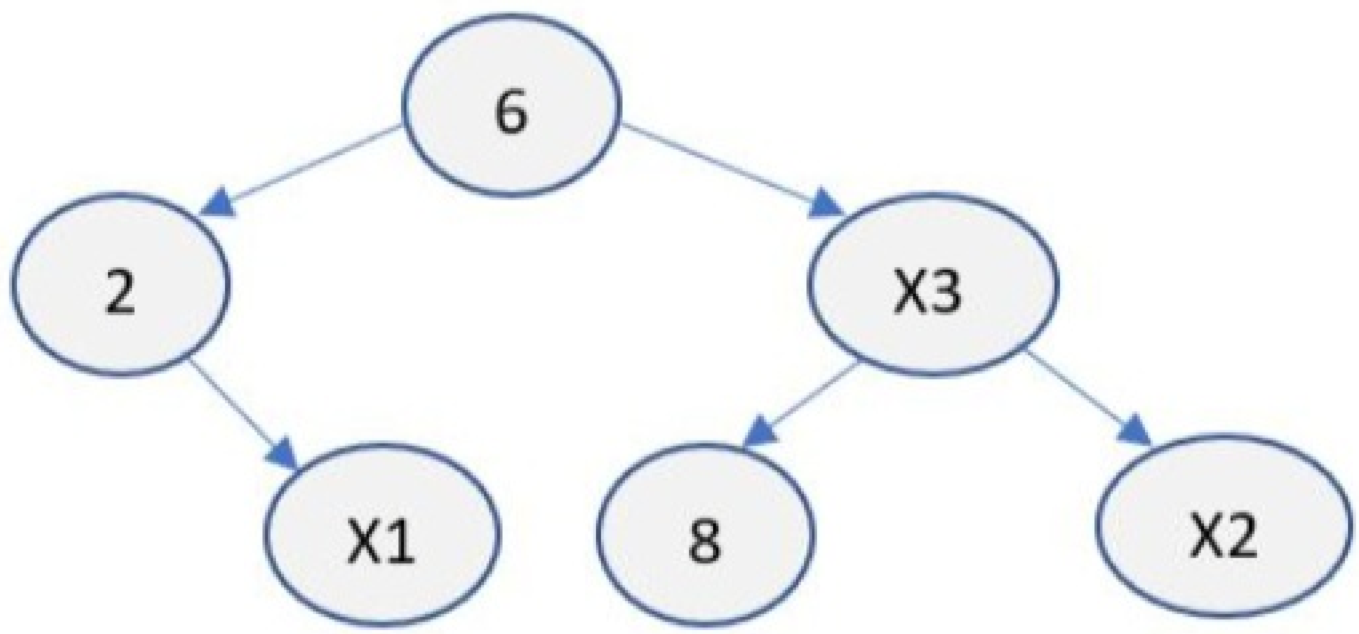
1. Consider the following binary search tree below with missing values $X1$, $X2$ and $X3$.

1 / 1 point

Note that the leaves labeled NIL are not shown, but please assume that they exist.



Select all true statements about the tree.

- [ ] $X1$ can be any value less than or equal to 6.
- [x] $X1$ can be set to the number 5 while remaining a valid binary search tree.

Correct
$X1$ must also be ≥ 2 since it is the right child of 2, and $X1 \leq 6$ since it is in the left subtree of the root 6. Therefore, 5 is a possible value.

- [ ] $X3$ can be any number ≥ 6.
- [x] $X3$ can be any number ≥ 8 and $\leq X2$.

Correct
Correct

- [x] $X2$ must have a value ≥ 8 and $\geq X3$.

