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DAY-4

Q.1. Design a stack that supports push, pop, top, and retrieving the minimum element in constant time.

Implement the MinStack class:

- MinStack() initializes the stack object.
- void push(int val) pushes the element val onto the stack.
- void pop() removes the element on the top of the stack.
- int top() gets the top element of the stack.
- int getMin() retrieves the minimum element in the stack.

You must implement a solution with O(1) time complexity for each function.

Example 1:

Input

["MinStack","push","push","push","getMin","pop","top","getMin"]
[[],[-2],[0],[-3],[],[],[],[]]

Output

[null,null,null,null,-3,null,0,-2]

Explanation

MinStack minStack = new MinStack();
minStack.push(-2);
minStack.push(0);
minStack.push(-3);
minStack.getMin(); // return -3
minStack.pop();
minStack.top(); // return 0
minStack.getMin(); // return -2

Program Code:-

```cpp
#include <stack>
#include <iostream>
using namespace std;

class MinStack {
private:
    stack<int> mainStack;
    stack<int> minStack;

public:
    MinStack() {}

    void push(int val) {
        mainStack.push(val);
        if (minStack.empty() || val <= minStack.top()) {
            minStack.push(val);
        }
    }

    void pop() {
        if (mainStack.top() == minStack.top()) {
            minStack.pop();
        }
        mainStack.pop();
    }

    int top() {
        return mainStack.top();
    }

    int getMin() {
        return minStack.top();
    }
};

int main() {
    MinStack minStack;
    minStack.push(-2);
    minStack.push(0);
    minStack.push(-3);
    cout << minStack.getMin() << endl;
    minStack.pop();
    cout << minStack.top() << endl;
    cout << minStack.getMin() << endl;
    return 0;
```

```
}
```

Output:-

```
-3
0
-2
PS C:\Users\DELL\Desktop>
```

Q2 Given a string s, find the first non-repeating character in it and return its index. If it does not exist, return -1.

Example 1:

Input: s = "leetcode"

Output: 0

Explanation:

The character 'l' at index 0 is the first character that does not occur at any other index.

Example 2:

Input: s = "loveleetcode"

Output: 2

Example 3:

Input: s = "aabb"

Output: -1

Constraints:

- 1 <= s.length <= 105
- s consists of only lowercase English letters.

Program Code:-

```cpp
#include <iostream>
#include <string>
using namespace std;

class Solution {
public:
    int firstUniqChar(string s) {
        int lower[26] = {0};
        for (int i = 0; i < s.length(); i++) {
            lower[s[i] - 'a']++;
        }
        for (int i = 0; i < s.length(); i++) {
            if (lower[s[i] - 'a'] == 1) return i;
        }
        return -1;
    }
};
int main() {
    string s;
    cout << "Enter a string: ";
    cin >> s;
    Solution solution;
    int index = solution.firstUniqChar(s);
    if (index != -1) {
        cout << "The first unique character is at index: " << index << endl;
    } else {
        cout << "No unique character found in the string." << endl;
    }
    return 0;
}
```

Output:-

```
Enter a string: yfxywsg
The first unique character is at index: 1
PS D:\Coding\CAMP>
```

Q3

Implement a simple text editor. The editor initially contains an empty string, S.Perform Q operations of the following 4 types:

- append(W) - Append string W to the end of S.
- delete (k)- Delete the last k characters of S.
- print (k)- Print the k^th character of S.
- undo() - Undo the last (not previously undone) operation of type 1 or 2, reverting S to the state it was in prior to that operation.

Example 1

S = 'abcde'

Ops=['1 fg', '3 6', '2 5', '4', '3 7', '4', '3 4']

operation

index	S	ops[index]	explanation
0	abcde	1 fg	append fg
1	abcdefg	3 6	print the 6th letter - f
2	abcdefg	2 5	delete the last 5 letters
3	ab	4	undo the last operation, index 2
4	abcdefg	3 7	print the 7th characgter - g
5	abcdefg	4	undo the last operation, index 0
6	abcde	3 4	print the 4th character – d

The results should be printed as:

f

g

d

Input Format

The first line contains an integer,Q , denoting the number of operations.

