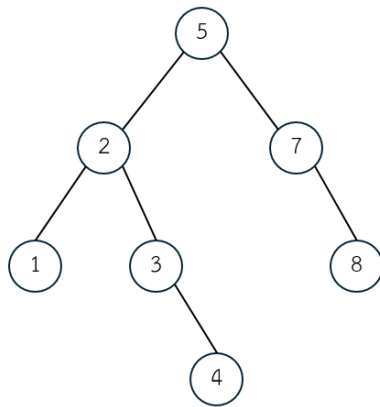


Conceptual Questions

[Some questions are modified from CP Data Structure Final Examination in previous years]

1. For the following binary tree, write down the order of nodes that traversal algorithms would visit them. Also, check if this binary tree is binary search tree.



Preorder Traversal _____

Inorder Traversal _____

Postorder Traversal _____

Is this a binary search tree? _____

2. Write down TRUE if the statement is true or FALSE if the statement is false in front of questions.
 - 2.1. Every AVL tree is binary search tree.
 - 2.2. Time complexity of searching a key in binary search tree is $O(\log n)$ where n is number of nodes in the tree.
 - 2.3. Binary heap can store duplicate values.
 - 2.4. Time complexity of searching value in AVL tree is $O(\log n)$ where n is number of nodes in the tree.
 - 2.5. In hash table, the load factor is always less than or equal to 1.
 - 2.6. Time complexity of adding data into binary heap is $\Theta(\log n)$.
 - 2.7. Time complexity of merge sort is $O(n \log n)$.
 - 2.8. Time complexity of bubble sort is $O(n \log n)$.
 - 2.9. Time complexity of selection sort is $O(n \log n)$.
 - 2.10. There is no sorting algorithm that has time complexity of $O(n)$.

3. If we insert 1, 2, 3, 4, 5, and 6 to empty binary min heap, then pop the value out for 1 time, draw the final binary min heap.

4. Consider an open addressing hash table which uses quadratic probing to solve collision problems. If the length of the array inside the has table is 13 and the hash function used in this table is

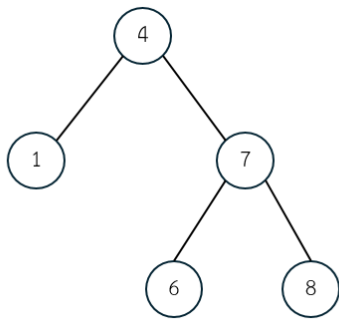
$$h(x) = x \% 13$$

Write down the data in the hash table after performing the following operations. (write X if the data in that index is deleted)

Operations	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
(Example) Add 10											10		
(Example) Add 24											10	24	
(Example) Delete 10											X	24	
Add 1													
Add 11													
Delete 24													
Add 37													
Add 23													

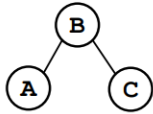
5. Why must the size of array in hash tables be prime number?

6. From the given AVL tree, draw the new AVL tree after inserting value 9 into this tree.



7. What is the purpose of AVL tree? Why don't we use normal binary search tree instead?
8. If we want to insert the value 1,2,3,4,5,6,7,8 into the empty AVL tree so that there is no any rotation occurred while inserting, write down the order of inserting (e.g. 5,6,3,4,2,1,8,7).

9. Draw a binary tree that has the order of visiting of inorder and postorder traversals as shown below.

<p>(Example)</p> <p>Inorder : A, B, C</p> <p>Postorder : A, C, B</p>	
<p>Inorder: X, Z, Y, U, V, W</p> <p>Postorder: V, U, W, Y, Z, X</p>	