CS 3358 Section 001 – Assignment 2

Due Date: September 29, 2021

This assignment has three parts pertaining to the queue implementation. The parts of code are given in the `.cpp` and `.h` files. The places you need to fill out in the code are marked by `// TODO`.

The queue implementation is supposed to be **array-based** in this assignment.

- (30 points) In `myqueue1.h`, implement the member functions of the class `MyQueue` based on the first method using a `counter` variable that keeps track of the number of elements in the queue.

- (30 points) In `myqueue2.h`, implement the member functions of the class `MyQueue` based on the second method using the `front` and `rear` indexes only (i.e., without having the `counter` variable).
    1. The number of elements in the queue must range from 0 to array size – 1 (i.e., the maximum capacity of the queue is the array size minus one).
    2. Make sure that the calculation of the current queue size in `CurrentSize()` is correct. It should be calculated based only on the `front` and `rear` indexes since there is no `counter` variable that tracks the number of elements in the queue.
    3. You may want to make use of `CurrentSize()`in `IsFull()` and `IsEmpty()`.

- (40 points) In `apptest.cpp`, complete the implementation of the function `CountStudent` for the following problem:

The CS department at Texas State offers red and blue t-shirts to students, referred to by numbers `0` and `1`, respectively. All students stand in a **queue**. Each student either prefers red or blue t-shirts.

The number of t-shirts provided by the department is equal to the number of students. The t-shirts are placed in a stack. At each step:

- If the student at the front of the queue **prefers** the t-shirt on the top of the stack, they will **take it and leave** the queue.
- Otherwise, they will **leave it and go to** the queue's end.

This continues until none of the queue students want to take the top t-shirt and are thus unable to have.

You are given two integer arrays `students` and `tshirts`, where `tshirts[i]` is the type of the i-th t-shirt in the stack (`i = 0` is the top of the stack) and `students[j]` is the preference of the j-th student in the initial queue (`j = 0` is the front of the queue). **Return the number of students who are unable to have the t-shirts.**

Compilation:
You can directly compile each of `queuetest.cpp` and `apptest.cpp` to the executable separately.

Submission:
You should submit your work via Canvas. You should pack `queuetest.cpp`, `apptest.cpp`, `myqueue1.h`, and `myqueue2.h` into a single `.zip` file to upload to Canvas. The `.zip` file should be named as `a2_yourNetID.zip`, such as `a2_d_n155.zip`.

Sample tests:
Note that successes in getting the following test results do not guarantee the correctness of your work and therefore do not guarantee you a satisfactory grade, while failures in getting the following test results probably do indicate flaws in your work and you may lose points.

Sample output for `queuetest`:

```
Testing the basic functions of your queue...
Please enter the max size/capacity of your queue: 3
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 5
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 8
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 7
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Nothing can be enqueued since the queue is full!
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
5 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
8 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
7 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
Nothing has been popped out since the queue is empty!
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: s
```

Another run:

```
Testing the basic functions of your queue...
Please enter the max size/capacity of your queue: 3
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 1
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 2
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 3
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Nothing can be enqueued since the queue is full!
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
1 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 4
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
2 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
3 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
4 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
Nothing has been popped out since the queue is empty!
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 5
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: e
Please enter an integer-type value you want to enqueue: 6
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
5 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
6 has been popped out.
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: d
Nothing has been popped out since the queue is empty!
Please enter 'e' for enqueue, 'd' for dequeue, and 's' for stop: s
```

Output for `apptest`:

```
Testing the CountStudent function...
Student Queue: 1 1 0 0
T-shirt Stack: 0 1 0 1
Number of students who are unable to have the t-shirts is: 0
Testing the CountStudent function...
Student Queue: 1 1 1 0 0 1
T-shirt Stack: 1 0 0 0 1 1
Number of students who are unable to have the t-shirts is: 3
Testing the CountStudent function...
Student Queue: 1 1 0 0 1 1 0
T-shirt Stack: 0 1 0 1 0 0 0
Number of students who are unable to have the t-shirts is: 2
```