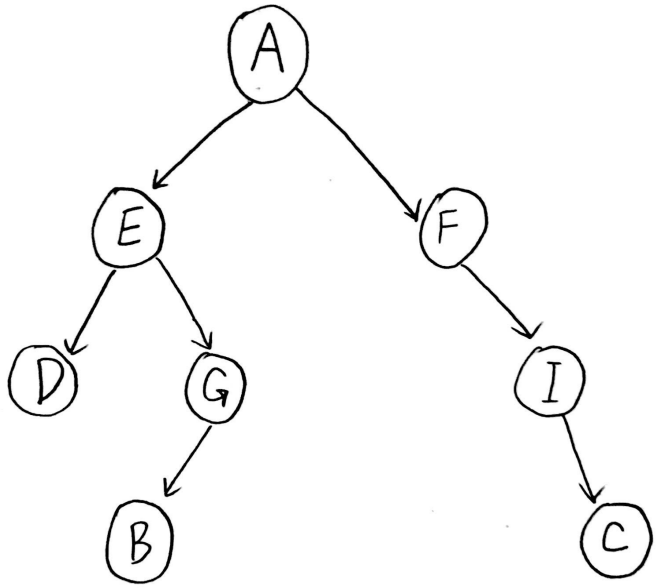
Liyuan Wang

CS 233

Homework 2

Due 10/20/2020

1. Pre-order: A, E, D, G, B, F, I, C (up, left, right)
   In-order: D, E, B, G, A, F, I, C (left, up, right)



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2.

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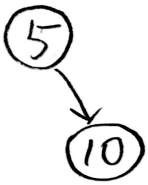
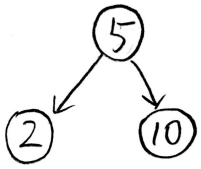
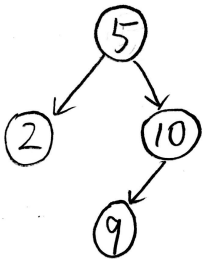
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
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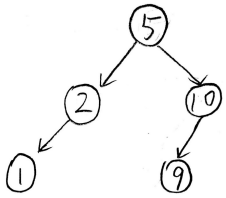
<td>  </td>
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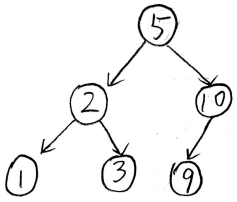
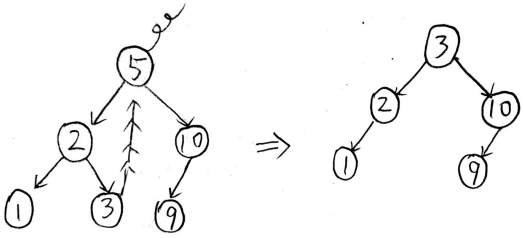
  </td>
<td>Delete node 5
  </td>
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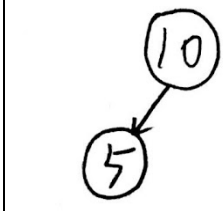
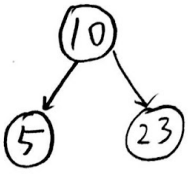
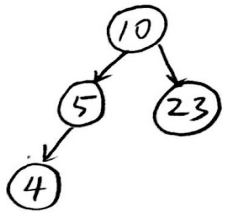
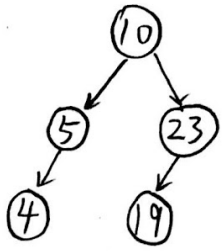
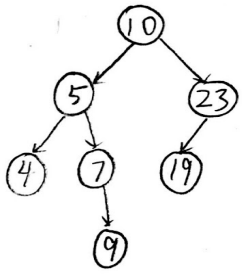
3.



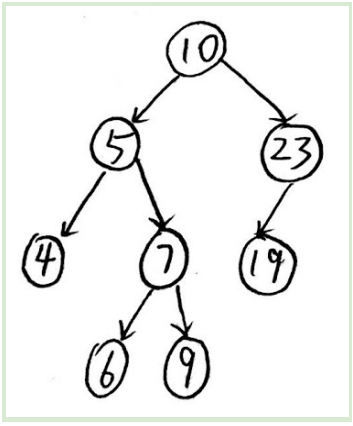




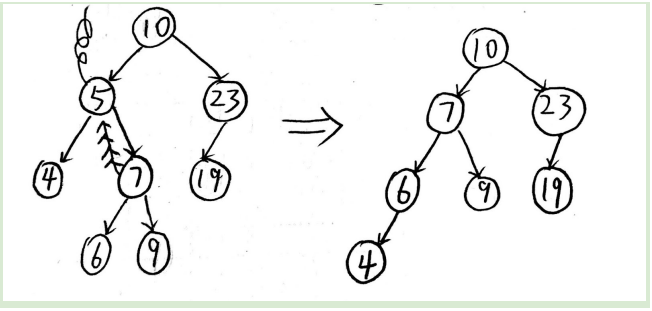




Finished inserting



Delete node 5



4. A) Height: The longest path is 4. So the height is **4**.

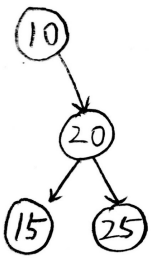
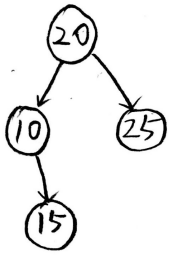
B) The minimum depth from root to node 90 is **3**.

