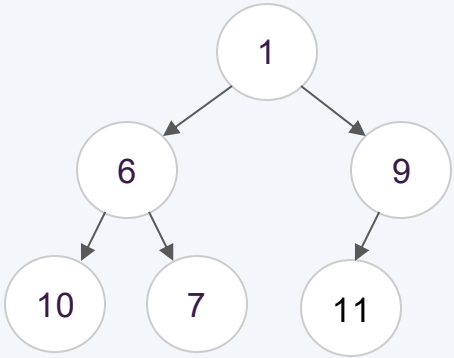
Midterm Review

12win midterm

Problem 3

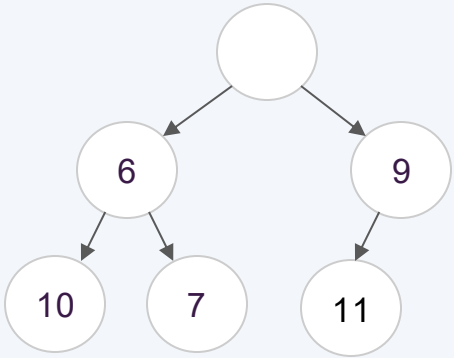
Consider the binary min heap.



Problem 3

a) DeleteMin

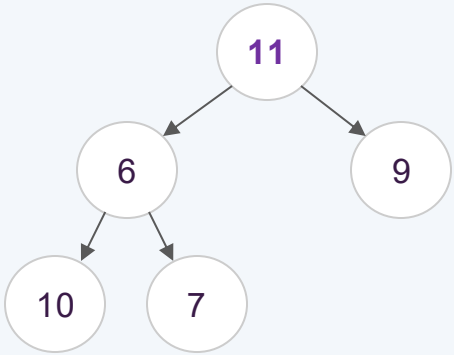
Step 1: remove the root node



Problem 3

a) DeleteMin

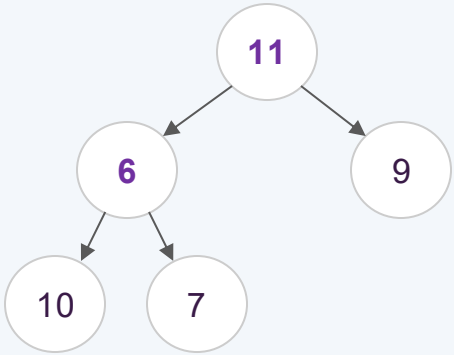
Step 2: bring the last element up to the root node



Problem 3

a) DeleteMin

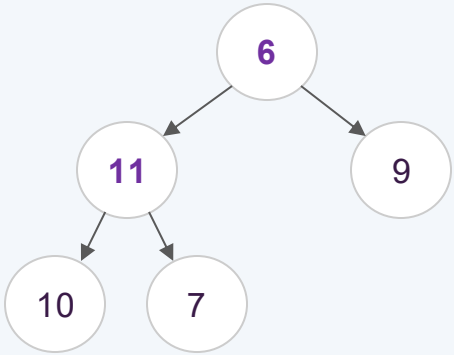
Step 3: percolate down, swapping with the smallest child



Problem 3

a) DeleteMin

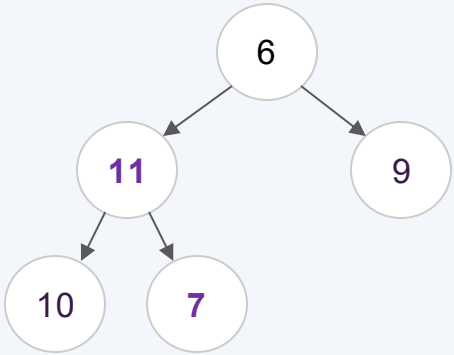
Step 3: percolate down, swapping with the smallest child



Problem 3

a) DeleteMin

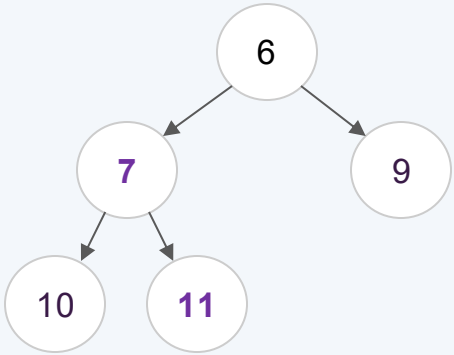
Step 3: percolate down, swapping with the smallest child



Problem 3

a) DeleteMin

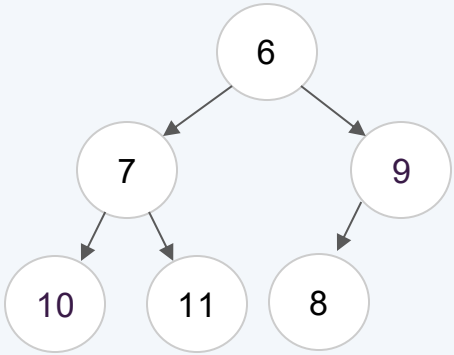
Step 3: percolate down, swapping with the smallest child



