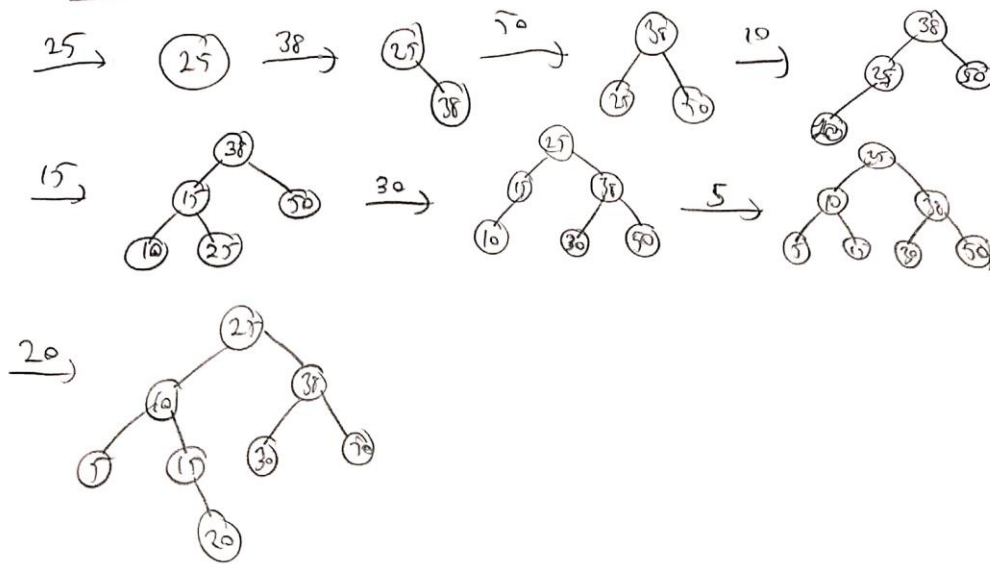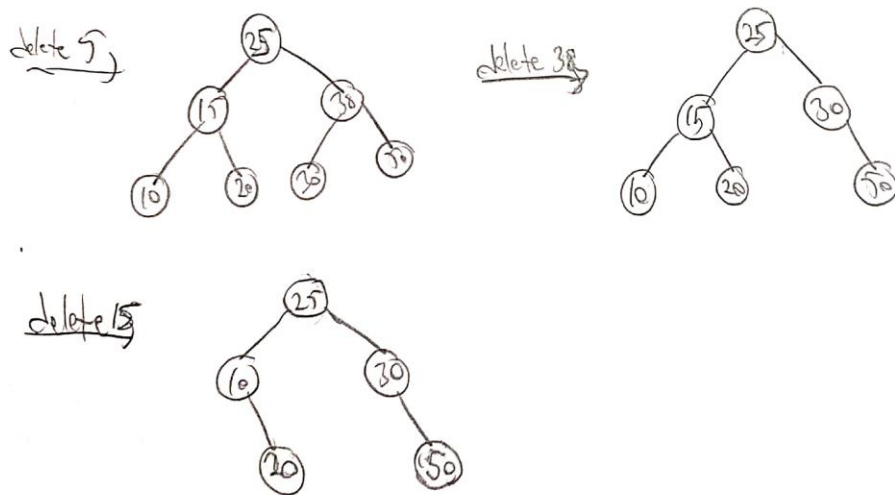# CS202 HW3
BALANCED SEARCH TREES

DENİZ SEMİH ÖZAL - 21802414

JULY 19, 2021
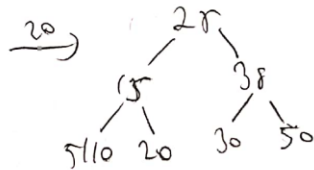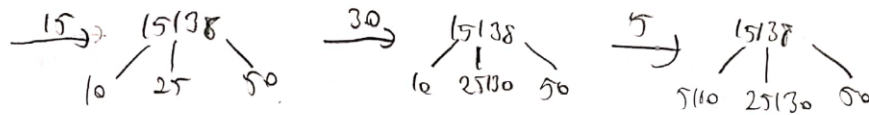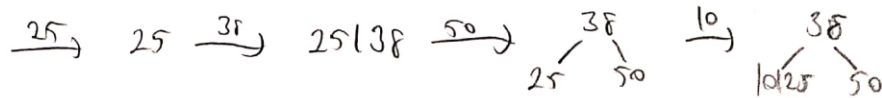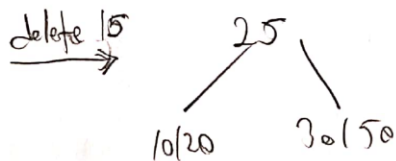
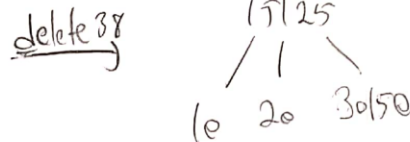## Question 1