C) Height is from leaf node to node 90, which is **1**.

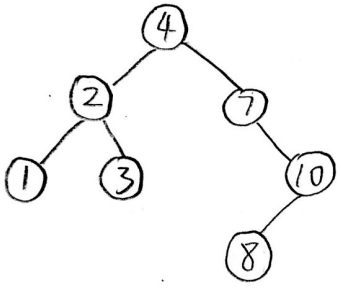
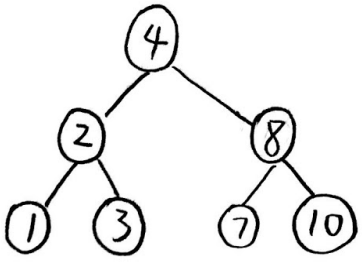
D)

Preorder = 100, 50, 3, 1, 20, 80, 52, 90, 83, 99, 150, 125, 152 (up, left, right)
Inorder = 1, 3, 20, 50, 52, 80, 83, 90, 99, 100, 125, 150, 152 (left, up, right)
Postorder = 1, 20, 3, 52, 83, 99, 90, 80, 50, 125, 152, 150, 100 (left, right, up)

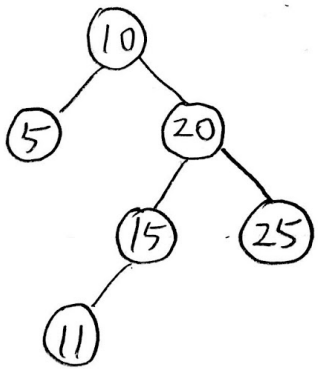
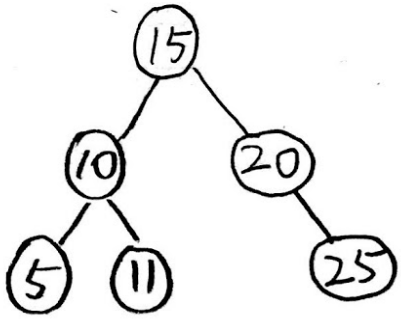
5.

Unbanlanced	Do a left rotation
	

6.

2 - 3 = -1 we can make it to be 0 	Do a left right rotation now 2 - 2 = 0 

7.

Unbanlanced 	node 20 right rotation 

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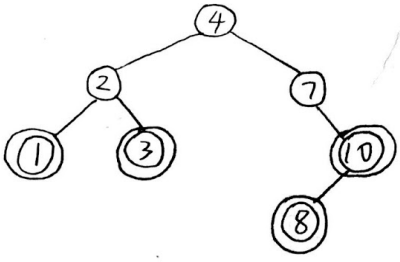
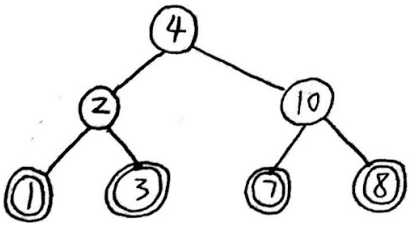
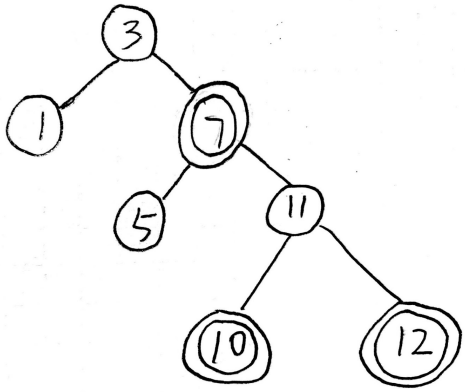
8.