Problem 3

b) Insert 8

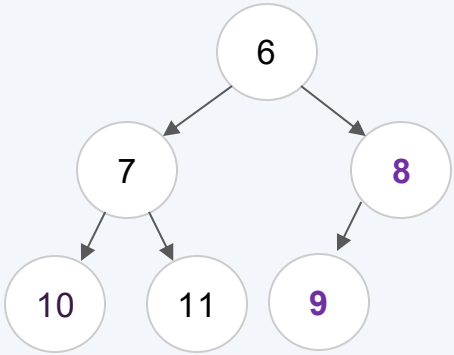
Step 1: attach new node to the rightmost empty space



Problem 3

b) Insert 8

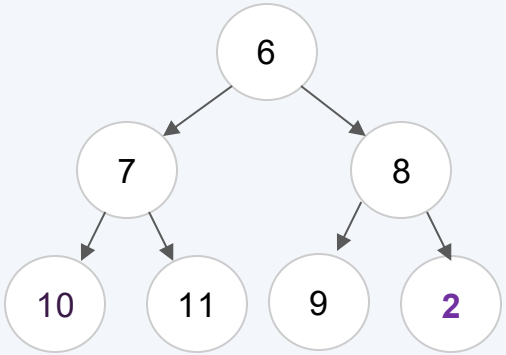
Step 2: percolate up



Problem 3

c) Insert 2

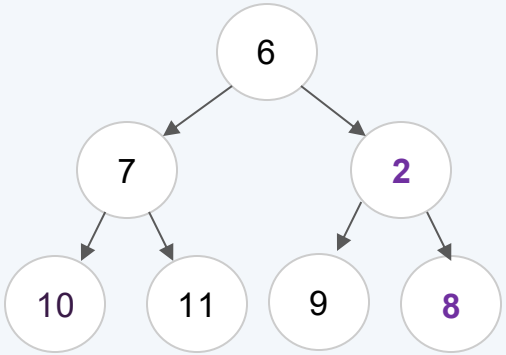
Step 1: insert new node to rightmost empty space



Problem 3

c) Insert 2

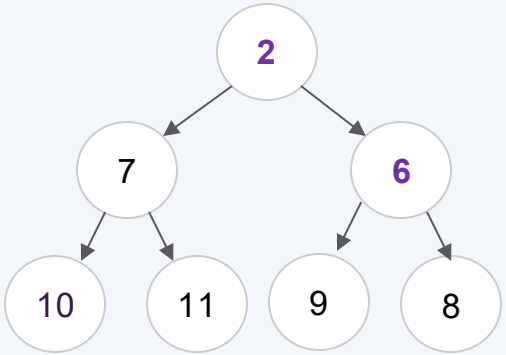
Step 2: percolate up



Problem 3

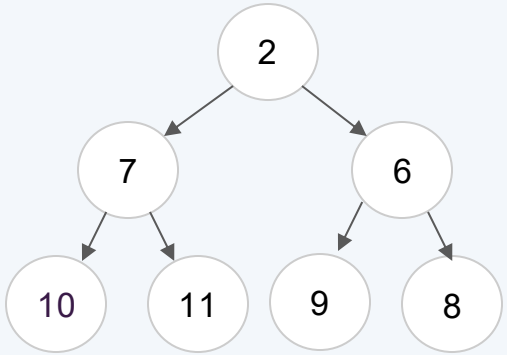
c) Insert 2

Step 2: percolate up



Problem 3

d) Draw out an array representation of the final heap in c)

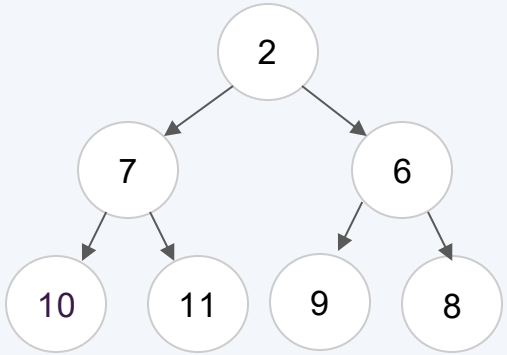


0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The parent of the node at index i:



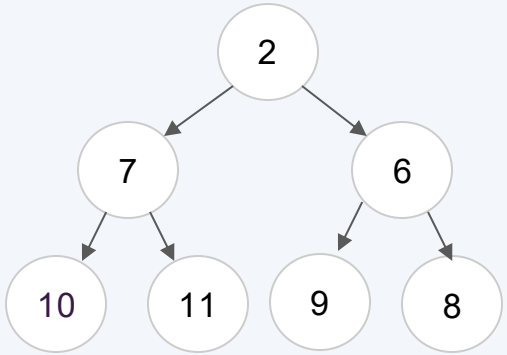
0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The parent of the node at index i:

$$\frac{i-1}{2}$$

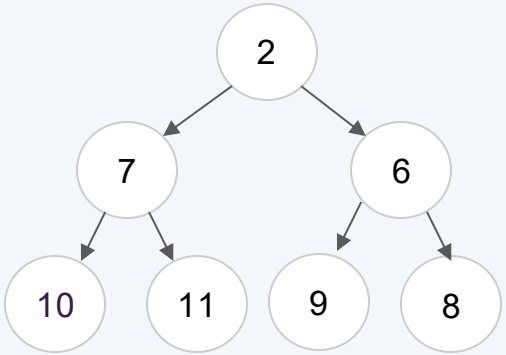


0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The left child of the node at index i:



