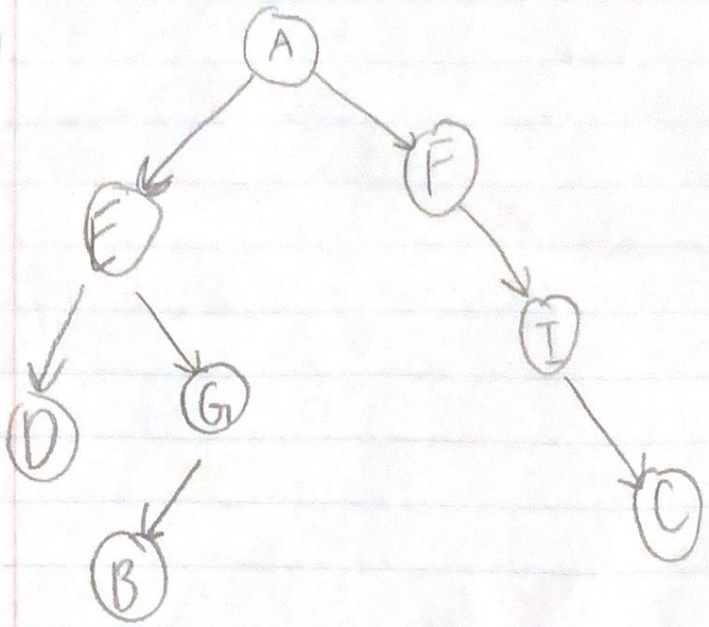
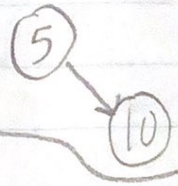
1.)

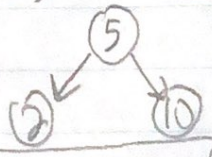


2.) Insert 5 : (5)

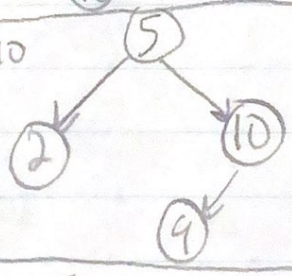
Insert 10: 10>5



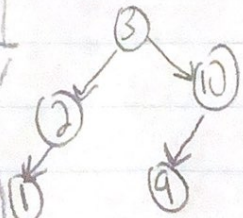
Insert 2: 2<5



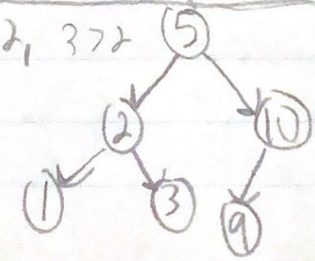
Insert 9: 9>5, <10



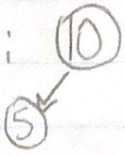
To remove, you would put 3 in 5's place

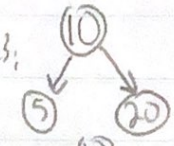


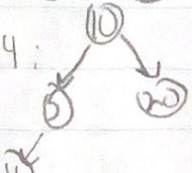
Insert 1 & 3, both <5, 1<2, 3>2

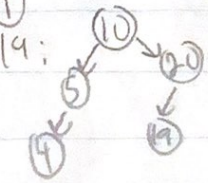


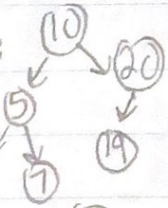
3.) Insert 10: 

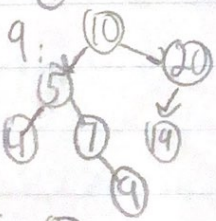
Insert 5: 

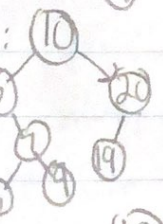
Insert 23: 

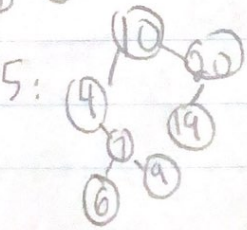
Insert 4: 

Insert 19: 

Insert 7: 

Insert 9: 

Insert 6: 

Delete 5: 

4.) a.) Height: 4 (100-50-80-90-83)

b.) Minimum height = depth

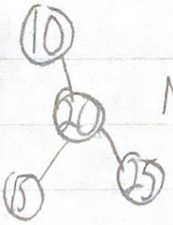
For 90: 3

c.) For 90, height is 1

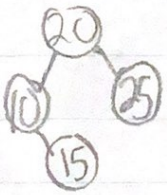
d.) Preorder: 100, 50, 3, 1, 20, 80, 52, 90, 83, 99, 150, 125, 152