AVL Tree Insertion

AVL Tree Deletion

2-3 Tree Insertion

Deniz Özal Degan
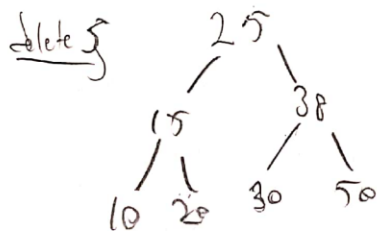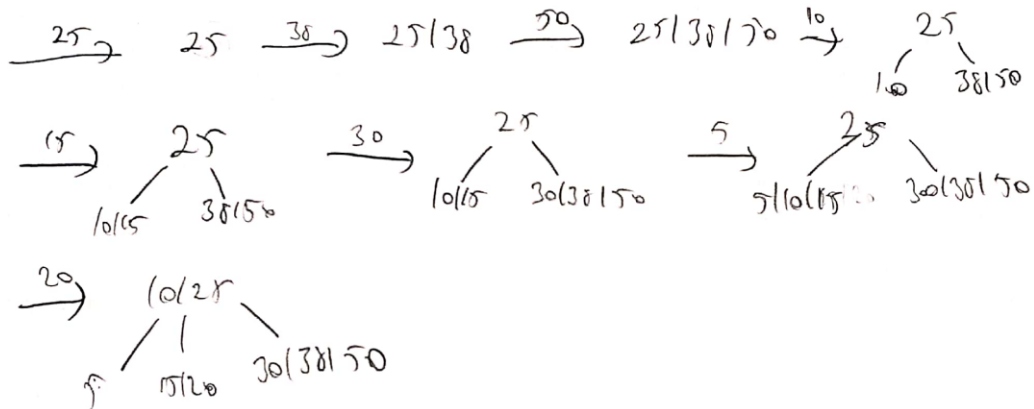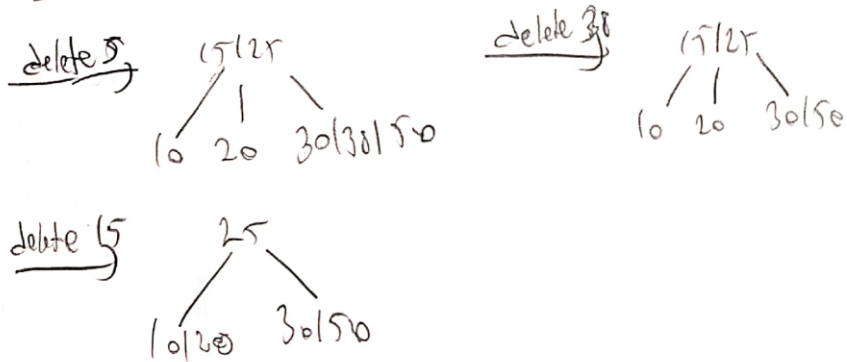
$25 \rightarrow$ 25 $\xrightarrow{35}$ 25|35 $\xrightarrow{50}$
```
    38
   /  \
  25   50
```
$\xrightarrow{10}$
```
     38
    /   \
 10|25   50
```

$\xrightarrow{15}$
```
    15|38
   /  |   \
  10  25   50
```
$\xrightarrow{30}$
```
     15|38
    /   |    \
  10  25|30  50
```
$\xrightarrow{5}$
```
       15|35
      /   |    \
   5|10  25|30  50
```

$\xrightarrow{20}$
```
         25
        /    \
      15      38
     / |      / \
  5|10 20   30  50
```