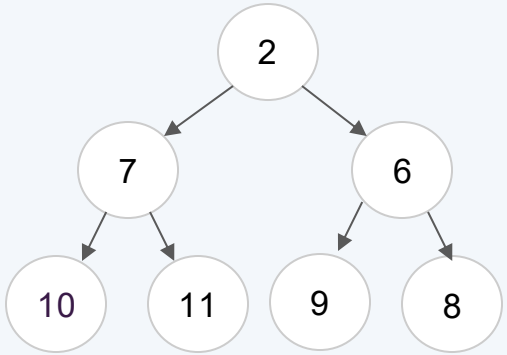
0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The left child of the node at index i:

$$2i + 1$$

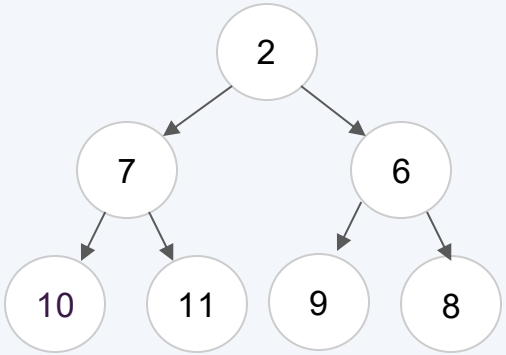


0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The right child of the node at index i:



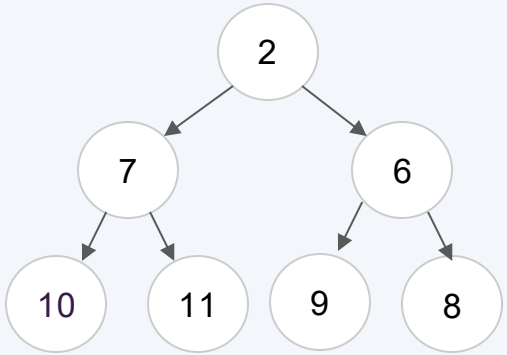
0	1	2	3	4	5	6
2	7	6	10	11	9	8

Problem 3

e) In the array, what is the index of:

The right child of the node at index i:

$$2i + 2$$



0	1	2	3	4	5	6
2	7	6	10	11	9	8

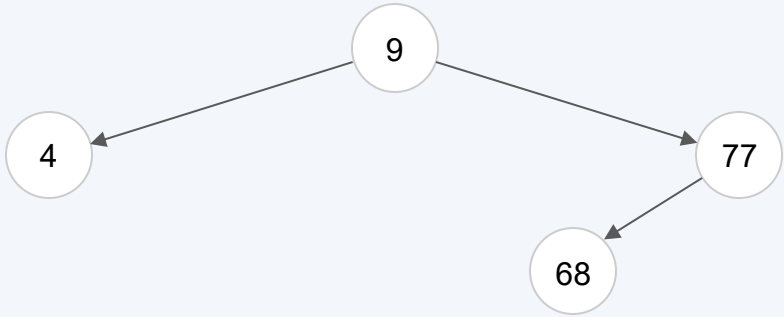
AVL Practice

12win midterm question 4

Problem 4

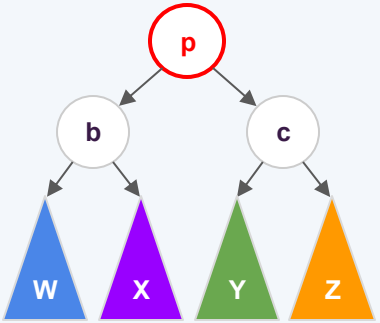
Perform the following operations in order, drawing the result after each operation and using it as the starting point for the next operation.