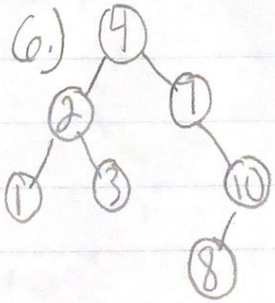
In order: 1, 3, 20, 50, 52, 80, 83, 90, 99, 100, 125, 150, 152

Post order: 1, 20, 3, 52, 83, 99, 90, 80, 50, 125, 152, 150, 100

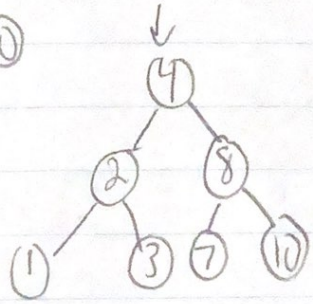
5.) 

Need RR rotation

So, 

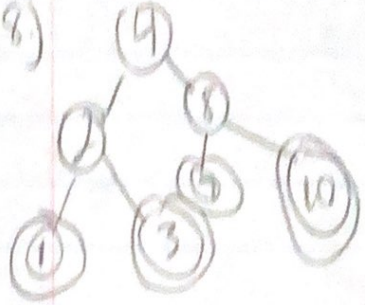
6.) 

Need RL Rotation

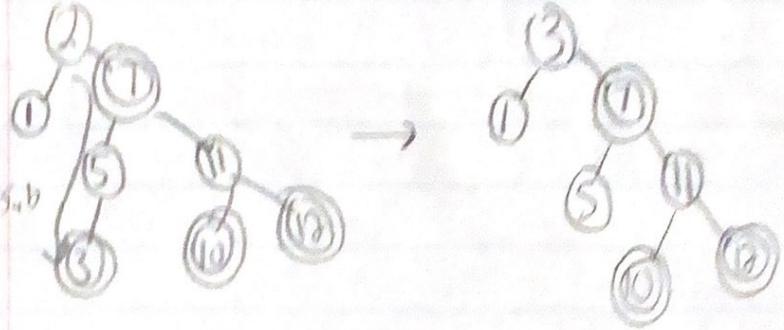


7.)

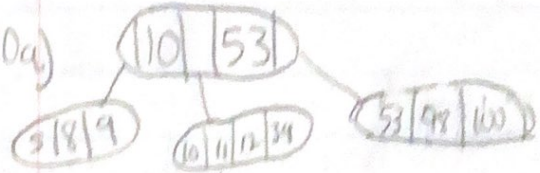
8.)



9.)

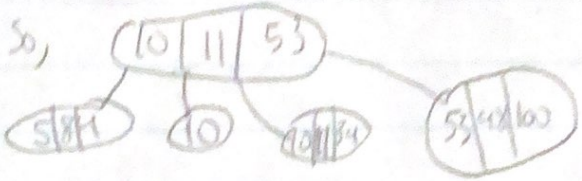


10a)

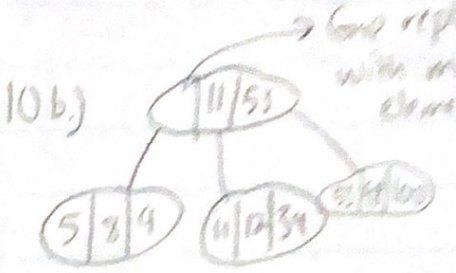


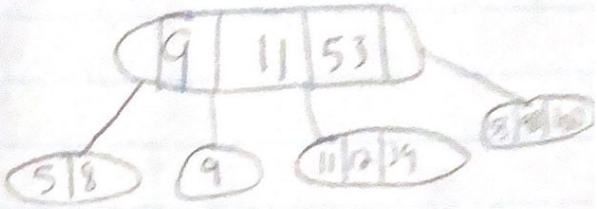
Violates condition

So,



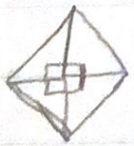
10b.)





Final tree

11a.) The size of the internal node is 3.
The size is 3, because we can see in the B-tree structure there are 3 nodes available



11b.) The size of B-tree leaf nodes (L) is 6. In the given B-tree their size is 6, in the node the last place is recognized as a pointer, there is a null that is assigned for the pointer.

11c.) The height of the B+ tree is:

$\log_{(\frac{1}{2}m)}(N+\frac{1}{2}) =$

11d.) $\log_{(\frac{1}{2}(3000)}(30000.5)) = 8.653 \approx 9$

11e.) $\log_{(\frac{1}{2}(2.5mil)}(2.5mil.5) = 12.4949 \approx 12.5 \approx 13$