Linked Queue Push Operation

Assume that we have the following lines of code:

```
myqueue queue1;      // Line 1

queue1.push(5);      // Line 2
queue1.push(8);      // Line 3
queue1.push(3);      // Line 4
```

The following sequence of diagrams shows how the `myqueue` object and its associated dynamic storage changes as these lines are executed.

Figure 1: The new, empty `myqueue` object `queue1` created in Line 1 of the code above. The `q_front` and `q_back` pointers are `nullptr`, while `q_size` is 0.

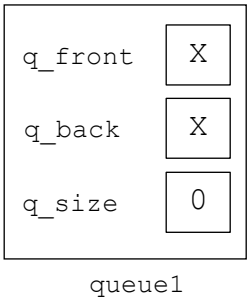


Figure 2a: The call to `push()` in Line 2 causes a new list `Node` to be allocated using the temporary pointer `new_node`. The node's `value` field is initialized to the value passed to `push()`, while its `next` field is initialized to `nullptr`.

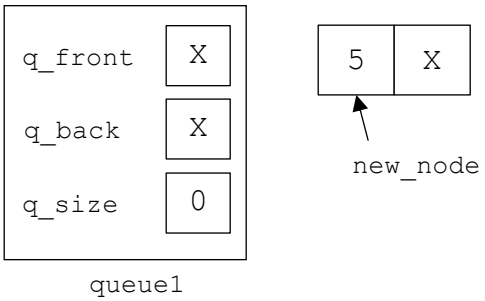


Figure 2b: Since the queue is currently empty, the pointer `q_front` is set to point at `new_node`. Then `q_back` is set to point at `new_node` and the `q_size` is incremented to 1.

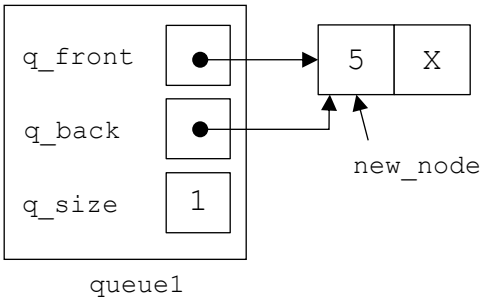


Figure 2c: When the `push()` method ends, the local variable `new_node` ceases to exist.

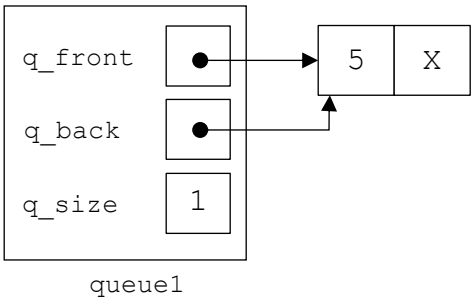


Figure 3a: The call to `push()` in Line 3 causes a new list `Node` to be allocated using the temporary pointer `new_node`. The node's `value` field is initialized to the value passed to `push()`, while its `next` field is initialized to `nullptr`.

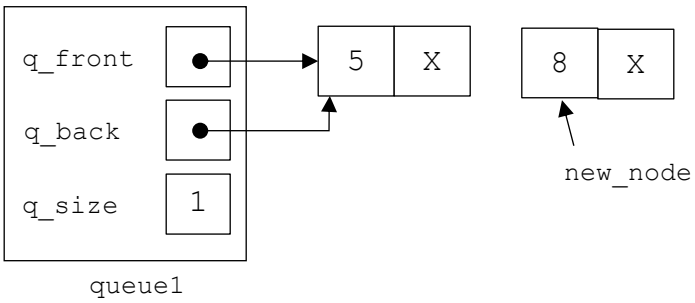


Figure 3b: Since the queue is not empty, the pointer `q_back->next` is set to point at `new_node`. Then `q_back` is set to point at `new_node` and the `q_size` is incremented to 2.