2 - 3 = -1 we can make it to be 0 	After right left rotation 2 - 2 = 0 

9. After delete node 2, node 3 go replace node 2's position

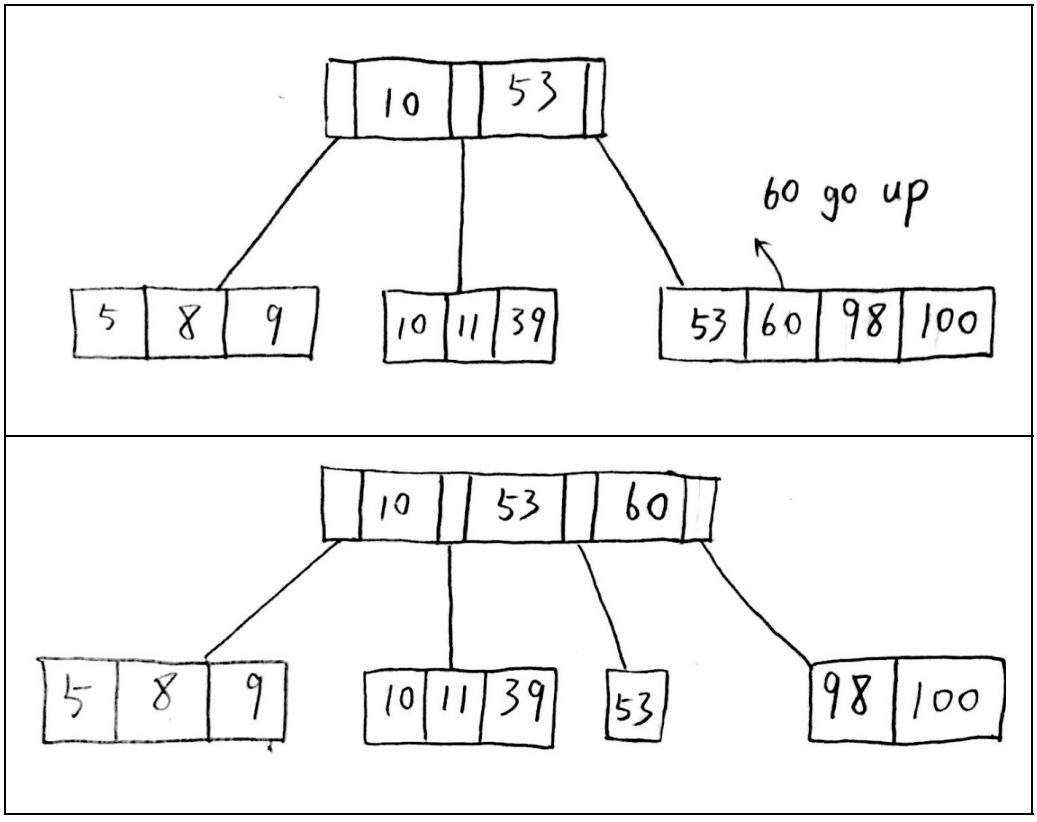


10.

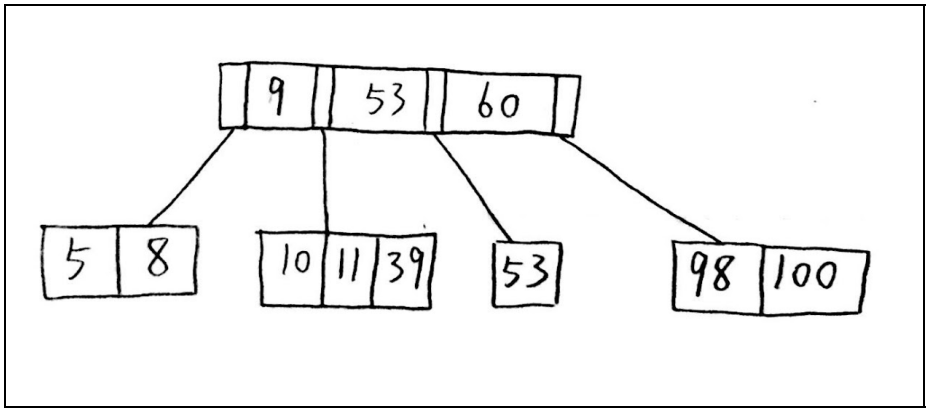
a. Node 60 goes to the root, then leaves over 53, 98, 100.

Since child 53 is less than 60 and equal to root 53, so child 53 will be in the middle of root 53 and 60.

Now 98 and 100 left over, stay to the right of 60.



b. After deleting node 10 in the root, the maximum number on the left of this node 10 will go up to replace node 10, which is node 9.



11.

Calculate the size of the internal nodes (M) for our B-tree:

Since the given B tree structure has 3 nodes available, so **Node(M) = 3.**

Calculate the size of the B-tree leaf nodes (L):

Since the leaf nodes are 6 in the picture, thus **nodes(L) = 6.**

How tall (on average) will our tree be (in terms of M) with N customer records?

Height	Range	up to
1	< 25	5^2
2	26 - 125	5^3
3	126 - 625	5^4
4	626 - 3125	5^5
m	5^m < N ≤ 5^(m+1)	5^m
So the height will be between 5^m and 5^(m+1)		

If we insert 30,000 CustomerData records, how tall will be tree be?

So N = 30000

$5^6 = 15625$

$5^7 = 78125$

30000 is between 15625 and 78125

got equation: $5^6 < 30000 \leq 5^7$ (in this case, m = 6)

So, the height is 6.

If we insert 2,500,000 customers how tall will the tree be?

Same process as the last question. 89102

$5^8 = 390625$

$5^9 = 1,953,125$

$5^{10} = 9,765,625$

N = 2,500,000 and N is between 5^9 and 5^{10}

So, equation $5^9 < N \leq 5^{10}$ (in this case m = 9). **Thus, the height will be 9.**