a) Insert 52
b) Delete 9
c) Insert 75
d) Insert 55

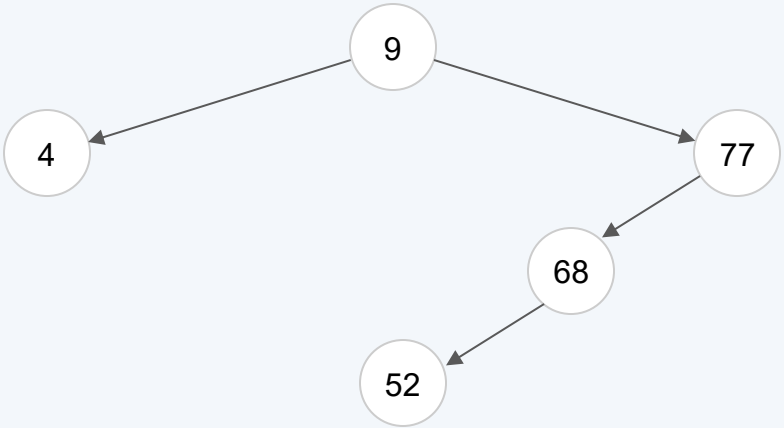


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

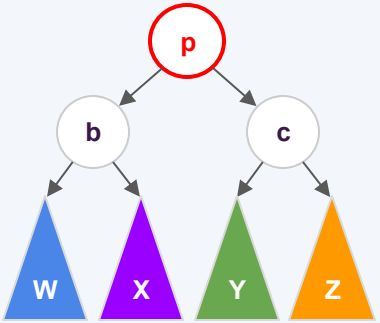


a) Insert 52

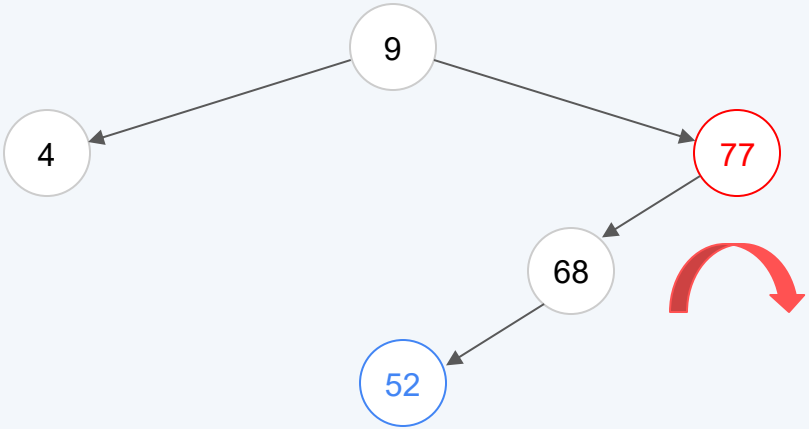


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

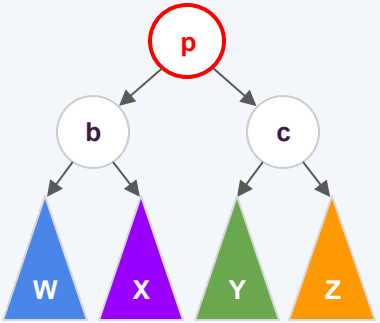


a) Insert 52



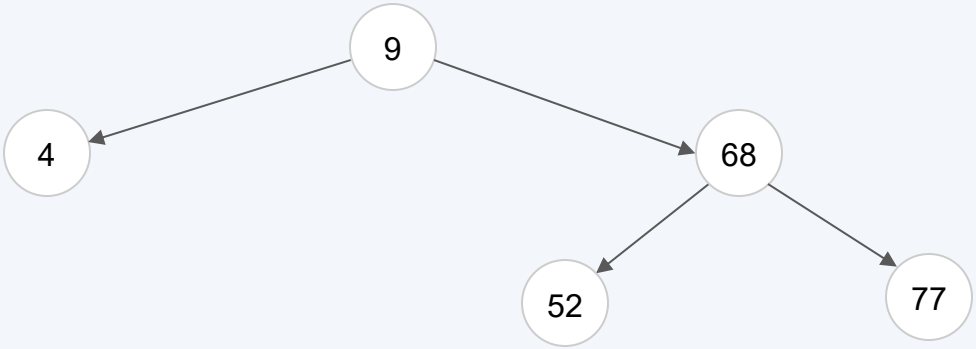
Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



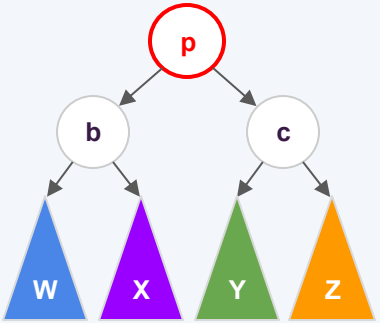
a) Insert 52

Final answer:

