

Homework 3

Due: 10/28/2024

1. Implement Stack using Queues

Implement a last-in-first-out (LIFO) stack using only two queues. The implemented stack should support all the functions of a normal stack (push, top, pop, and empty).

Implement the MyStack class:

- void push(int x) Pushes element x to the top of the stack.
- int pop() Removes the element on the top of the stack and returns it.
- int top() Returns the element on the top of the stack.
- boolean empty() Returns true if the stack is empty, false otherwise.

Notes:

- You must use **only** standard operations of a queue, which means that only push to back, peek/pop from front, size and is empty operations are valid.
- Depending on your language, the queue may not be supported natively. You may simulate a queue using a list or deque (double-ended queue) as long as you use only a queue's standard operations.

Example 1:

Input

```
["MyStack", "push", "push", "top", "pop", "empty"]
```

```
[[], [1], [2], [], [], []]
```

Output

```
[null, null, null, 2, 2, false]
```

Explanation

```
MyStack myStack = new MyStack();
```

```
myStack.push(1);
```

```
myStack.push(2);
```

```
myStack.top(); // return 2
```

```
myStack.pop(); // return 2
```

```
myStack.empty(); // return False
```

2. Implement Queue using Stacks

Implement a first in first out (FIFO) queue using only two stacks. The implemented queue should support all the functions of a normal queue (push, peek, pop, and empty).

Implement the MyQueue class:

- void push(int x) Pushes element x to the back of the queue.
- int pop() Removes the element from the front of the queue and returns it.
- int peek() Returns the element at the front of the queue.
- boolean empty() Returns true if the queue is empty, false otherwise.

Notes:

- You must use **only** standard operations of a stack, which means only push to top, peek/pop from top, size, and is empty operations are valid.
- Depending on your language, the stack may not be supported natively. You may simulate a stack using a list or deque (double-ended queue) as long as you use only a stack's standard operations.

Example 1:

Input

```
["MyQueue", "push", "push", "peek", "pop", "empty"]
```

```
[[], [1], [2], [], [], []]
```

Output

```
[null, null, null, 1, 1, false]
```

Explanation

```
MyQueue myQueue = new MyQueue();  
myQueue.push(1); // queue is: [1]  
myQueue.push(2); // queue is: [1, 2] (leftmost is front of the queue)  
myQueue.peek(); // return 1  
myQueue.pop(); // return 1, queue is [2]  
myQueue.empty(); // return false
```