CSCI-1200 Data Structures — Spring 2023
Lab 7 — List Implementation

Checkpoint 1

estimate: 20-30 minutes

For our warmup exercise, let's reverse a home-made singly-linked chain of `Node` objects by writing a function `reverse`.

Pull out some paper. Following the conventions from lecture, draw a picture of a "homemade" singly-linked list that stores the values 1, 2, 3, and 4. Make a variable on the stack named `my_list` of type `Node*` that points to the first node in the chain (the node storing the value 1). The 4 node objects should be separate blobs of memory dynamically-allocated on the heap.

Now, *modify this diagram* to reverse the list – you can do this by only changing pointers! You should use the existing node objects. Don't copy the entire diagram or make any new nodes. You should not change the values inside of any node – *don't swap values.*

Then, write pseudo-code to reverse this list, just changing the pointers as you diagrammed above. You may use helper variables (of type `Node*`) but no other data structures or variables. *Remember that when we directly manipulate homemade linked lists we don't use iterators.*

Finally, download this starter code:
http://www.cs.rpi.edu/academics/courses/spring23/csci1200/labs/07_list_implementation/checkpoint1.cpp

Complete the `reverse` function using your diagram and pseudocode as a guide. Test and debug the code. Add a few additional test cases to the main function to ensure your code works with an empty list, and lists with one or two values. Also add a test or two of a node chain with something other than `int`s.

If you have time, write 2 versions of this function, one version should be iterative (using a `for` or `while` loop) and one version should be recursive.

To complete this checkpoint, show a TA or mentor your diagram and your debugged function(s) to reverse a homemade singly-linked list.

The rest of this lab gives you practice in working with our implementation of the `dslist` class that mimics the STL `list` class. Create a directory/folder named `lab7` and download these files into that folder:

http://www.cs.rpi.edu/academics/courses/spring23/csci1200/labs/07_list_implementation/dslist.h
http://www.cs.rpi.edu/academics/courses/spring23/csci1200/labs/07_list_implementation/checkpoint2.cpp

Checkpoint 2

estimate: 20-30 minutes

The implementation of the `dslist` class is incomplete. In particular, the class is missing the `destroy_list` private member function that is used by the destructor and the `clear` member function. The provided test case in `checkpoint2.cpp` works "fine", so what's the problem?

Before we fix the problem, let's use Dr. Memory and/or Valgrind to look at the details more carefully. You should use the memory debugging tools *both* on your local machine *and* by submitting the files to the homework server. Study the memory debugger output carefully. The output should match your understanding of the problems caused by the missing `destroy_list` implementation. Ask a TA if you have any questions.

Now write and debug the `destroy_list` function and then re-run the memory debugger (both locally and on the submission server) to show that the memory problems have been fixed. Also finish the implementation of the `push_front`, `pop_front`, and `pop_back` functions.

To complete this checkpoint, show a TA the implementation and memory debugger output before and after writing `destroy_list`.

Checkpoint 3

estimate: 30-50 minutes

For the remainder of lab time, work on Homework 5 and ask your TA and mentors lots of questions!

First make sure to finish the diagrams for `Separate` as described on page 3 of the Homework 5 handout.

Be prepared to discuss your debugging & testing strategy. What "corner" cases will you need to test to be sure that your functions are fully debugged (and will get full credit on any hidden tests on the server)? How will you write those test cases and verify they are working?

(∼20 minutes before the end of lab:) To complete this checkpoint and the entire lab, show your TA or mentor your hand-drawn `Separate` cases and your progress on the homework.