

# CS 455 Extra Credit Assignment

Spring 2024 [Bono]

**Due:** Tuesday, Apr. 30, 11:59pm*No work accepted after this date.*

## Introduction and Background

This is an extra credit assignment worth 3%. (So, someone with a perfect score in the course who also got full marks on this could have 103 weighted points at the end, out of 100 points of required work.) It is open to anyone in the class, but is completely optional.

The assignment is to implement and test some functions that operate on C++ linked lists. It's like a lab, although a bit bigger than a lab; but unlike a lab you are required to do the work independently (i.e., no partnerships).

Like PA5, this is a multi-file program with a Makefile that uses separate compilation. We did that primarily to give us the freedom to easily test your code using a different test driver than the one you're writing here. Hopefully between the Makefile handout (readings for Week 14), the recent lectures, and the last assignment, you are feeling comfortable with multi-file C++ programs.

## The assignment files

The files in **bold** below are ones you modify and submit. The ones not in bold are ones that you will use, but not modify.

- **ecListFuncs.h** This contains the Node struct definition for our linked lists (but not the method implementations) and commented prototypes for the functions you are required to write.
- **ecListFuncs.cpp** Implementation file for the the list functions required for this assignment. Stub versions of the functions are already provided so you can compile the program right from the start. Also has the definitions of the Node constructors.
- **ectest.cpp** A test program for your list functions.
- **Makefile** A file with rules for the "make" command. There are comments at the top of the file telling you how to use it.
- **README** See section on [Submitting your program](#) for what to put in it. Before you start the assignment please read the following statement which you will be "signing" in the README:

"I certify that the work submitted for this assignment does not violate USC's student conduct code. In particular, the work is my own, not a collaboration, and does not involve code created by other people or AI software, with the exception of the resources explicitly mentioned in the CS 455 Course Syllabus. And I did not share my solution or parts of it with other students in the course."

## The assignment

Do the following two tasks:

1. Complete the implementation of the test program **ectest.cpp**. It should be a *non-interactive* program that thoroughly tests the three functions specified in **ecListFuncs.h**. It should compare the actual results to the expected results for each case you test, and print out the message "FAILED" for any test cases where the expected result does not match the actual result. You should also print out something about what each test case is (input and results), but it's up to

- you what that will look like. Note: we provided a few helper functions to make it easier to test your code on hard-coded lists and print out results: see `ectest.cpp` for details.
2. Complete the implementation of the three functions `isMonotonicIncr`, `removeMax`, and `fillGaps`, described in more detail in `ecListFuncs.h`. None of the functions depend on each other, and we will test each of them separately, so you can still get some extra credit by just implementing some of the functions. Use the test program you completed in the previous step to test each of these functions as you implement them.

The complete specification for these functions (i.e., prototypes + function comments) are given in `ecListFuncs.h`. You put your implementations of these functions, including any helper functions, in `ecListFuncs.cpp`.

We provided a Makefile. To compile the code use the command:

```
make ectest
```

## Grading criteria

Unlike other programming assignments this one will be graded primarily on correctness. You will also be evaluated on whether you have a test program that meets the spec given, and thoroughly tests all of the list functions you implemented.

Another evaluation criterion is not wasting resources. For example, you will lose credit if you implement what should be an  $O(n)$  function in  $O(n^2)$ , or if you have memory leaks, e.g., by doing unnecessary calls to `new`, or not reclaiming memory no longer needed. However, it's fine if your test program (`ectest.cpp`) doesn't reclaim memory for any linked list(s) it creates for testing your three functions once it's done with those list(s).

Additionally, the `ecListFuncs.cpp` functions that modify a list are meant to add or remove nodes from an existing list: not rebuild a list from scratch with all new nodes.

We will not be evaluating your code on style, except that if your code is so messy/unreadable that we can't evaluate the aspects mentioned in the previous paragraphs you will just lose credit for that part. (I would hope things like using good names and consistent indenting are automatic for you by now.) You are not required to write helper functions, but you we encourage you to do so to increase code readability and reuse. Helper functions may be helpful in both your test program and for the the list functions you're implementing.

For each of the three functions in `ecListFuncs.cpp`, you will receive no credit for the function if it prints anything.

You will also receive no credit for any of the three functions implemented, but with no accompanying code to test that function in `ectest.cpp`.

## README file / Submitting your program

Your `README` file must document which of the functions you successfully completed and known bugs in your program (this might be in the form of test cases you tried, but that didn't work), and any special instructions or other information for the grader. It must also contain the signed [certification](#) shown near the top of this document.

The submit script will check that the necessary files are present, will compile them, and will make sure there are no `cout` statements in your `ecListFuncs.cpp` code.