Each line i of the Q subsequent lines (where $0 \leq i < Q$) defines an operation to be performed. Each operation starts with a single integer, t (where $t \in \{1,2,3,4\}$), denoting a type of operation as defined in the Problem Statement above. If the operation requires an argument, t is followed by its space-separated argument. For example, if t=1 and W="abcd" , line i will be 1 abcd.

Program Code:-

```
#include <iostream>
#include <vector>
#include <stack>
#include <string>
using namespace std;

class TextEditor {
private:
    string s;
    stack<string> undoStack;

public:
    TextEditor() {}

    void append(string w) {
        undoStack.push("1 " + w);
        s += w;
    }

    void deleteChars(int k) {
        string deleted = s.substr(s.size() - k);
        undoStack.push("2 " + deleted);
        s = s.substr(0, s.size() - k);
    }

    void print(int k) {
        cout << s[k - 1] << endl;
    }

    void undo() {
        if (undoStack.empty()) return;

        string operation = undoStack.top();
        undoStack.pop();

        if (operation[0] == '1') {
            s = s.substr(0, s.size() - operation.substr(2).size());
        } else if (operation[0] == '2') {
            s += operation.substr(2);
        }
    }
};

int main() {
    TextEditor editor;
```

```
    editor.append("abc");
    editor.print(3);    // c
    editor.deleteChars(3);
    editor.append("xy");
    editor.print(2);    // y
    editor.undo();
    editor.print(1);    // a
    return 0;
}
```

Output:-

```
pp -o A3 } ; if ($?) { .\A3 }
c
y
```

Q4.

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

Program Code:-

```
#include <stack>
#include <iostream>
using namespace std;

class MyQueue {
private:
    stack<int> stack1, stack2;

public:
    MyQueue() {}

    void push(int x) {
        stack1.push(x);
    }
    int pop() {
        if (stack2.empty()) {
            while (!stack1.empty()) {
                stack2.push(stack1.top());
                stack1.pop();
            }
        }
        int val = stack2.top();
        stack2.pop();
        return val;
    }
    int peek() {
        if (stack2.empty()) {
            while (!stack1.empty()) {
                stack2.push(stack1.top());
                stack1.pop();
            }
        }
        return stack2.top();
    }
    bool empty() {
        return stack1.empty() && stack2.empty();
    }
};

int main() {
    MyQueue queue;
    queue.push(1);
    queue.push(2);
```

```
    cout << queue.peek() << endl;
    cout << queue.pop() << endl;
    cout << queue.empty() << endl;
    return 0;
}
```

Output:-

```
1
1
0
PS C:\Users\DELL\Desktop>
```

Q5. You are given an array of strings tokens that represents an arithmetic expression in a Reverse Polish Notation.
Evaluate the expression. Return an integer that represents the value of the expression.
Note that:

- The valid operators are '+', '-', '*', and '/'.
- Each operand may be an integer or another expression.
- The division between two integers always truncates toward zero.
- There will not be any division by zero.
- The input represents a valid arithmetic expression in a reverse polish notation.
- The answer and all the intermediate calculations can be represented in a 32-bit integer.

Example 1:
Input: tokens = ["2","1","+","3","*"]
Output: 9
Explanation: ((2 + 1) * 3) = 9

Program Code:-

```
#include <iostream>
#include <stack>
#include <vector>
#include <string>
#include <cstdlib>
using namespace std;
```

```cpp
int evalRPN(vector<string>& tokens) {
    stack<int> stk;
    for (string& token : tokens) {
        if (token == "+" || token == "-" || token == "*" || token == "/") {
            int b = stk.top();
            stk.pop();
            int a = stk.top();
            stk.pop();

            if (token == "+") stk.push(a + b);
            else if (token == "-") stk.push(a - b);
            else if (token == "*") stk.push(a * b);
            else if (token == "/") stk.push(a / b);
        } else {
            stk.push(atoi(token.c_str()));
        }
    }
    return stk.top();
}

int main() {
    vector<string> tokens = {"2","1","+","3","*"};
    cout << evalRPN(tokens) << endl;

    tokens = {"4","13","5","/","+"};
    cout << evalRPN(tokens) << endl;

    tokens = {"10","6","9","3","+","-11","*","/","*","17","+","5","+"};
    cout << evalRPN(tokens) << endl;

    return 0;
}
```

Output:-

```
9
6
22
PS C:\Users\DELL\Desktop>
```