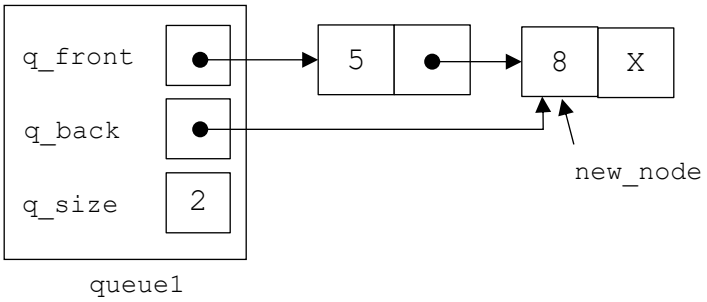


Figure 3c: When the `push()` method ends, the local variable `new_node` ceases to exist.

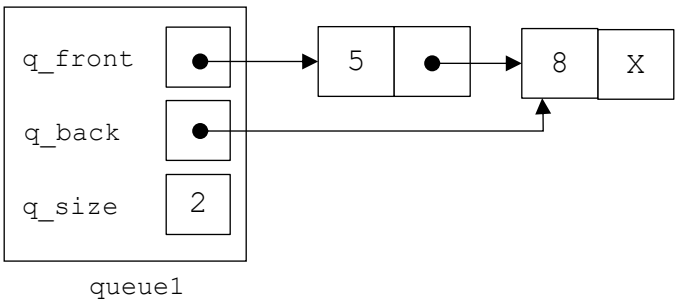


Figure 4a: The call to `push()` in Line 4 causes a new list `Node` to be allocated using the temporary pointer `new_node`. The node's `value` field is initialized to the value passed to `push()`, while its `next` field is initialized to `nullptr`.

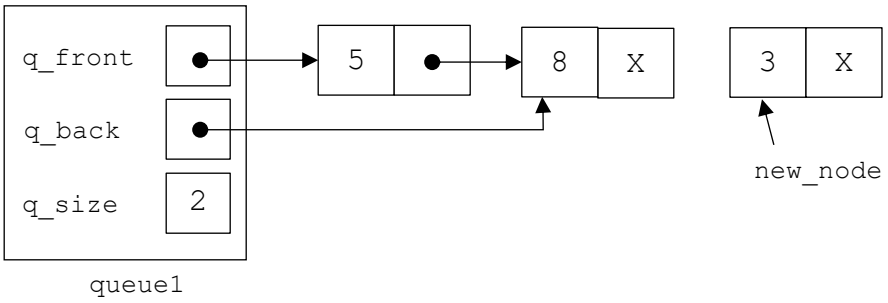


Figure 4b: Since the queue is not empty, the pointer `q_back->next` is set to point at `new_node`. Then `q_back` is set to point at `new_node` and the `q_size` is incremented to 3.

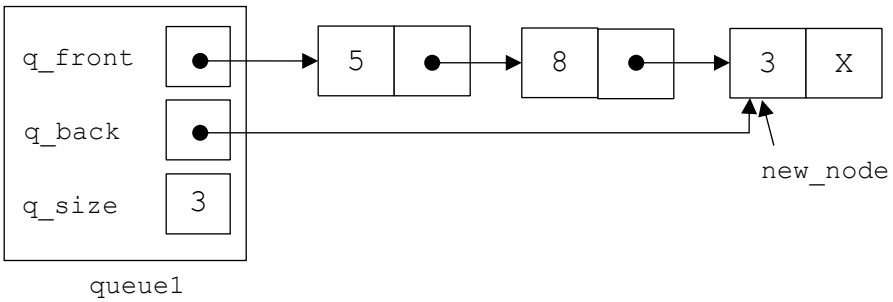
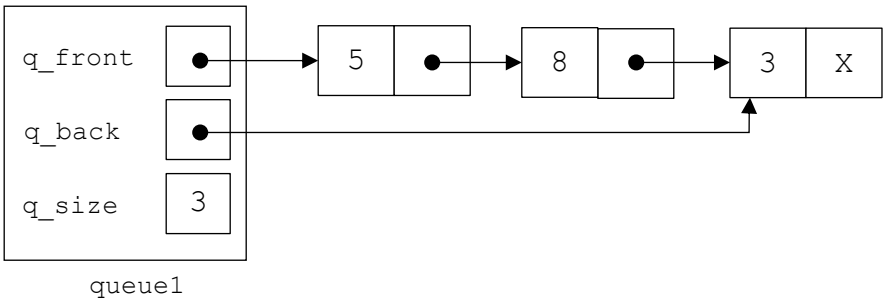


