173. Binary Search Tree Iterator

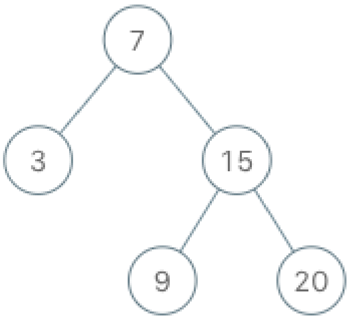
Implement the `BSTIterator` class that represents an iterator over the **in-order traversal** of a binary search tree (BST):

- `BSTIterator(TreeNode root)` Initializes an object of the `BSTIterator` class. The `root` of the BST is given as part of the constructor. The pointer should be initialized to a non-existent number smaller than any element in the BST.
- `boolean hasNext()` Returns `true` if there exists a number in the traversal to the right of the pointer, otherwise returns `false`.
- `int next()` Moves the pointer to the right, then returns the number at the pointer.

Notice that by initializing the pointer to a non-existent smallest number, the first call to `next()` will return the smallest element in the BST.

You may assume that `next()` calls will always be valid. That is, there will be at least a next number in the in-order traversal when `next()` is called.

Example 1:



```
Input
["BSTIterator", "next", "next", "hasNext", "next", "hasNext", "next",
"hasNext", "next", "hasNext"]
[[[7, 3, 15, null, null, 9, 20]], [], [], [], [], [], [], [], [], []]
Output
[null, 3, 7, true, 9, true, 15, true, 20, false]

Explanation
BSTIterator bSTIterator = new BSTIterator([7, 3, 15, null, null, 9, 20]);
bSTIterator.next();    // return 3
bSTIterator.next();    // return 7
bSTIterator.hasNext(); // return True
bSTIterator.next();    // return 9
bSTIterator.hasNext(); // return True
bSTIterator.next();    // return 15
bSTIterator.hasNext(); // return True
bSTIterator.next();    // return 20
bSTIterator.hasNext(); // return False
```

Constraints:

- The number of nodes in the tree is in the range `[1, 10<sup>5</sup>]`.
- `0 <= Node.val <= 10<sup>6</sup>`
- At most `10<sup>5</sup>` calls will be made to `hasNext`, and `next`.

Follow up:

- Could you implement `next()` and `hasNext()` to run in average `O(1)` time and use `O(h)` memory, where `h` is the height of the tree?

```
class BSTIterator:

    def __init__(self, root: TreeNode):
        self.res = []
        self.inorder(root,self.res)
        self.pointer = 0

    def inorder(self,root,res):
        if root is None:
            return
        self.inorder(root.left,res)
        res.append(root.val)
        self.inorder(root.right,res)




    def next(self) -> int:
        if self.hasNext:
            temp = self.res[self.pointer]
            self.pointer = self.pointer+1
            return temp


    def hasNext(self) -> bool:
        if self.pointer>=len(self.res):
            return False
        else:
            return True
```

Follow Up answer.

```
class BSTIterator:

    def __init__(self, root: Optional[TreeNode]):
        self.stack = []
        self.addNodes(root)

    def addNodes(self,root):
        while root!=None:
            self.stack.append(root)
            root = root.left


    def next(self) -> int:
        temp = self.stack.pop()
        self.addNodes(temp.right)
        return temp.val


    def hasNext(self) -> bool:
        return len(self.stack)
```