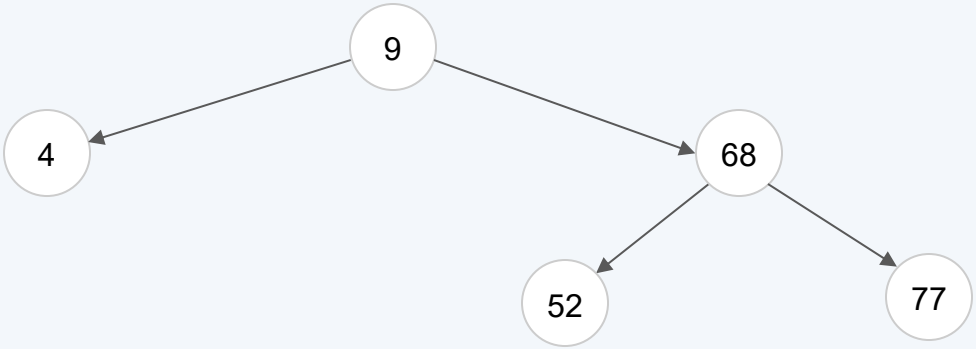


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



b) Delete 9

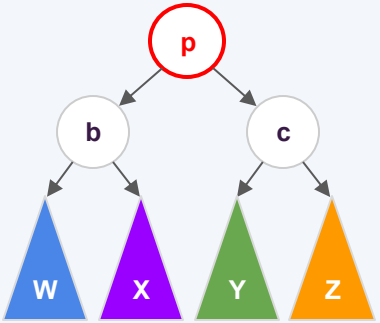


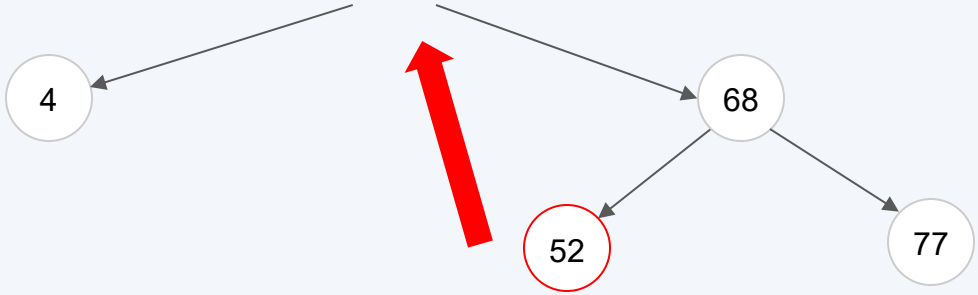
We did not cover general AVL delete. But if you did the previous operation correctly, you can delete this without creating an imbalance.

Problem 4

b) Delete 9

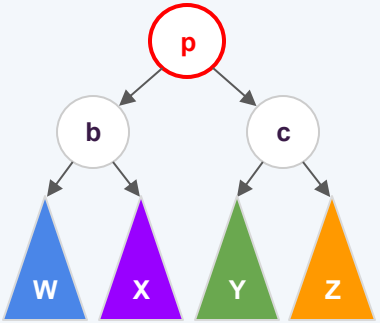
Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation





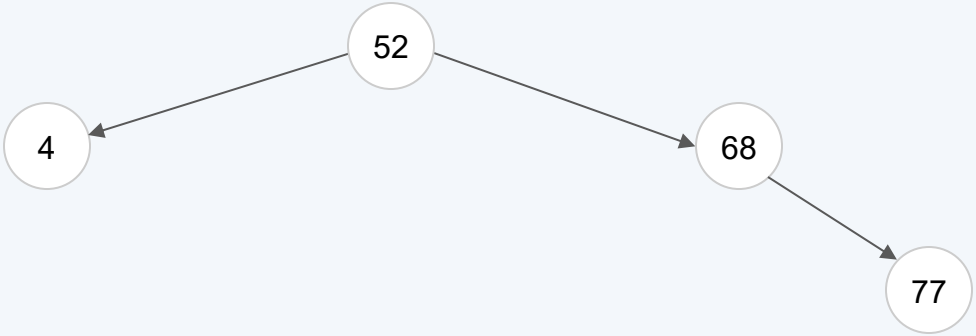
Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



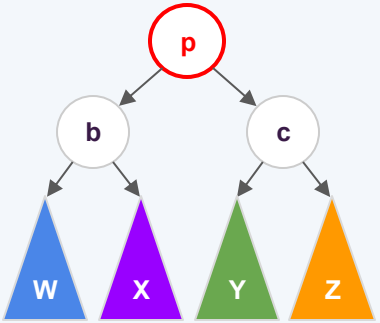
b) Delete 9

Final answer:

