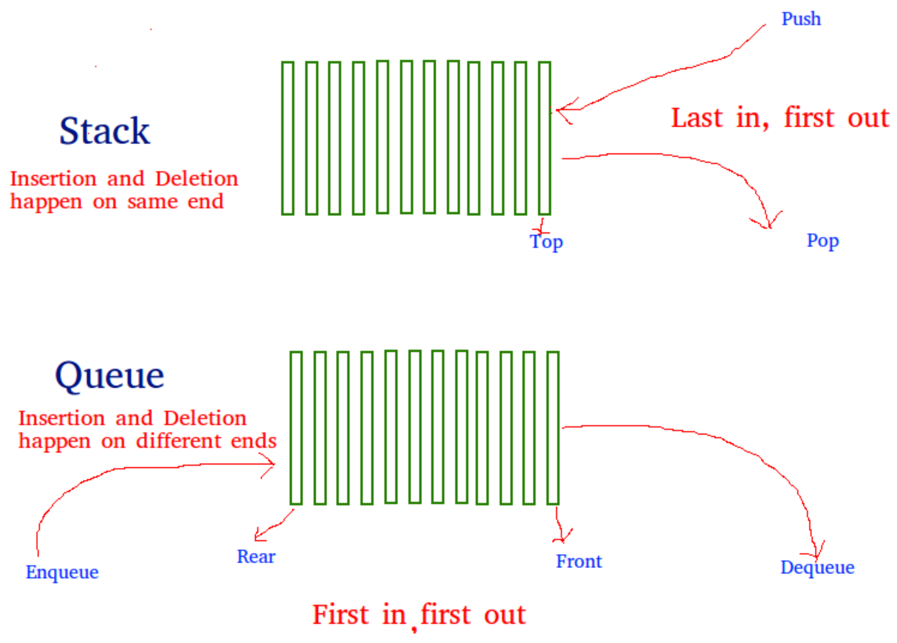
Implement Stack using Queues

The problem is opposite of this post. We are given a Queue data structure that supports standard operations like enqueue() and dequeue(). We need to implement a Stack data structure using only instances of Queue and queue operations allowed on the instances.


Push
Stack
Insertion and Deletion happen on same end
Last in, first out
Top
Pop
Queue
Insertion and Deletion happen on different ends
Enqueue
Rear
Front
Dequeue
First in, first out

Recommended: Please solve it on "*PRACTICE*" first, before moving on to the solution.

A stack can be implemented using two queues. Let stack to be implemented be 's' and queues us[illegible] implement be 'q1' and 'q2'. Stack 's' can be implemented in two ways:

Method 1 (By making push operation costly)

This method makes sure that newly entered element is always at the front of ‘q1’, so that pop operation just dequeues from ‘q1’. ‘q2’ is used to put every new element at front of ‘q1’.

```
push(s, x) // x is the element to be pushed and s is stack
  1) Enqueue x to q2
  2) One by one dequeue everything from q1 and enqueue to q2.
  3) Swap the names of q1 and q2

// Swapping of names is done to avoid one more movement of all elements
// from q2 to q1.

pop(s)
  1) Dequeue an item from q1 and return it.
```

```
/* Program to implement a stack using
two queue */
#include<bits/stdc++.h>
using namespace std;

class Stack
{
    // Two inbuilt queues
    queue<int> q1, q2;

    // To maintain current number of
    // elements
    int curr_size;

    public:
    Stack()
    {
        curr_size = 0;
    }

    void push(int x)
    {
        curr_size++;

        // Push x first in empty q2
        q2.push(x);

        // Push all the remaining
        // elements in q1 to q2.
        while (!q1.empty())
        {
            q2.push(q1.front());
            q1.pop();
        }

        // swap the names of two queues
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
    }

    void pop(){

        // if no elements are there in q1
        if (q1.empty())
            return ;
        q1.pop();
        curr_size--;
    }
    int top()
    {
        if (q1.empty())
            return -1;
        return q1.front();
    }

    int size()
    {
        return curr_size;
    }
};

// driver code
int main()
{
    Stack s;
    s.push(1);
    s.push(2);
    s.push(3);

    cout << "current size: " << s.size()
         << endl;
    cout << s.top() << endl;
    s.pop();
    cout << s.top() << endl;
    s.pop();
    cout << s.top() << endl;

    cout << "current size: " << s.size()
         << endl;
    return 0;
}
// This code is contributed by Chhavi
```

Run on IDE

Output :

```
current size: 3
3
2
1
current size: 1
```

Method 2 (By making pop operation costly)

In push operation, the new element is always enqueued to q1. In pop() operation, if q2 is empty then all the elements except the last, are moved to q2. Finally the last element is dequeued from q1 and returned.