Figure 4c: When the `push()` method ends, the local variable `new_node` ceases to exist.



Linked Queue Pop Operation

Assume that we then add the following lines of code after the code listed above:

```
queue1.pop();        // Line 5
queue1.pop();        // Line 6
queue1.pop();        // Line 7
```

The following sequence of diagrams shows how the `myqueue` object and its associated dynamic storage changes as these lines are executed.

Figure 5a: The call to `pop()` in Line 5 creates the temporary pointer `del_node` and sets it to the value of `q_front`.

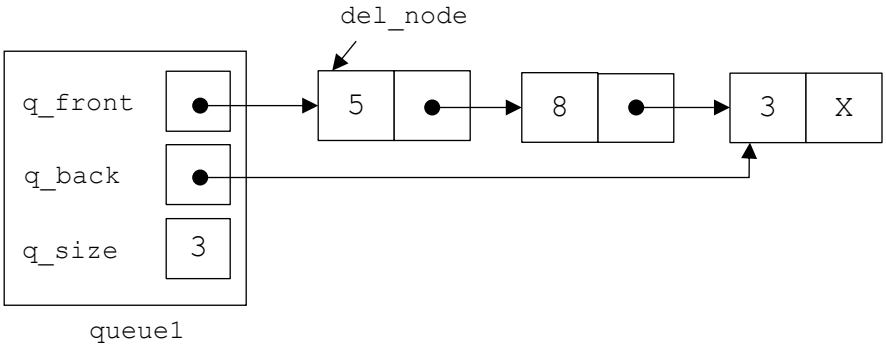


Figure 5b: The pointer `q_front` is set to `q_front->next`. It now points to the 2nd node in the list. `q_front` is not `nullptr`, so `q_back` is not changed.

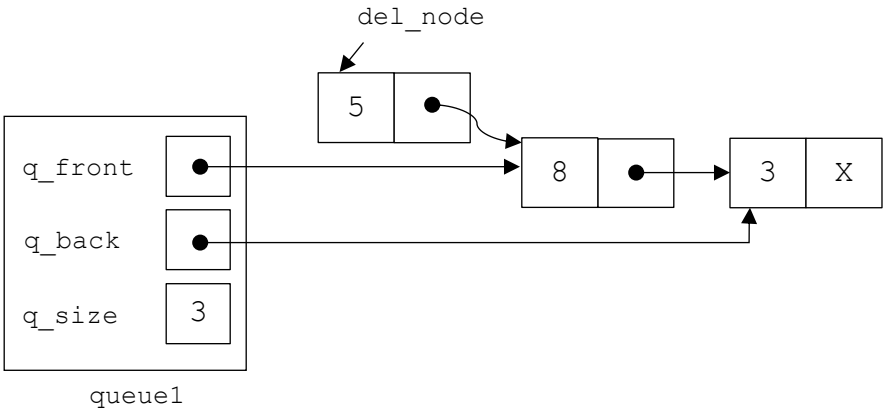


Figure 5c: The node pointed to by `del_node` is deleted and `q_size` is decremented to 2.

