

CSCE 221 Assignment 3 Cover Page

First Name

Last Name

UIN

User Name

E-mail address

Please list all sources in the table below including web pages which you used to solve or implement the current homework. If you fail to cite sources you can get a lower number of points or even zero, read more on Aggie Honor System Office website: <http://aggiehonor.tamu.edu/>

Type of sources				
People				
Web pages (provide URL)				
Printed material				
Other Sources				

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

Summer 2017

due to eCampus by July 29th, and demonstration of Part 1 in labs on July 24th.

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.