

On my honor, I pledge that I have neither received nor provided improper assistance  
in the completion of this assignment

-21900112 김성민

## Operations: size()

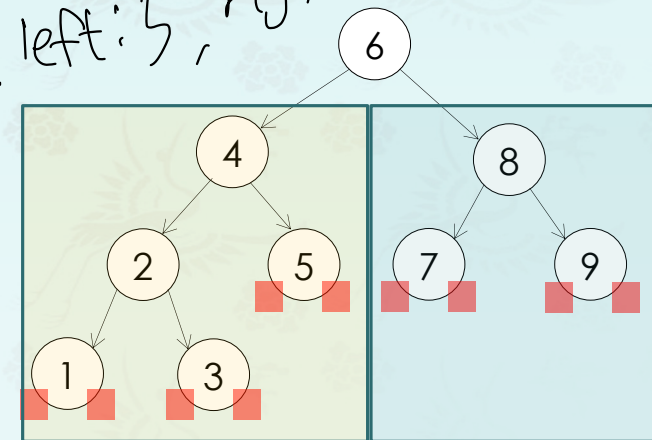
```
// returns the number of nodes in the binary tree
int size(tree node) {
    if (empty(node)) return 0;
    return size(node->left) + size(node->right) + 1;
}
```

- Q1. What is the total number of the function calls to complete with the tree and how many returns each?
- Q2. Which node invokes the last function call?
- Q3. Which node finishes its size function call and returns size = 1 for the first time?

19, left: 5, right: 3

node 9

node 1



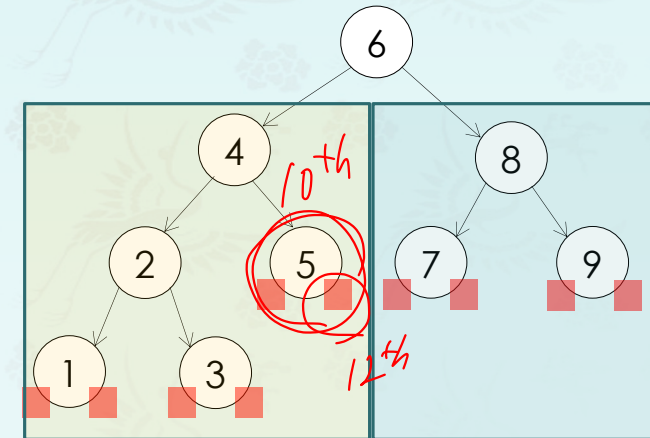
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## Operations: height()

```
// returns the max depth of a tree.  
// height = -1 for empty tree, 0 for root only tree  
int height(tree node) {  
    if (empty(node)) return -1;  
    int left  = height(node->left);  
    int right = height(node->right);  
    return max(left, right) + 1;  
}
```

- Q1. What is the total number of the function call to complete with the tree below? 19
- Q2. What is the return value of the 10<sup>th</sup> and 12<sup>th</sup> function call? 10<sup>th</sup>: 0, 12<sup>th</sup>: -1
- Q3. What is the return value of the node 2? 1



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-21900112 33601

## Operations: containsBT(), findBT()

```
// returns true if key is in a given binary tree, false otherwise.  
bool containsBT(tree root, int key) {  
    if (empty(root)) return false;  
    if (key == root->key) return true;  
  
    return containsBT(root->left, key) || containsBT(root->right, key);  
}
```

- Q1: Which node invokes **containsBT(root->right, key)** for the first time? *node 1*
- Q2: Which node will invoke **return false** for the first time? *left null node of node 1*
- Q3: How many function calls are made to reach the node **key=5**? *10*
- Q4: How many function calls still remain in the system stack to finish after key=5 is found and what are they?

$\text{containsBT}(6, 5), \text{containsBT}(4, 5) \Rightarrow 2$

