

CSC-363: Problem Set 4: C/C++ I

For this homework, you will implement a `LinkedList` class: a template implementation of a singly-linked list.

Linked List

The `LinkedList` class *must* be implemented with head and tail sentinel nodes. The `LinkedList` class will inherit from the abstract class `ListInterface` shown below. Your `LinkedList` class will implement all functions defined in the `ListInterface` and test accordingly with those tests described in `LinkedListTester`.

```
template <typename T>
class ListInterface
{
    // Returns the first element in the list
    virtual T& first() const = 0;

    // Returns the first element in the list
    virtual T& last() const = 0;

    // Determines if the linked list contains no elements.
    virtual bool isEmpty() const = 0;

    // Returns the number of elements in this container
    virtual unsigned size() const = 0;

    // Adds an item to the left side of the linked list
    virtual void push(const T& x) = 0;

    // Removes and returns an item from the left side of the queue.
    virtual bool pop() = 0;

    // Returns the item at the given index: list[n]
    // @throws a std::string exception if n is out of bounds.
    virtual T& operator[](unsigned n) = 0;

    // Determines if a target value is in the LinkedList; uses == for equality
    // comparison
    virtual bool contains(const T& target) const = 0;

    // Erase an element in the linked list (not based on an iterator)
    virtual bool remove(const T& target) = 0;

    //
    // Returns the 1-based position where an object is on this queue.
    // If the object target occurs as an item in this queue, this function
    // returns the distance from the top of the queue of the occurrence
    // nearest the top of the queue; the topmost item on the queue is
    // considered to be at distance 1. The overloaded == function is used to
    // compare target to the items in this queue.
    //
    virtual int search(const T& target = T{}) const = 0;

    // Delete everything from the linked list
    virtual void clear() = 0;
};
```

Testing

A complete test suite has been provided. The `main` function initiates the complete test suite for `LinkedList`.

Notes

- Make sure to review the provided code.
- Recall, that when defining a template class in C++, both the class definitions and all functions must be defined in the same file (a `.hpp` file).

Submitting

Header Comments

Your program must use the following standard comment at the top of *each source code file*. Copy and paste this comment and modify it accordingly.

```
/*
<Student Name>
<File Name>
<Assignment>
<Describe, in general, the code contained.>
*/
```

Inline Comments

Please comment your code with a *reasonable amount of comments* throughout the program. Each function should have a comment that includes information about input, output, overall operation of the function, as well as any limitations that might raise exceptions. Each *block* of code (3-4 or more lines in sequence) in a function should be commented.

It is prohibited to state *long* comments to the right of lines of source code.

Proof of Program Execution

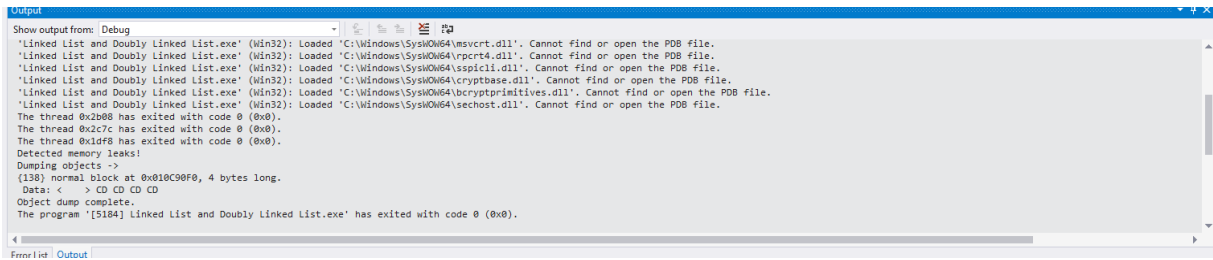
Execute your code and take a screenshot of the associated output window. Place these *labeled* screenshots into a word processing document (Word, OpenOffice, GoogleDocs, etc.) in an ordered manner.

Last, create a PDF of this document and call it `evidence.pdf`.

Verification of Proper Memory Management

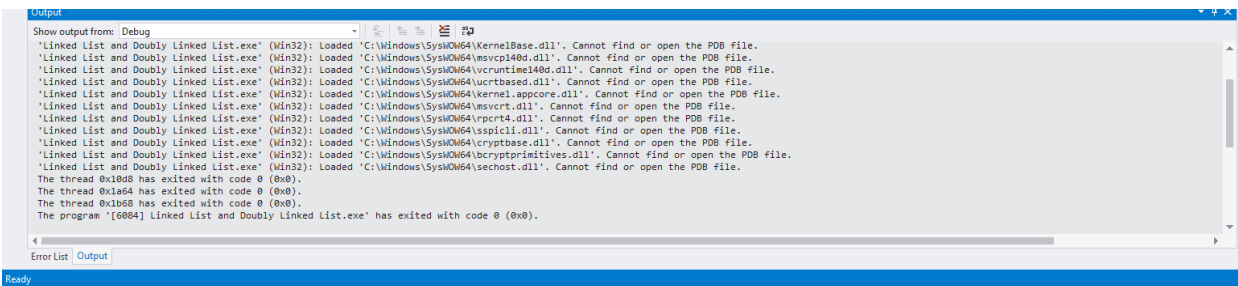
Your implementation should have no memory leaks; include a screenshot of the output window in the `evidence.pdf` file.

Indicates a Leak:



```
Output
Show output from: Debug
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\msvcrt.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\rpcrt4.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\sspicli.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\cryptbase.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\bcryptprimitives.dll'. Cannot find or open the PDB file.
The thread 0x2008 has exited with code 0 (0x0).
The thread 0x2c7c has exited with code 0 (0x0).
The thread 0x1d8 has exited with code 0 (0x0).
Detected memory leaks!
Dumping objects ->
(138) normal block at 0x010C90F0, 4 bytes long.
Data: < > CD CD CD CD
Object dump complete.
The program '[5184] Linked List and Doubly Linked List.exe' has exited with code 0 (0x0).
```

Indicates no memory leaks.



```
Output
Show output from: Debug
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\kernelbase.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\msvcpl40d.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\ucrtime140d.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\ucrtime140d.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\kernel.appcore.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\msvcrt.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\rpcrt4.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\sspicli.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\cryptbase.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\bcryptprimitives.dll'. Cannot find or open the PDB file.
'Linked List and Doubly Linked List.exe' (Win32): Loaded 'C:\Windows\System64\sechost.dll'. Cannot find or open the PDB file.
The thread 0x10d8 has exited with code 0 (0x0).
The thread 0x1a64 has exited with code 0 (0x0).
The thread 0x10d8 has exited with code 0 (0x0).
The program '[6084] Linked List and Doubly Linked List.exe' has exited with code 0 (0x0).
```

Source Code Files

Place all source files (only *.cpp, *.hpp, *.h) into a folder name `src`.

Final Submission File

In a folder named `lab`, place (1) folder `src`, and (2) `evidence.pdf`. Zip folder `lab` and label that zip file as `lab.zip`.

Submit your zip file on Moodle.