2-3 Tree Deletion

delete 5 →
```
        25
       /    \
     15      38
    / |      / \
  10 20    30  50
```

delete 38 →
```
     15|25
    /   |   \
  10   20  30|50
```

delete 15 →
```
       25
      /    \
  10|20    30|50
```

Deniz Öztal Banjo

2-3-4 Insertion

$25 \rightarrow$ 25 $\xrightarrow{30}$ $25|38$ $\xrightarrow{50}$ $25|38|50$ $\xrightarrow{10}$ 25
                                                                    $\diagdown$
                                                        10 $38|50$

$\xrightarrow{15}$ 25 $\xrightarrow{30}$ 25 $\xrightarrow{5}$ 25
            $\diagup \diagdown$ $\diagup \diagdown$ $\diagup \diagdown$
       $10|15$ $38|50$ $10|15$ $30|38|50$ $5|10|15$ $30|30|50$

$\xrightarrow{20}$ $10|25$
            $\diagup | \diagdown$
       5 $15|20$ $30|38|50$

2-3-4 Deletion

$\underline{delete\ 5} \rightarrow$ $15|25$ $\underline{delete\ 38}$ $15|25$
                        $\diagup | \diagdown$ $\diagup | \diagdown$
                   10 20 $30|38|50$ 10 20 $30|50$

$\underline{delete\ 15} \rightarrow$ 25
                          $\diagup \diagdown$
                     $10|20$ $30|50$

Question 2

b) heapRebuild()
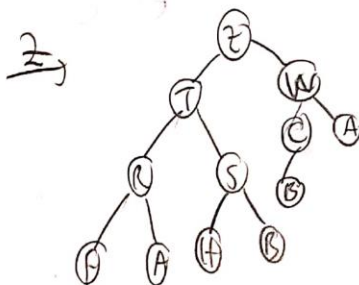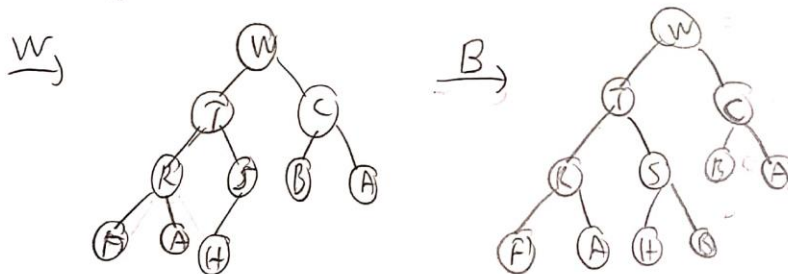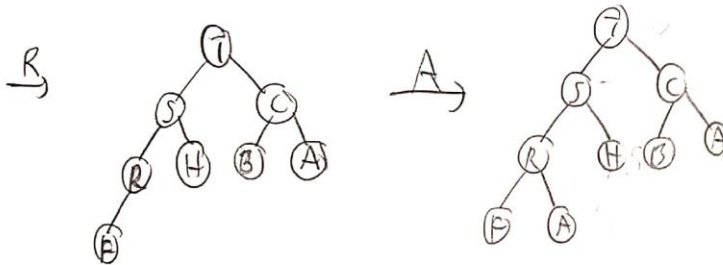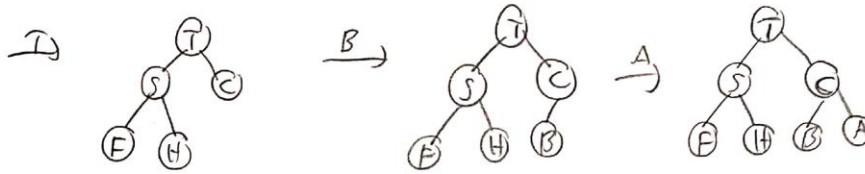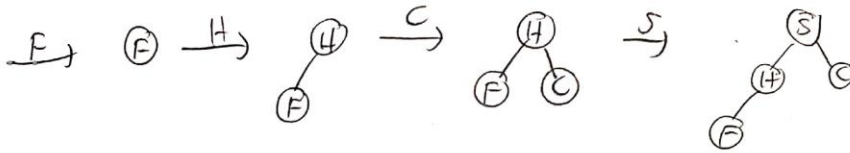
Deniz Öral Deniz

e	1	2	3	4	5	6	7	8	9	10	11
F	H	C	S	T	B	A	R	A	W	B	Z

Initial

index=5

index=4

index=3

index=2

index=1

index=0