



Assignment 4: Code-Reading

Summary and Motivation

The data structures and algorithms that you learn about in class are not just academic exercises; they are fundamental to software engineering practice and their use can be found in many applications and programs. In this exercise you will discover an instance of their use outside of the classroom, and you will be asked to read, understand, and document your understanding of the code that you find.

This assignment begins by asking you to explore an *open source project* and then to explore its *GitHub* repository and answer a few questions about it. *GitHub* is a code hosting platform that supports version control and collaboration on projects by people from anywhere in the world. A *repository* is a storage location that is used to organize a single project and provides a structured and version-controlled way for programmers to store the development files for that project. Repositories can contain folders and files, images, videos, spreadsheets, and data sets. In this assignment, you will not need to know anything about version control, nor will you learn about version control. *GitHub's* role is limited to its code hosting features.

Instructions

Answer all questions using the template that is on the website. The details for accessing and using it are below.

- (6%) *QGIS* (also known as *Quantum GIS*) is a user-friendly *open source Geographic Information System (GIS)* that runs on Linux, Unix, Mac OSX, and Windows. It is licensed under the **GNU General Public License**. *QGIS* lets you browse and create map data on your computer. It supports many common spatial data formats (e.g. *ESRI ShapeFile*, *geotiff*). You can learn more about it from the **QGIS homepage**. Your first step is to visit the homepage and answer the following questions:
 - What is a GIS? Find the description of a GIS in the documentation on the site and summarize in a sentence or two how it is defined there.
 - What are the names of the top-level namespaces in this project? You will have to navigate around the site to find the answer to this question.
- (9%) **Open Hub** is a website that allows people to search for meta-data about open source projects such as *QGIS*. Visit the Open Hub page and enter *QGIS* in the search bar to search for the page describing *QGIS*. Answer the following questions using the currently available Open Hub data:
 - How many people have contributed to *QGIS*?
 - How many commits have been made?
 - How many lines of code are in the project?
- (3%) The source code for *QGIS* is available on **GitHub**. Go to the *GitHub* website, enter *QGIS* in the search bar, and find the *qgis/QGIS* repository. Why are the numbers of contributors and commits different from those on the *Open Hub* page?
- (12%) The *QGIS* code has an implementation of a priority queue. Find the header file and the implementation file for the `PriorityQueue` class. Download the two files. (If you have disk space, you can *clone* the entire repository but this is unnecessary.) Answer the following questions:
 - In what namespace is this class?
 - Is the code for the `PriorityQueue` authored by the project organization, or is it third-party?
 - What type of software license does it have?



5. (70%) Read the code that implements the `PriorityQueue` class. Notice that there is no documentation, essentially, in the `.cpp` file. Your remaining task is to understand the implementations of the public functions of this class, and to write pre- and post-conditions for the following seven functions:

```
int  getBest();
void remove( int key );
void insert( int key, double p );
void downheap( int id );
void upheap( int key );
void decreaseKey( int key );
void setPriority( int key, double new_p );
```

Make an exact copy of the interface file (the `.h` file) that you downloaded and put your comments in the copy where they belong. Name the file with the same name as it is in the project.

Grading Rubric

The weights of each question are as indicated above. Questions are assessed on their completeness and correctness. Expository answers (ones that explain or describe) will be graded on their clarity, conciseness, and content.

Submitting the Homework

This assignment is due by the end of the day (i.e. 11:59PM, EST) on April 9, 2019. I have created a plain text answer sheet for you to use as a template for the answers to all questions except question 5. It is called `assignment4_answer_sheet.txt` and is downloadable from the [course website](#). Type all of your answers into the space provided, expanding it if necessary. Submit this document either as a plain text file or, if you wish, converted to a PDF.

Create a directory named named `username_assignment4`. where `username` is to be replaced by your CS Department network login name. Put the answer sheet file and the commented header file into that directory. **Do not place anything else into this directory.** You will lose 1% for each file that does not belong there, and you will lose 2% if you do not name the directory correctly¹.

Next, create a zip archive for this directory by running the zip command

```
zip -r username_hwk4.zip ./username_hwk4
```

This will compress all of your files into the file named `username_hwk4.zip`. **Do not use the tar compress utility.**

Assuming this file is in your current working directory you submit by entering the command

```
submit_cs335_hwk 4 username_hwk4.zip
```

because it is the third homework. The program will copy your file into the `hwk4` subdirectory

```
/data/biocs/b/student.accounts/cs335_sw/hwks/hwk4/
```

and if it is successful, it will display the message, "File ... successfully submitted."

You will not be able to read this file, nor will anyone else except for me. But you can double-check that the command succeeded by typing the command

```
ls -l /data/biocs/b/student.accounts/cs335_sw/hwks/hwk4
```

and making sure you see a non-empty file there.

If you put a solution there and then decide to change it before the deadline, just replace it by the new version. Once the deadline has passed, you cannot do this. I will grade whatever version is there at the end of the day on the due date. You cannot resubmit the program after the due date.

¹I have scripts that process your submissions automatically and misnamed files force me to manually override them.