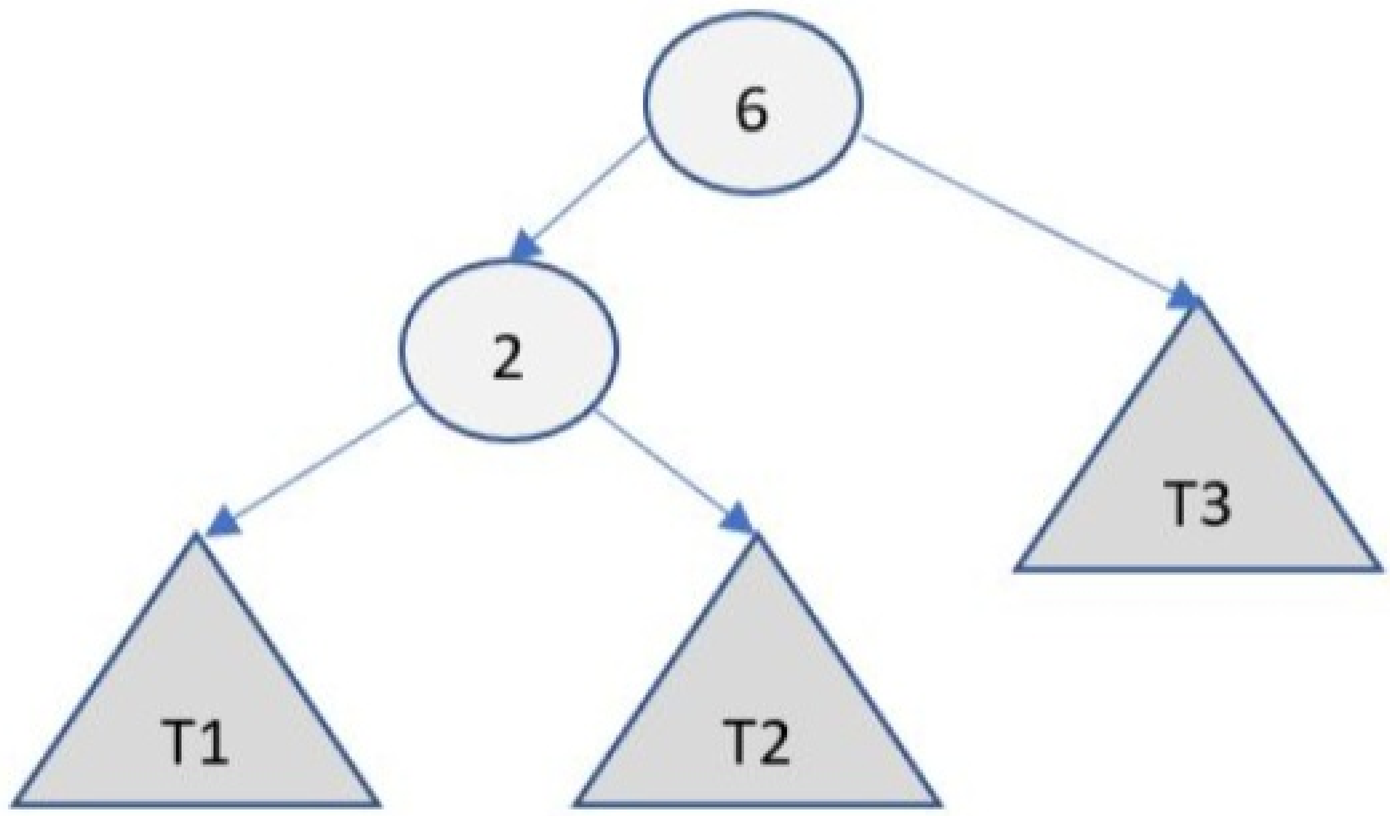
Correct
Correct

- [x] The height of the root node is 3.

Correct
Correct. Note that the root has a longest path of length 3 to a leaf.

2. Consider the following binary search tree with subtrees shown below. Select all true statements about it.

1 / 1 point



- [x] Every node in $T1$ must have value ≤ 2.

Correct
Correct since T1 is the left subtree of node 2.

- [x] Every node in $T2$ must have key ≥ 2 and ≤ 6.

Correct
Correct since T1 is in the right subtree of node 2 and left subtree of the node 6.

- [ ] If the node with key 25 is found in the tree, we will find it in subtree $T2$.

- [ ] If the node with key -10 is to be found in the tree, it can be found in subtree $T2$.

- [x] If the node with key 7 is to be found in the tree, it will be found in $T3$.

Correct
Correct since 7 > 6 it will be found in the right subtree of the root node 6.

- [x] If the height of subtree $T1$ is 4 and that of subtree $T2$ is 2 then the height of node labeled 2 is 5.

Correct
Correct since max(4, 2) + 1 = 5

3. Select all correct statements from the list below about binary search trees.

1 / 1 point

- [x] In a fully balanced binary search tree with n total nodes (internal and leaf nodes), where $n = 2^k - 1$ for some k, we will have $(n+1)/2$ leaves.

Correct

Correct. Think of a BST with 7 nodes, 1 root, 2 children of the root, 4 leaves. Generalize the pattern to a BST with $2^k - 1$ nodes

- [x] In the worst case, a binary search tree with n internal nodes can have height n.

Correct

Correct. Every node in the tree has a single child in the worst case

- [ ] Assuming that all keys are distinct, the key at the root is the median among all keys of the binary search tree.