1. Problem 4.6

Assume :

# of full nodes in a binary tree = x
# of half nodes in a binary tree = y
# of leaf nodes in a binary tree = z.

N (the total number of nodes) = $x + y + z$.

# of edges on full nodes = $x \times 2$
# of edges on half nodes = $y \times 1$
# of edges on leaf nodes = $z \times 0$

# of edges in a binary tree = $N-1$

$$\therefore N-1 = 2x + y + 0$$

$$(x+y+z)-1 = 2x+y$$

$$x+1 = z$$

Therefore, the number of full nodes + 1 is equal to the total number of nodes.

2. Problem 4.8

a) Preorder = (−, *, *, a, b, +, c, d, e)

Inorder = (a, *, b, *, c, +, d, −, e) = (a b) × (c + d) − e

Postorder = a, b, *, c, d, +, *, e, −

b) predecessor of '−' is = '*'

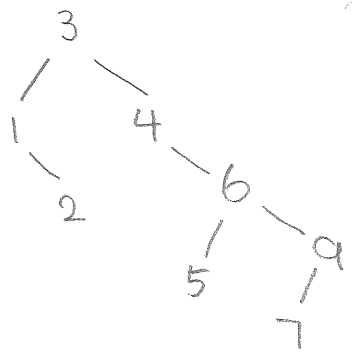
Successor of '−' is = 'e'

c) Predecessor of 'c' is = '*'

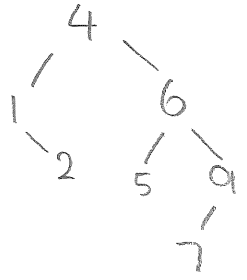
Successor of 'c' is = '+'

3. Problem 4.9

a)



b)



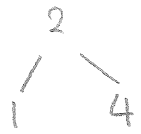
The remove function starts from the root. Because the root data value matches the given key, and since the root is not null, the function takes the leftmost of the right subtree and set that as the new root.

4. problem 4.19

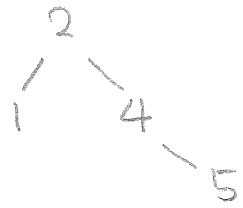
1)

2)

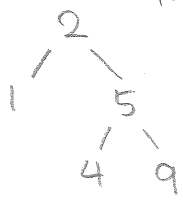
3)



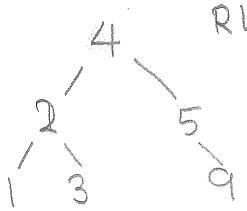
4)



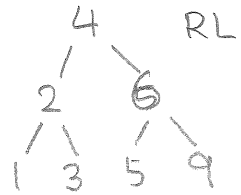
5) RR



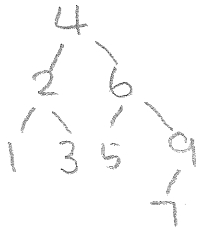
6) RL



7) RL



8)



5.