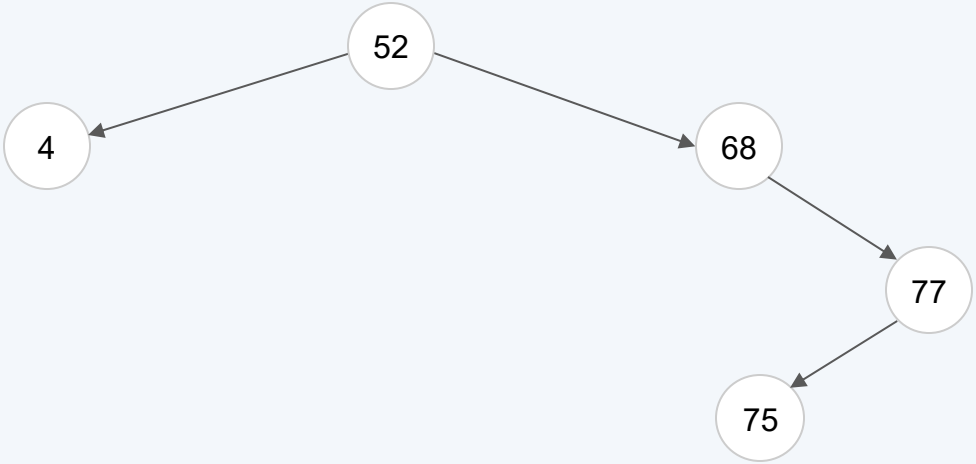


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



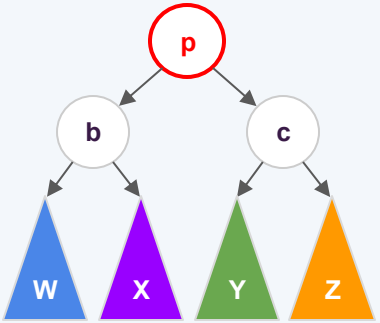
c) Insert 75

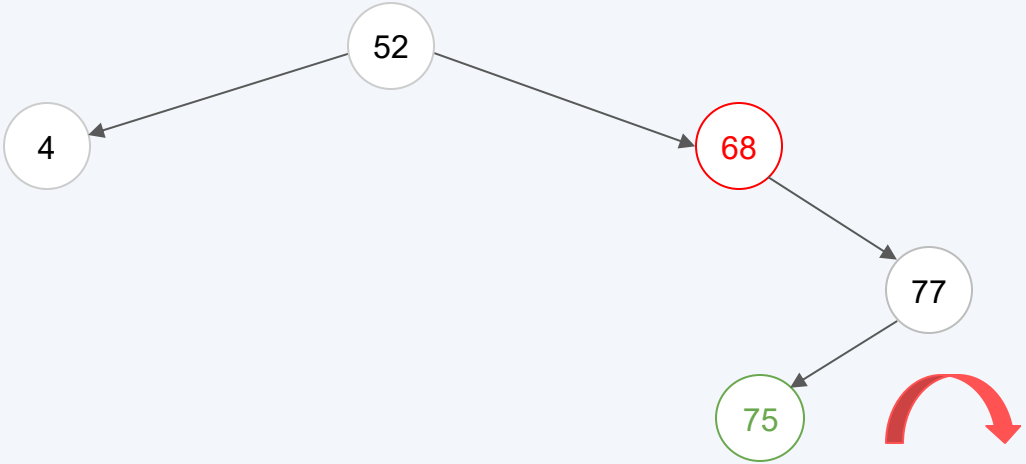


Problem 4

c) Insert 75

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

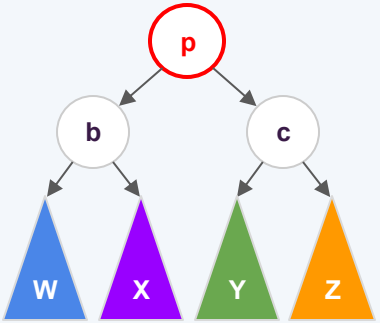


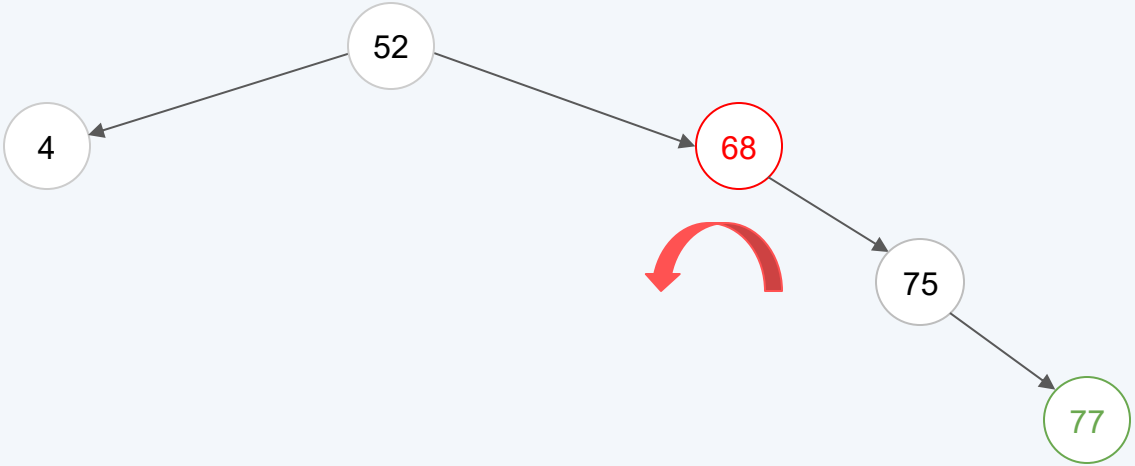


Problem 4

c) Insert 75

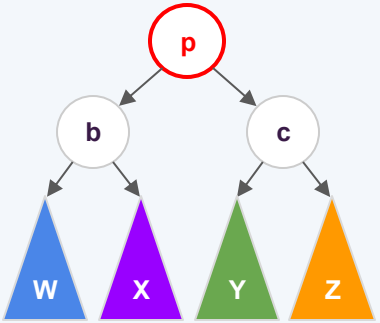
Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation





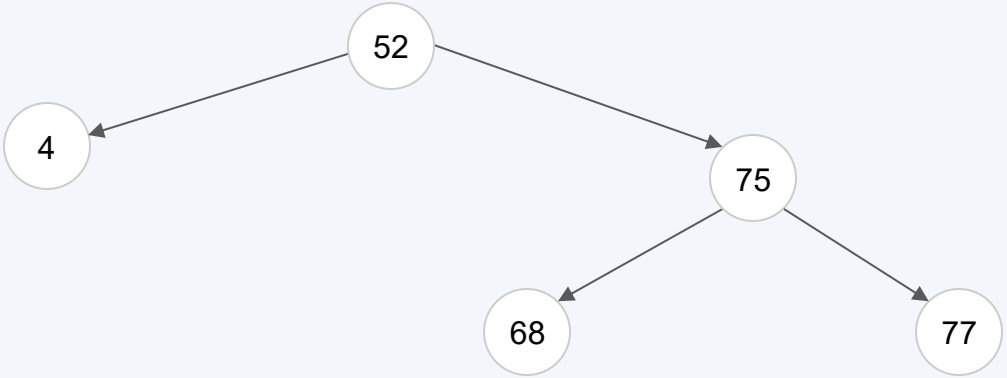
Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



c) Insert 75

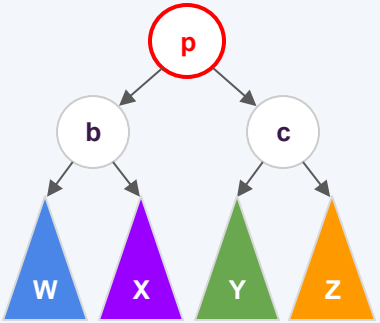
Final answer:

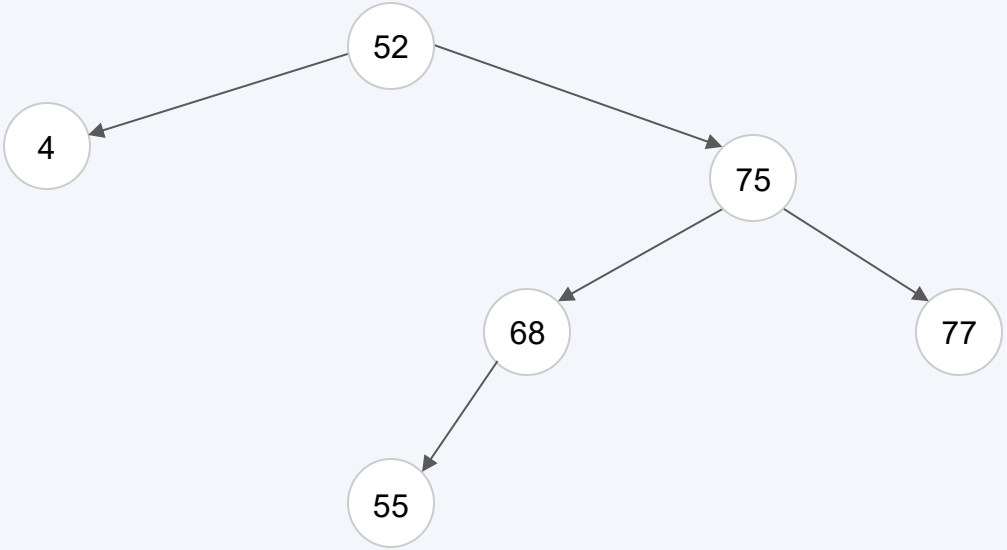


Problem 4

d) Insert 55

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

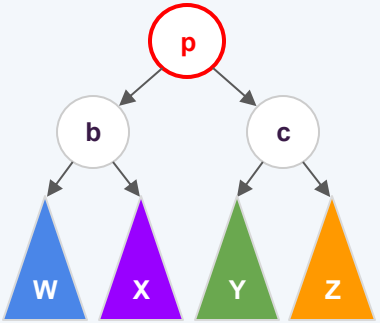


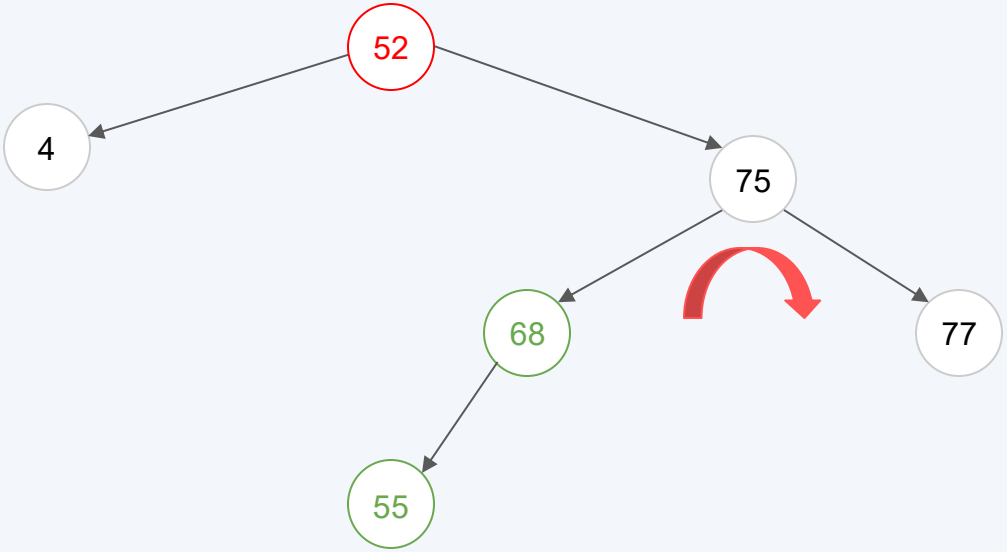


Problem 4

d) Insert 55

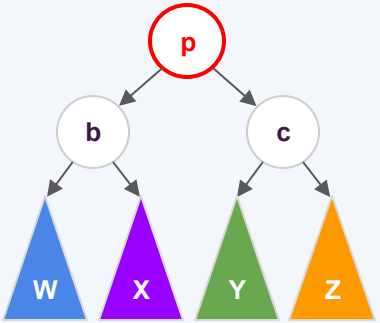
Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



