

CS 2110 Timed Lab 4: C

Your TAs

Spring 2020

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Please take the time to read the entire document before starting the assignment. It is your responsibility to follow the instructions and rules.

1 Timed Lab Rules - Please Read

1.1 General Rules

1. You are permitted to submit the timed lab at any time prior to 11:59 pm EDT (Eastern Daylight Time).
2. Although you may ask TAs for clarification via Piazza as a private post, you are ultimately responsible for what you submit. **The information provided in this Timed Lab document takes precedence.** If in doubt, please make sure to indicate any conflicting information to your TAs.
3. **You are strictly prohibited from collaborating or communicating with any other person about Timed Lab 4 or any materials deemed to be related to Timed Lab 4. If any collaboration of any kind is detected, you will receive a 0 on the assignment and may be reported to the Office of Student Integrity.**
4. We reserve the right to monitor your computer during the 24-hour Timed Lab period using cameras, packet capture software, and other means.

1.2 Submission Rules

1. Follow the guidelines under the Deliverables section.
2. You are also responsible for ensuring that what you turned in is what you meant to turn in. After submitting you should be sure to download your submission into a brand new folder and test if it works. No excuses if you submit the wrong files, what you turn in is what we grade. In addition, your assignment must be turned in via Gradescope.
3. Do not submit links to files. We will not grade assignments submitted this way as it is easy to change the files after the submission period ends.

1.3 Is collaboration allowed?

To reiterate, absolutely NOT. No collaboration is allowed for timed labs.

2 Overview

2.1 Description

In this timed lab, you'll be writing two functions which will act on a singly linked list of pokemon structs. The first of these, `deep_copy()`, performs a deep copy on a list.

The second function, `destroy()`, takes a pointer to a list and destroys the list, freeing all dynamically-allocated memory associated with it.

3 Instructions

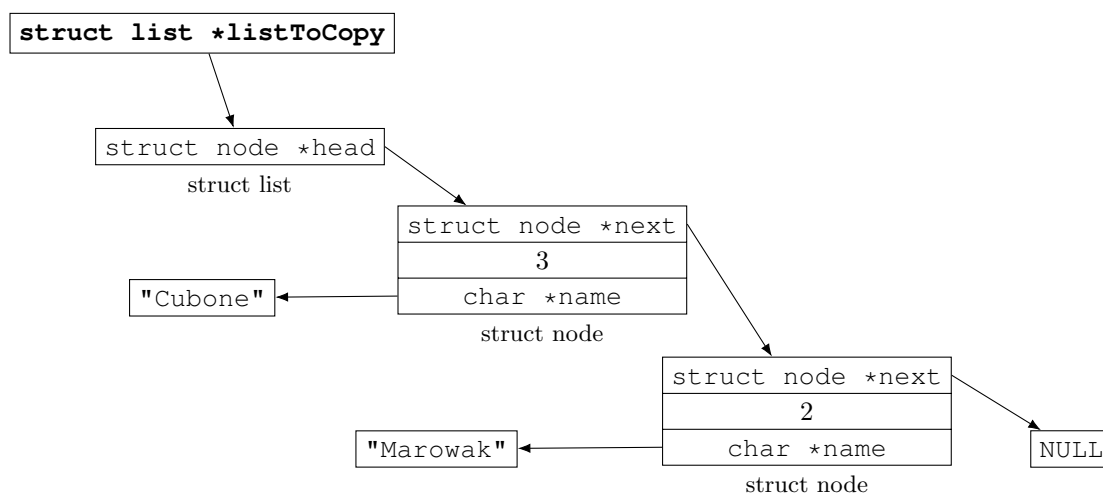
You have been given one C file - `tl4.c` - in which you should complete the `deep_copy()` and `destroy()` functions according to the comments.

You should **not** modify any other files. Doing so may result in point deductions. You should also **not** modify the `#include` statements, nor add any more. You are also not allowed to add any global variables.

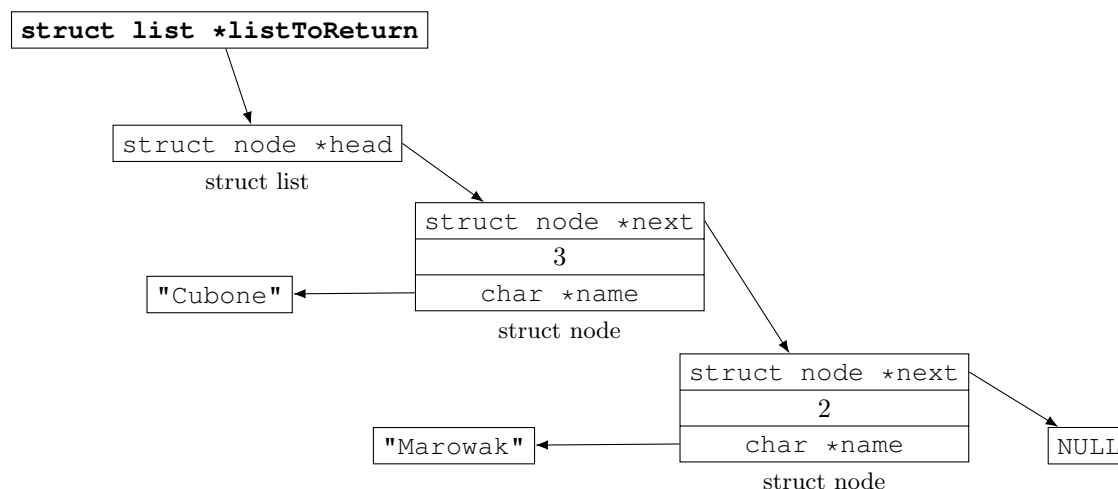
3.1 Writing `deep_copy()`

The function `deep_copy()` takes in one argument, a pointer to `List` and returns a pointer to a newly allocated `List`. You should allocate memory for any nodes or elements of the node that are dynamically allocated. If the system cannot allocate enough memory to perform a deep copy, any allocations performed within the function should be freed, and `NULL` should be returned. There's an example below:

Original:



Deep Copy:



3.2 Writing `destroy()`

The function `destroy()` takes in one argument, a pointer to `struct list`, and does not return anything. After this function executes, all dynamically allocated memory associated with `listToDestroy` must be

freed. This includes any node structs in the list and their pokemon struct data, the list itself, and *any* other heap data referenced by any of these structs.

4 Debugging with GDB - List of Commands

Debug a specific test: `make run-gdb TEST=test_name`

Basic Commands:

- `b function` **break point** at a specific function
- `r` **run** your code (be sure to set a break point first)
- `n` **step over** code
- `s` **step into** code
- `p/x variable` **print** variable in current scope in hexadecimal
- `bt` **back trace** displays the stack trace

5 Rubric and Grading

5.1 Autograder

We have provided you with a test suite to check your linked list that you can run locally on your very own personal computer. You can run these using the Makefile.

Note: There is a file called `test_utils.o` that contains some functions that the test suite needs. We are not providing you the source code for this, so make sure not to accidentally delete this file as you will need to redownload the assignment. Also keep in mind that this file does not have debugging symbols so you will not be able to step into it with `gdb` (which will be discussed shortly).

Your process for doing this lab should be to write one function at a time and make sure all of the tests pass for that function—and if one of your functions depends on another, write the most simple one first! Then, you can make sure that you do not have any memory leaks using `valgrind`. It doesn't pay to run `valgrind` on tests that you haven't passed yet. Further down, there are instructions for running `valgrind` on an individual test under the Makefile section, as well as how to run it on all of your tests.

The given test cases are the same as the ones on Gradescope. Your grade on Gradescope may not necessarily be your final grade as we reserve the right to adjust the weighting. However, if you pass all the tests and have no memory leaks according to `valgrind`, you can rest assured that you will get 100 as long as you did not cheat or hard code in values.

You will not receive credit for any tests you pass where `valgrind` detects memory leaks or memory errors. Gradescope will run `valgrind` on your submission, but you may also run the tester locally with `valgrind` for ease of use.

Printing out the contents of your structures can't catch all logical and memory errors, which is why we also require you run your code through `valgrind`.

We certainly will be checking for memory leaks by using `valgrind`, so if you learn how to use it, you'll catch any memory errors before we do.

Your code must not crash, run infinitely, nor generate memory leaks/errors.

Any test we run for which `valgrind` reports a memory leak or memory error will receive half or no credit (depending on the test).

If you need help with debugging, there is a C debugger called `gdb` that will help point out problems. See instructions in the Makefile section for running an individual test with `gdb`.

5.2 Makefile

We have provided a Makefile for this timed lab that will build your project. Here are the commands you should be using with this Makefile:

1. To clean your working directory (use this command instead of manually deleting the `.o` files): `make clean`
2. To run the tests without `valgrind` or `gdb`: `make run-tests`
3. To run your tests with `valgrind`: `make run-valgrind`
4. To debug a specific test with `valgrind`: `make run-valgrind TEST=test_name`
5. To debug a specific test using `gdb`: `make run-gdb TEST=test_name`

Then, at the (`gdb`) prompt:

- (a) Set some breakpoints (if you need to — for stepping through your code you would, but you wouldn't if you just want to see where your code is segfaulting) with `b suites/list_suite.c:420`, or `b tl4.c:69`, or wherever you want to set a breakpoint
- (b) Run the test with `run`
- (c) If you set breakpoints: you can step line-by-line (including into function calls) with `s` or step over function calls with `n`
- (d) If your code segfaults, you can run `bt` to see a stack trace

To get an individual test name, you can look at the output produced by the tester. For example, the following failed test is `test_list_deep_copy_basic_easy`:

```
suites/list_suite.c:50:F:test_list_deep_copy_basic_easy:test_list_deep_copy_basic_easy:0
~~~~~
```

Beware that segfaulting tests will show the line number of the last test assertion made before the segfault, not the segfaulting line number itself. This is a limitation of the testing library we use. To see what line in your code (or in the tests) is segfaulting, follow the “To debug a specific test using gdb” instructions above.

Note: The checker may not reflect your actual grade on this assignment. We reserve the right to update the checker as we see fit when grading.

6 Deliverables

Please upload the following files to Gradescope:

1. `tl4.c`

Your file must compile with our Makefile, which means it must compile with the following gcc flags:

```
-std=c99 -pedantic -Wall -Werror -Wextra -Wstrict-prototypes -Wold-style-definition
```

All non-compiling timed labs will receive a zero. If you want to avoid this, do not run gcc manually; use the Makefile as described below.

Download and test your submission to make sure you submitted the right files!