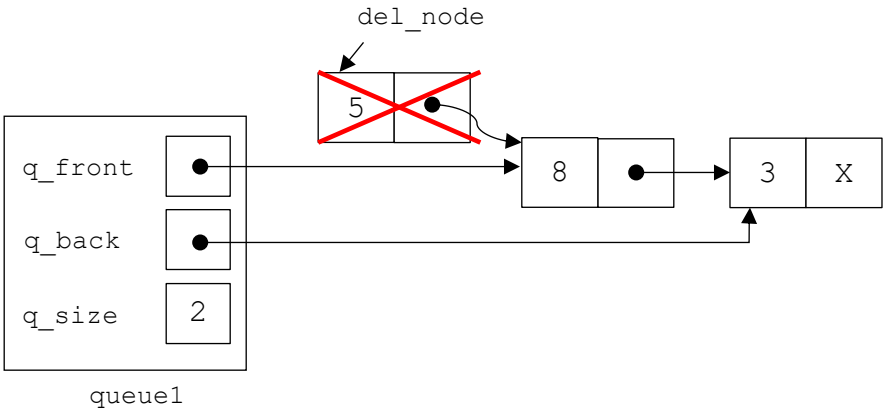


Figure 5d: When the `pop()` method ends, the local variable `del_node` ceases to exist.

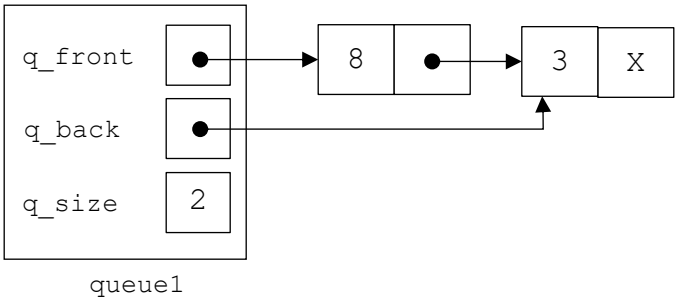


Figure 6a: The call to `pop()` in Line 6 creates the temporary pointer `del_node` and sets it to the value of `q_front`.

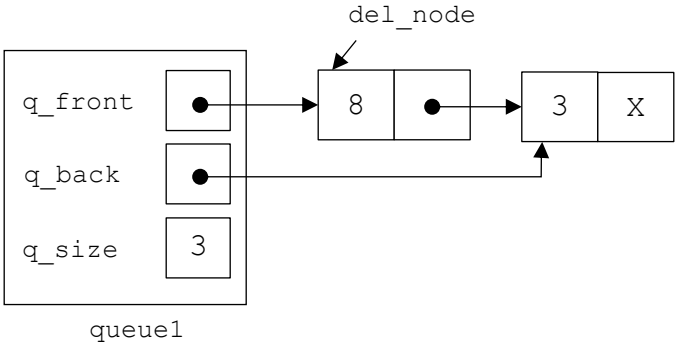


Figure 6b: The pointer `q_front` is set to `q_front->next`. It now points to the 2nd node in the list. `q_front` is not `nullptr`, so `q_back` is not changed.

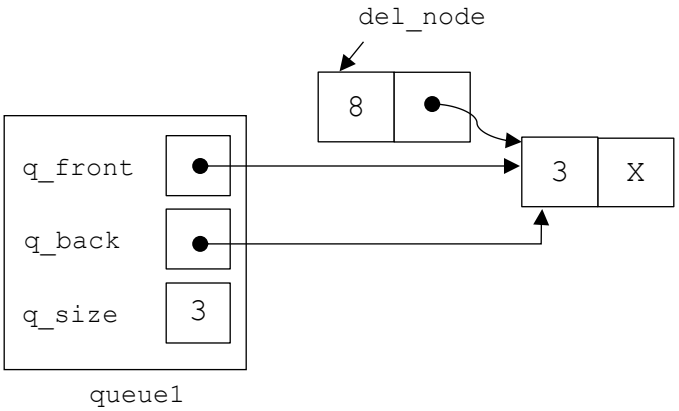


Figure 6c: The node pointed to by `del_node` is deleted and `q_size` is decremented to 1.

