

CS6140: Advanced Programming Lab

Assignment 4 : Tools for Mathematical and Algorithmic Writing

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Goal of the Assignment

You will learn to write professional documents that include mathematics. This will require you to learn the following two useful tools, both of which have extensive documentation online.

L^AT_EX is a tool useful for typesetting mathematical documents. You can find more details in the following web pages.

- <http://www.latex-project.org/>
- <http://en.wikibooks.org/wiki/LaTeX>

graphviz is a package of software for visualizing graphs. The package includes several tools, each having a different philosophy for graph visualization. All the tools read the input graph described in the “dot” language (see [http://en.wikipedia.org/wiki/DOT_\(graph_description_language\)](http://en.wikipedia.org/wiki/DOT_(graph_description_language))). The package has a web site <http://www.graphviz.org/> containing documentation. (The gallery of graphs generated by graphviz is quite nice.)

This lab assignment is slightly open ended with the intention of allowing you to exercise your creative juices. While we will help you get started with the tools¹, it is your responsibility to understand how to use the tools to suit your purpose. The more elegant your usage, the better; avoid gaudy usage.

Requirements

You are required to submit a document of either 2 or 3 pages in length (and a font size of 11) describing the workings of a binary heap. Your document must be typeset using L^AT_EX and must include figures generated by graphviz to illustrate how a min-heap works. You will be graded on the following qualities.

1. The document must be written professionally and must use the English language properly. While genuine grammatical errors (i.e., errors stemming from a non-English educational background) will be tolerated to a limited extent, sloppy writing (that include typographic errors, incomplete sentences, etc.) will not be accepted.
2. The document must flow well. You are free to decide the details, but we expect an introductory paragraph in which you explain what a binary heap is followed by some technical details. Your technical details must include the how insertion and extract-min operations work.

¹In particular, we will give you a sample L^AT_EX file and a sample dot file.

3. Your document must include a clear proof that the height of a complete binary tree is $O(\log n)$ and therefore, insertion and extract-min operations take $O(\log n)$.
4. Your document must use several small (but sufficiently non-trivial) figures to illustrate the workings of a heap. While we don't want to mandate this, the smart thing to do will be to implement a function in your heap class (from previous lab assignments) that will output the state of the heap into a file using the "dot" language. Your figures must have a label and caption. When referring to a figure in the text, you must reference it properly using the label.
5. You must cite your sources. In particular, we expect that you cite at least one source. Verbatim copying is not allowed. You can refer to various sources, but must write in your own words.

Submission

The deadline is Sunday (Aug 24, 2014) midnight (11:59PM). You will be required to submit two files:

`<roll number>.tex` and

`<roll number>.pdf`

You are not required to turn in your figures. Please note that we intend to run both your pdf and tex files through turnitin. So please avoid any and all forms of copying.