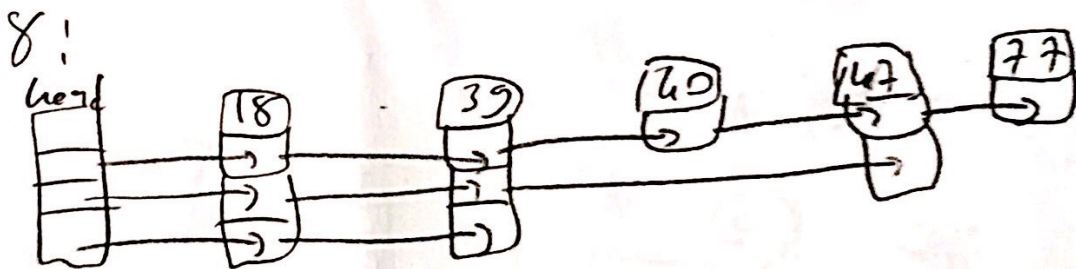
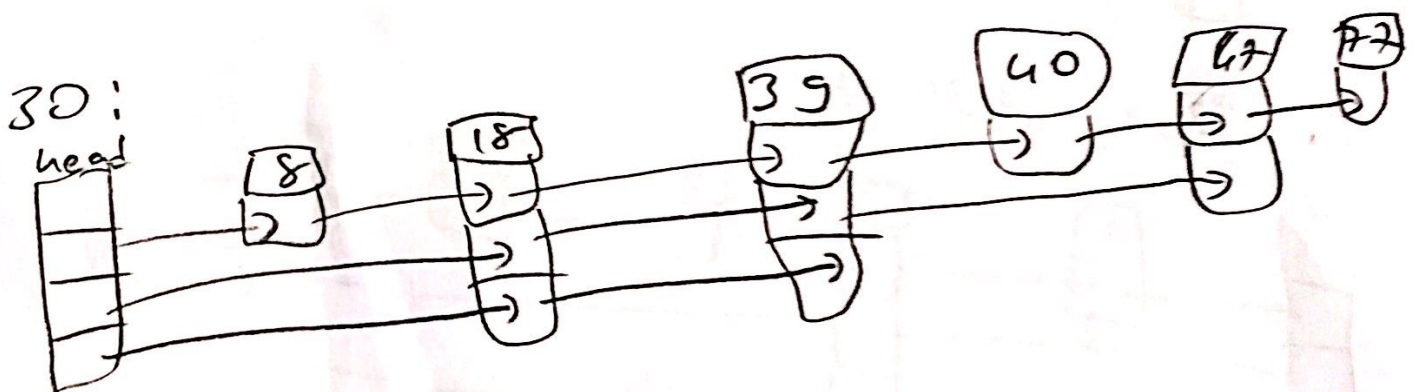
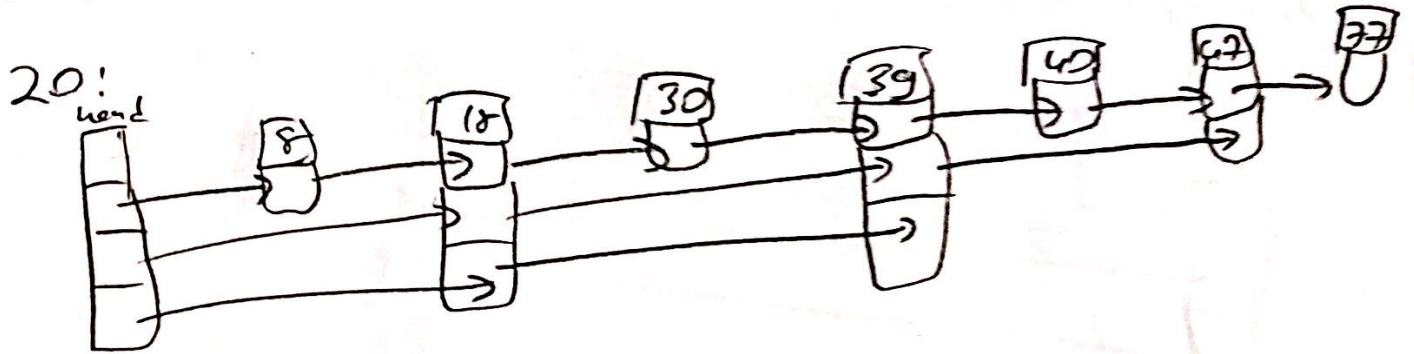
20, 30, 8, 47, 39, 18, 40:



20, 30, 8, 47, 39, 18, 40, 77:

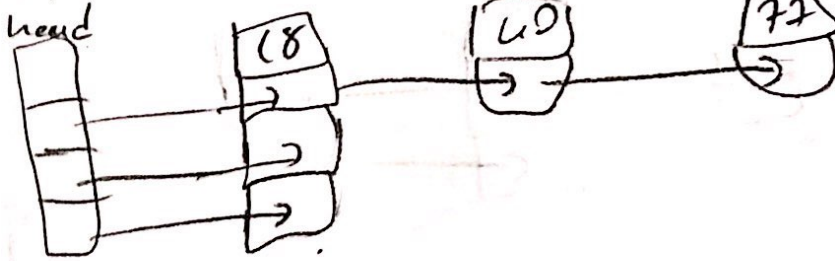


Skip List Removal



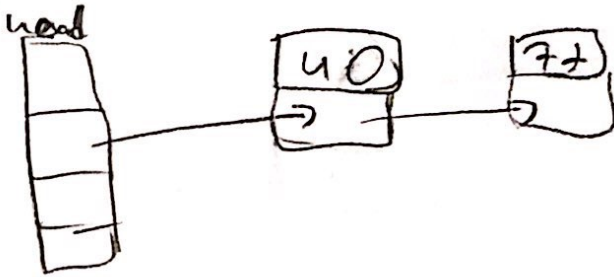
35!

head



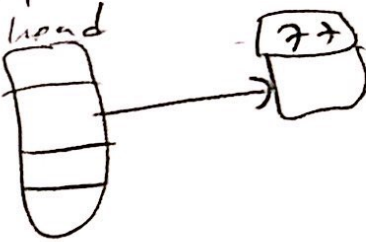
18!

head



40!

head



77!

Empty.

Mustafa

TOĞRÖZ

171044027.