

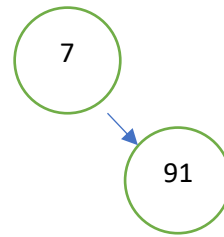
Sertaç Derya Sec3 22003208 HW4

a) AVL Tree

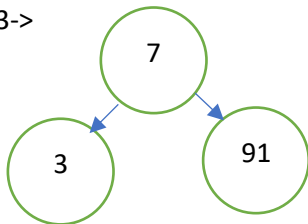
insert 7->



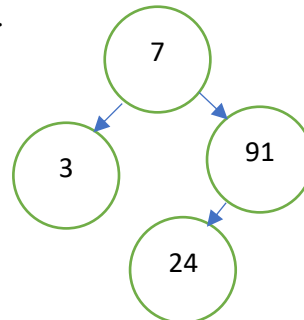
insert 91->



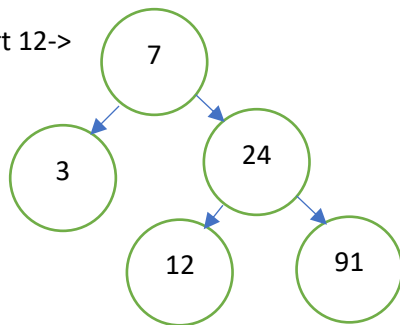
insert 3->



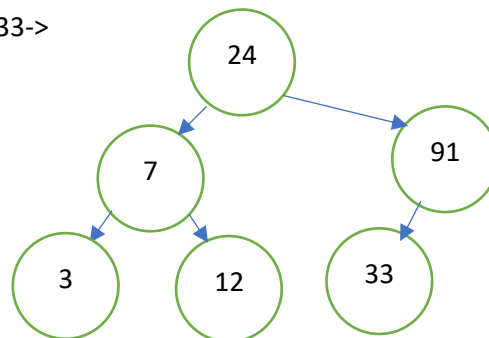
insert 24->



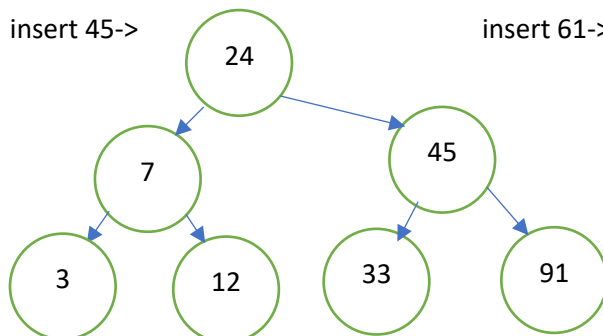
insert 12->



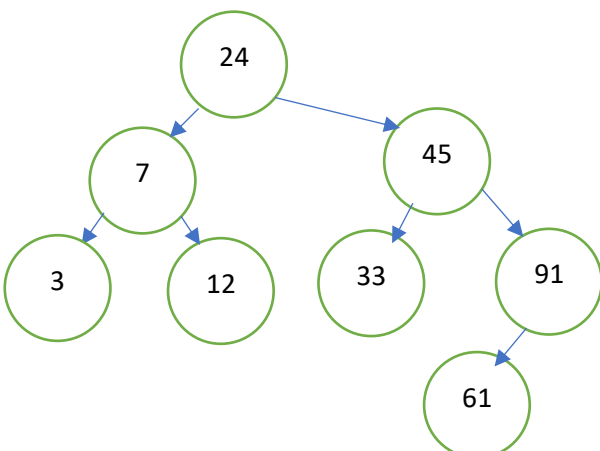
insert 33->



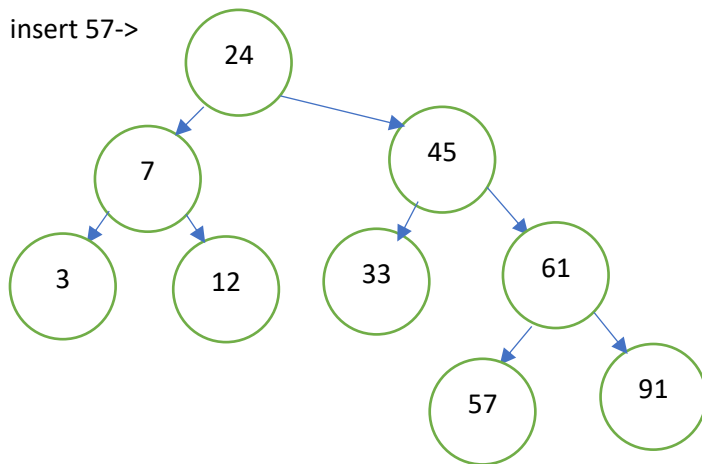
insert 45->



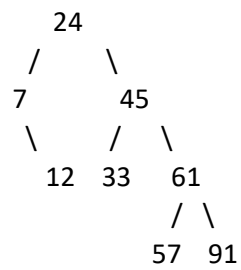
insert 61->



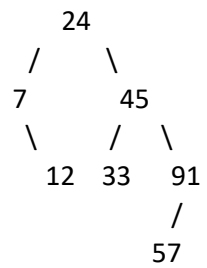
insert 57->



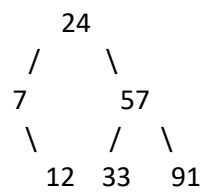
delete 3->



delete 61->



delete 45->



2-3 Tree

Insert 7-> 7

Insert 3-> 7
 / \
 3 91

Insert 12-> (7-24)
 / | \
 3 12 91

Insert 45-> 24
 / \
 7 45
 / \
 3 12 33 91

Insert 57-> 24
 / \
 7 (45-61)
 / \
 3 12 33 57 91

Delete 61-> (24-45)
 / | \
 (7-12) 33 (57-91)

insert 91-> (7-91)

insert 24-> 7
 / \
 3 (24-91)

insert 33-> (7-24)
 / | \
 3 12 (33-91)

insert 61-> 24
 / \
 7 45
 / \
 3 12 33 (61-91)

delete 3-> 45
 / \
 24 61
 / \
 (7-12) 33 57 91

delete 45-> (24-57)
 / | \
 (7-12) 33 91

2-3-4 Tree

Insert 7-> 7

Insert 3-> (3-7-91)

Insert 12-> 7
 / \
 3 (12-24-91)

Insert 45-> (7-24)
 / | \
 3 12 (33-45-91)

Insert 57-> 24
 / \
 7 45
 / | | \
 3 12 33 (57-61-91)

insert 91-> (7-91)

insert 24-> 7
 / \
 3 (24-91)

insert 33-> (7-24)
 / | \
 3 12 (33-91)

insert 61-> (7-24-45)
 / | | \
 3 12 33 (61-91)

Delete 3->

```
      (24-45)
     /  |  \
  (7-12) 33 (57-61-91)
```

delete 61->

```
      (24-45)
     /  |  \
  (7-12) 33 (57-91)
```

Delete 45->

```
      (24-57)
     /  |  \
  (7-12) 33  91
```