

CSCE 221 Assignment 3 Cover Page

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I certify that I have listed all the sources that I used to develop the solutions/codes to the submitted work.
On my honor as an Aggie, I have neither given nor received any unauthorized help on this academic work.

Your Name

Date

CSCE 221 Assignment 3

Spring 2019

due to eCampus by March 7, and demonstration of Part 1 in labs on February 27

Objective

This is an individual assignment which has two parts.

1. Part 1: C++ implementation of `DoublyLinkedList` for `int` and generic types based on the provided supplementary code.
2. Part 2: C++ implementation of `MinQueue` data structure that can store *comparable elements*.

Part 1: Implementation of `DoublyLinkedList`

1. Untar supplementary code `221-A3-code.tar`. Use the 7-zip software to extract the files in Windows, or use the following command in Linux.

```
tar xfv 221-A3-code.tar
```

2. `DoublyLinkedList` for integers

- (a) Most of the code is extracted from the lecture slides. An exception structure is defined to complete the program.
- (b) You need to complete the functions which are declared in the header file `DoublyLinkedList.h`.
- (c) Type the following commands to compile the program

```
make
```

- (d) The main program includes examples of creating doubly linked lists, and demonstrates how to use them. Type the following command to run the executable file:

```
./run-dll
```

- (e) Test the doubly linked list functions in `main`.

3. Implement a templated version of the class `DoublyLinkedList` and test the functions for correctness. Follow the instructions below:

- (a) Templates should be declared and defined in a header `.h` file. Move the content of `DoublyLinkedList.cpp` and `DoublyLinkedList.h` to `TemplateDoublyLinkedList.h`
- (b) Replace `int obj` by `T obj` in the struct `DListNode` so the list nodes store generic `T` objects instead of integers. Later on, when a `DListNode` object is created, say, in the main function, `T` can be specified as a `char`, `string` or a user-defined class.
- (c) To create a templated class with a generic type `T`, you must replace a declaration/return type `int` by `T` (except for the `count` variable).
 - i. To use the generic type `T`, you must change each type declaration.
 - ii. Use the generic type `T` anywhere throughout the class `TemplateLinkedList`.
- (d) Add the keyword `template <typename T>` before a class declaration.
- (e) In each member function signature, replace `DoublyLinkedList::` by `DoublyLinkedList<T>::`
- (f) If a member function is defined outside the class declaration, change the function signature, that is, replace `LinkedList::` by `TemplateLinkedList<T>::`

- (g) To use the generic type `T` anywhere throughout the class `DListNode` and `DoublyLinkedList`, you must declare (add) `template <typename T>` before classes and member functions defined outside the class declaration.
4. Compile and run the generic version in a similar way as for `int` type. Type the following commands to compile the program.

```
make
```

5. The main program includes examples of creating doubly linked lists of `string`, and demonstrates how to use them. Type the following command to run the executable.

```
./run-tdll
```

Part 2: Implementation of MinQueue data structure based on DoublyLinkedList

The `MinQueue` data structure should store *the comparable elements* that support the queue operations: `enqueue(x)`, `dequeue()`, `size()`, `isEmpty()`, and in addition the `min()` operation that returns (but not deletes) the smallest value currently stored in the queue.

Use the adapter design pattern for implementation of `MinQueue` that work together with the class `DoublyLinkedLists` defined in the Part 1. The runtime worst case of all operations except `min()` should be *constant*, $O(1)$.

The implementation details of the `MinQueue` operations, justification of their running time, and tests for correctness should be provided in the part 2 of the report.

What to submit to eCampus?

- Create a directory for the Part 1 that includes: `DoublyLinkedList` source code for `int` and generic types, typed report with description of the linked list implementation, complexity analysis of code expressed in terms of big-O, and the test cases done for correctness.
- Create a directory for the Part 2 that includes: `MinQueue` source code, typed report with description of the `MinQueue` class implementation, complexity analysis of code expressed in terms of big-O, and the test cases done for correctness.
- Make a tar file that contains the Part 1 and Part 2 directories and submit it to eCampus for grading.