

Problem 716: Max Stack

Problem Information

Difficulty: Hard

Acceptance Rate: 45.73%

Paid Only: Yes

Tags: Linked List, Stack, Design, Doubly-Linked List, Ordered Set

Problem Description

Design a max stack data structure that supports the stack operations and supports finding the stack's maximum element.

Implement the `MaxStack` class:

* `MaxStack()` Initializes the stack object.
* `void push(int x)` Pushes element `x` onto the stack.
* `int pop()` Removes the element on top of the stack and returns it.
* `int top()` Gets the element on the top of the stack without removing it.
* `int peekMax()` Retrieves the maximum element in the stack without removing it.
* `int popMax()` Retrieves the maximum element in the stack and removes it. If there is more than one maximum element, only remove the **top-most** one.

You must come up with a solution that supports `O(1)` for each `top` call and `O(logn)` for each other call.

Example 1:

```
**Input** ["MaxStack", "push", "push", "push", "top", "popMax", "top", "peekMax", "pop", "top"]
[], [5], [1], [5], [], [], [], [], []]
**Output** [null, null, null, null, 5, 5, 1, 5, 1, 5]
**Explanation**
MaxStack stk = new MaxStack(); stk.push(5); // [5] the top of the stack and the
maximum number is 5. stk.push(1); // [1, 5] the top of the stack is 1, but the maximum is
5. stk.push(5); // [5, 5] the top of the stack is 5, which is also the maximum, because it
is the top most one. stk.top(); // return 5, [5] the stack did not change.
stk.popMax(); // return 5, [1] the stack is changed now, and the top is different from
the max. stk.top(); // return 1, [1] the stack did not change. stk.peekMax(); // return 5,
[1] the stack did not change. stk.pop(); // return 1, [1] the top of the stack and
the max element is now 5. stk.top(); // return 5, [5] the stack did not change.
```

****Constraints:****

* $-107 \leq x \leq 107$ * At most `105` calls will be made to `push`, `pop`, `top`, `peekMax`, and `popMax`. * There will be **at least one element** in the stack when `pop`, `top`, `peekMax`, or `popMax` is called.

Code Snippets

C++:

```
class MaxStack {
public:
    MaxStack() {

    }

    void push(int x) {

    }

    int pop() {

    }

    int top() {

    }

    int peekMax() {

    }

    int popMax() {

    }
};

/***
* Your MaxStack object will be instantiated and called as such:
* MaxStack* obj = new MaxStack();
*/
```

```
* obj->push(x);  
* int param_2 = obj->pop();  
* int param_3 = obj->top();  
* int param_4 = obj->peekMax();  
* int param_5 = obj->popMax();  
*/
```

Java:

```
class MaxStack {  
  
    public MaxStack() {  
  
    }  
  
    public void push(int x) {  
  
    }  
  
    public int pop() {  
  
    }  
  
    public int top() {  
  
    }  
  
    public int peekMax() {  
  
    }  
  
    public int popMax() {  
  
    }  
  
    /**  
     * Your MaxStack object will be instantiated and called as such:  
     * MaxStack obj = new MaxStack();  
     * obj.push(x);  
     * int param_2 = obj.pop();  
     * int param_3 = obj.top();  
     */
```

```
* int param_4 = obj.peekMax();
* int param_5 = obj.popMax();
*/
```

Python3:

```
class MaxStack:

    def __init__(self):

        def push(self, x: int) -> None:

            def pop(self) -> int:

                def top(self) -> int:

                    def peekMax(self) -> int:

                        def popMax(self) -> int:

# Your MaxStack object will be instantiated and called as such:
# obj = MaxStack()
# obj.push(x)
# param_2 = obj.pop()
# param_3 = obj.top()
# param_4 = obj.peekMax()
# param_5 = obj.popMax()
```