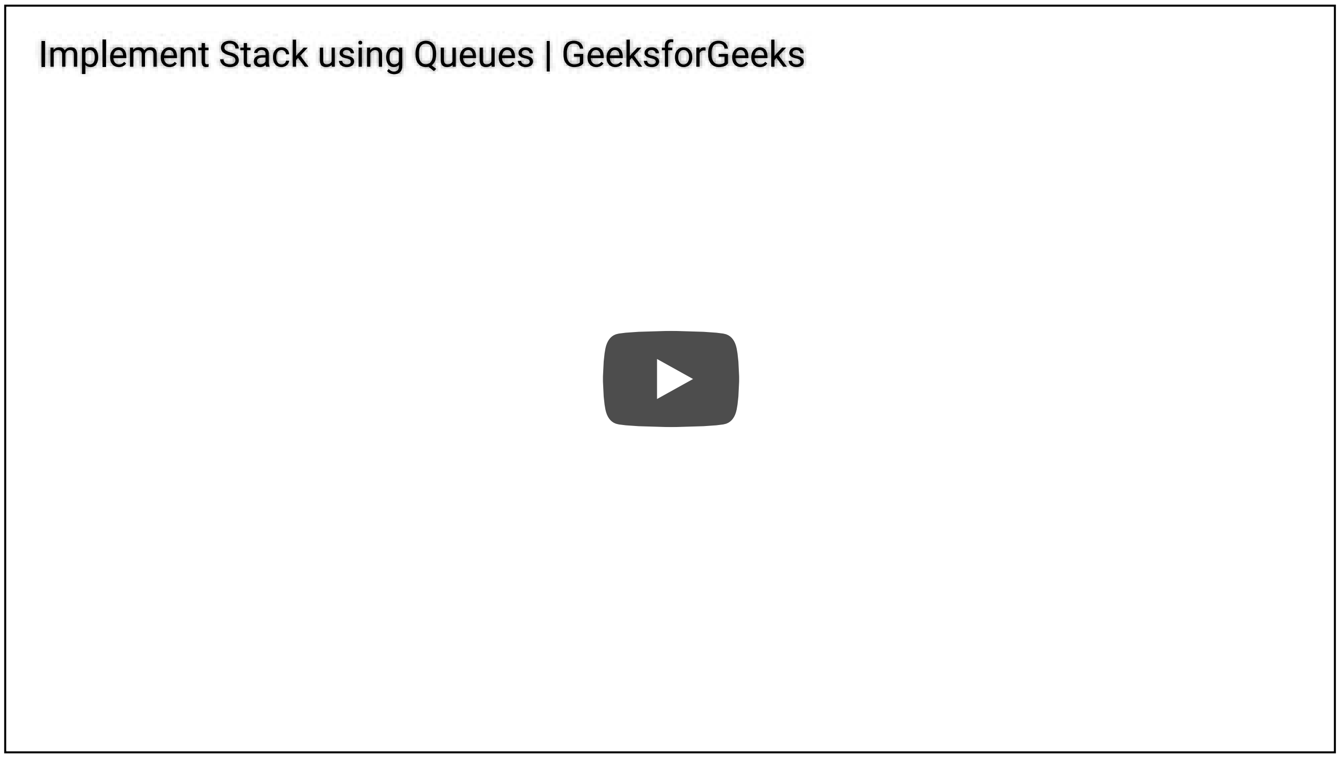
```
push(s,  x)
  1) Enqueue x to q1 (assuming size of q1 is unlimited).

pop(s)
  1) One by one dequeue everything except the last element from q1 and enqueue to q2.
  2) Dequeue the last item of q1, the dequeued item is result, store it.
  3) Swap the names of q1 and q2
  4) Return the item stored in step 2.
// Swapping of names is done to avoid one more movement of all elements
// from q2 to q1.
```

```
/* Program to implement a stack
using two queue */
#include<bits/stdc++.h>
using namespace std;

class Stack
{
    queue<int> q1, q2;
    int curr_size;

    public:
    Stack()
    {
        curr_size = 0;
    }

    void pop()
    {
        if (q1.empty())
            return;

        // Leave one element in q1 and
        // push others in q2.
        while (q1.size() != 1)
        {
            q2.push(q1.front());
            q1.pop();
        }

        // Pop the only left element
        // from q1
        q1.pop();
        curr_size--;

        // swap the names of two queues
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
    }

    void push(int x)
    {
        q1.push(x);
        curr_size++;
    }

    int top()
    {
        if (q1.empty())
            return -1;

        while( q1.size() != 1 )
        {
           q2.push(q1.front());
           q1.pop();
        }

        // last pushed element
        int temp = q1.front();

        // push last element to q2
        q2.push(temp);

        // swap the two queues names
        queue<int> q = q1;
        q1 = q2;
        q2 = q;
        return temp;
    }

    int size()
    {
        return curr_size;
    }
};

// driver code
int main()
{
    Stack s;
    s.push(1);
    s.push(2);
    s.push(3);
    s.push(4);

    cout << "current size: " << s.size()
         << endl;
    cout << s.top() << endl;
    s.pop();
    cout << s.top() << endl;
    s.pop();
    cout << s.top() << endl;
    cout << "current size: " << s.size()
         << endl;
    return 0;
}
// This code is contributed by Chhavi
```

Run on IDE

Output :

```
current size: 4
4
3
2
current size: 2
```



References:
Implement Stack using Two Queues

Asked in: Accolite, Adobe, Amazon, CouponDunia, DE Shaw, Grofers, Kritikal Solutions, Oracle, Snapdeal

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