

COMP220 — Lab 1 & Homework 1

Fall 2016

Abstract

For lab you'll review some basics of complexity and algorithm analysis as well as hone your skills with Logarithmic thinking. For homework you'll dust off your C++ skills and explore the new programming environment: *Code::Blocks*.

1 Lab 1

1. The formula for the conversion from one logarithm base to another tells us that for any two bases a and b , $\log_a(n)$ differs from $\log_b(n)$ by exactly a factor of $\frac{1}{\log_b(a)}$.

$$\log_b(n) = \frac{\log_a(n)}{\log_a(b)}$$

Compute this factor for base $a = 2$ and each of the bases listed in the table below:

<u>Base</u>	<u>Conversion Factor for \log_2</u>
8	_____
10	_____
16	_____
23	_____
127	_____
256	_____

What do you notice about converting to \log_2 from some base $b = 2^k$?

2. Fill in the following table in three phases. First without using a calculator, fill in the integer lower and upper bound. If the logarithm is an exact integer, then put that as both the lower and upper bound. Then, take a shot at guessing the logarithm's actual value out to 2 decimal places. Finally, use a calculator to compute the actual log to 2 places and fill that in for the final column. When computing actual logarithms, you may only use the log base 10 function on a calculator; use the conversion formula for all other bases.

<u>Logarithm</u>	<u>Lower Int.</u>	<u>Upper Int.</u>	<u>Guesstimate</u>	<u>Actual Value</u>
$\log_2(17)$	_____	_____	_____	_____
$\log_2(725)$	_____	_____	_____	_____
$\log_2(1024)$	_____	_____	_____	_____
$\log_2(7)$	_____	_____	_____	_____
$\log_8(7)$	_____	_____	_____	_____
$\log_8(178)$	_____	_____	_____	_____
$\log_{16}(25)$	_____	_____	_____	_____
$\log_{16}(333)$	_____	_____	_____	_____
$\log_{10}(15)$	_____	_____	_____	_____
$\log_{10}(150)$	_____	_____	_____	_____
$\log_{10}(145787)$	_____	_____	_____	_____

3. Rank the following complexity from least to greatest order, in terms of resources needs by members of the class, where 1 is the least resource intense class and numbers proceed up from there.

$O(n \log n)$ _____

$O(n^2)$ _____

$O(1)$ _____

$O(2^n)$ _____

$O(n^3)$ _____

$O(\log n)$ _____

$O(n)$ _____

4. Determine the Big-O for each of the following functions.

$\frac{7}{100}n + 1.5E16$ _____

$\frac{x \log x}{25} - 13x + 5x^3$ _____

$\frac{(n+1)(n+2)}{n}$ _____

10^9 _____

$\log y + 135 + \frac{y}{2}$ _____

2 Homework 1

The goal of this homework is to get back into C++ and to familiarize yourself with the use of the new IDE, Code::Blocks. To do this you should complete *exercise 7 from chapter 2 of the text* with a few modifications:

1. Be sure to put your function in a library.
2. Write tests for your function using the gTest testing framework.
3. Write a main program that provides a basic CLI interface to your function. If your program is called *sqr* then running *sqr 4* at the CLI should produce *2*. You may assume valid command line arguments for this assignment; Error checking and validation of command line arguments is not required but you are strongly encouraged to do it anyway.

Submit your *source code only* via the *handin* program. The course is, of course, *comp220* and the assignment is *hwk1*. The homework is due prior to next week's lab, so **9/1 by 2pm**.