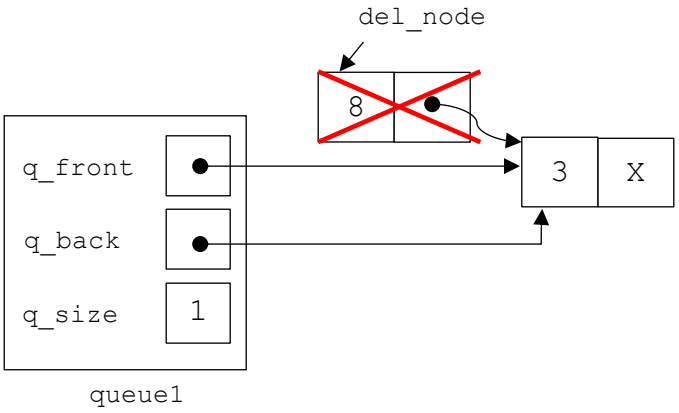


Figure 6d: When the `pop()` method ends, the local variable `del_node` ceases to exist.

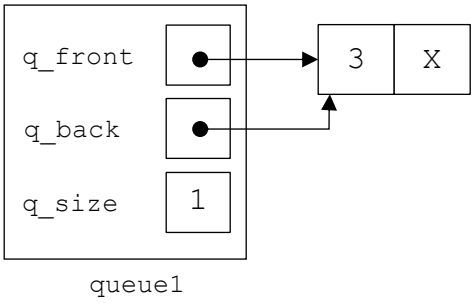


Figure 7a: The call to `pop()` in Line 7 creates the temporary pointer `del_node` and sets it to the value of `q_front`.

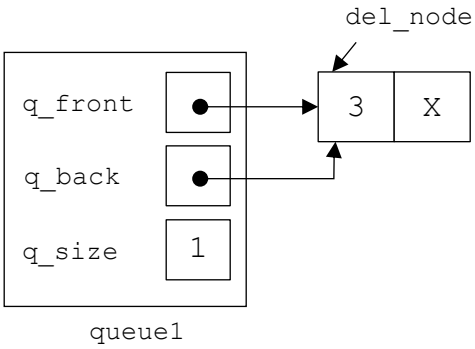


Figure 7b: The pointer `q_front` is set to `q_front->next`. It is now `nullptr`. Since `q_front` is `nullptr`, `q_back` is also set to `nullptr`.

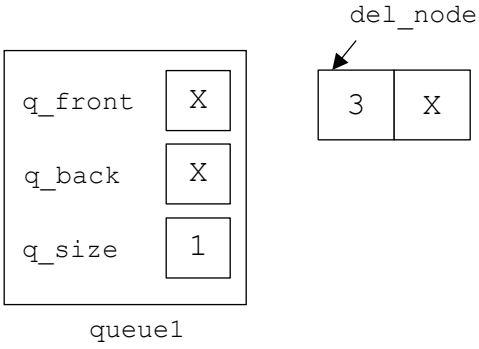


Figure 7c: The node pointed to by `del_node` is deleted and `q_size` is decremented to 0.

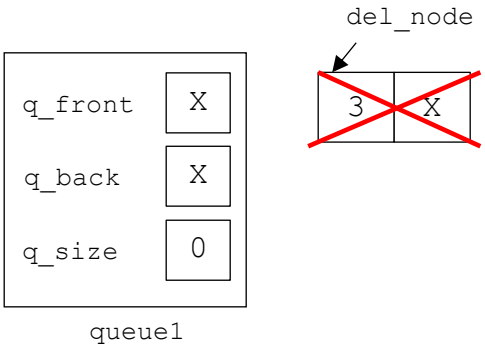


Figure 7d: When the `pop()` method ends, the local variable `del_node` ceases to exist. The queue is now empty.