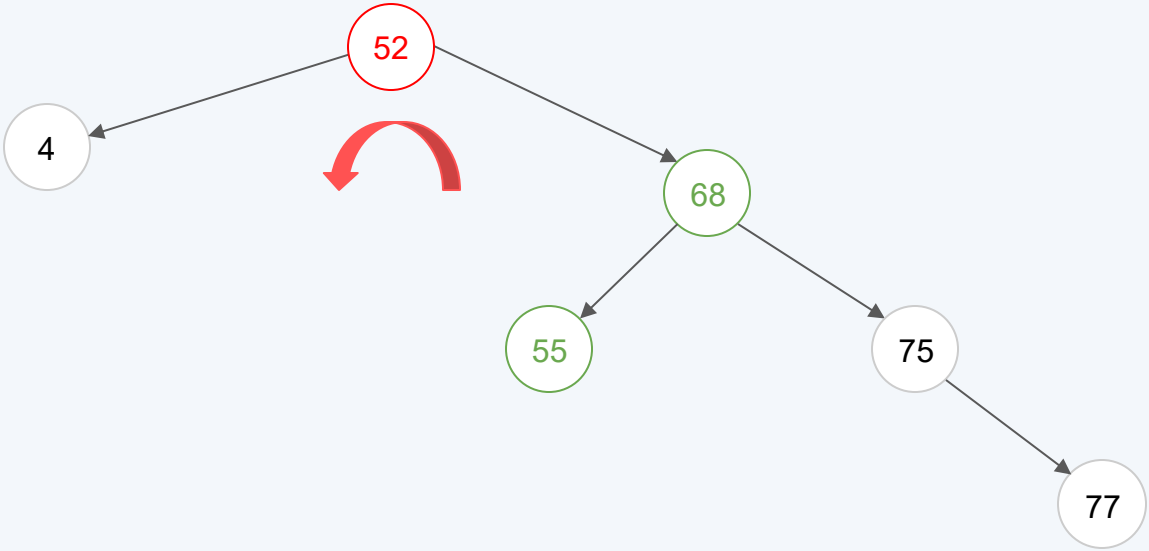


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

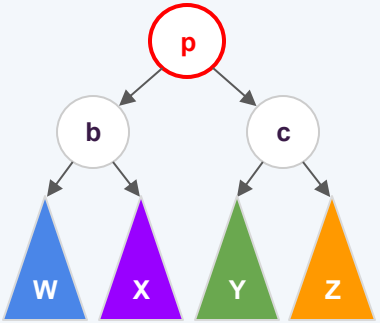


d) Insert 55

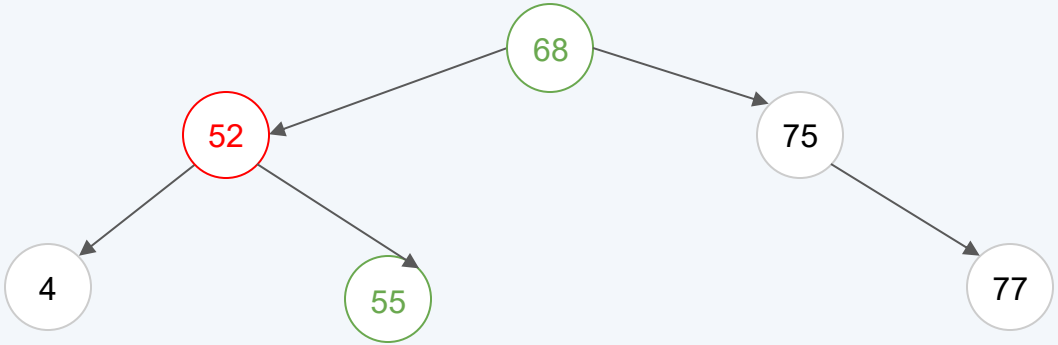


Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation

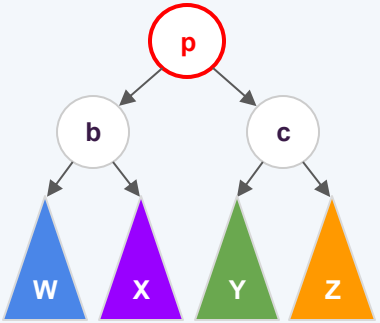


d) Insert 55



Problem 4

Case	Insert Location	Tree Rotation(s)
1	Left of Left (W)	Single right rotation
2	Right of Left (X)	Double left-right rotation
3	Left of Right (Y)	Double right-left rotation
4	Right of Right (Z)	Single left rotation



d) Insert 55

Final answer: