

CS 101 - Algorithms & Programming I

Fall 2022 - Lab 1

Due: Week of October 3, 2022

Remember the **honor code** for your programming assignments.

For all labs, your solutions must conform to the CS101 style **guidelines**!

All data and results should be stored in variables (or constants where appropriate) with meaningful names.

The objective of this lab is setting up & using a Java IDE, and writing some basic Java programs & debugging. Remember that analyzing your problems and designing them on a piece of paper *before* starting implementation/coding is always a best practice.

0. Setup Workspace

In VSC, you organize your programs into workspaces. A Visual Studio Code workspace is basically a collection of one or more folders that are opened in a VS Code window (instance). For CS101 labs, we would like you to create a single workspace where you collect all lab solutions. First, create a folder named `labs` in your chosen folder on your hard disk. Then start VSC and open this folder (File > Open Folder...). Now in VSC, under `labs`, create a new folder named `lab1`. Then, save the current workspace as `labs_ws` under the folder `labs` (File > Save Workspace As...). Now you have a workspace, within which you can create folders (one for each lab) and classes for your Java programs under each folder as needed.

In this lab, you are to have three Java classes/files (under `labs/lab1` folder) as described below.

1. Fix Compile Errors

First, download the provided `Lab01_Q1.java` from Moodle under the `lab1` directory. When you try to compile this program, it will give errors and will fail.

Your task here is to fix the compile errors in this program to get an output *exactly* as below:

```
Hi everyone, below are details about lab grades
Welcome to CS101 Fall 2022 Lab 01

There will be 9 lab sessions in this course.
Labs contribute to 25.0% of your total grade.
This lab:          2.7777777777777777          points
All labs:          25.0          points
You should come prepared...

Best of luck!
```

2. Calculate Simple Expressions

Now create a new/empty file of your own under the `lab1` folder named `Lab01_Q2.java` with a class with the same name that calculates these expressions:

$$\frac{32.2 - 17 \div 22}{(1.5 - 7.3) \times (4.3 + 24)}$$

$$\frac{73.5 \times 16.4 - 3^2 \times 81}{2^5 + 34}$$

$$(2.4 - 0.4)^{-2/6}$$

and outputs the results as below:

```
Result of expression 1 is: -0.19617399780675038
```

```
Result of expression 2 is: 7.218181818181816
Result of expression 3 is: 0.7937005259840998
```

3. Calculate Mass and Atom Count in Human Body

Finally, create a third file named `Lab01_Q3` under the `lab1` directory. Based on the information below,

- 98.6% of the mass of the human body is made up of six elements: oxygen (65%), carbon (18.5%), hydrogen (10%), nitrogen (3.2%), calcium (1.5%), and phosphorus.
- A 70kg human body contains approximately 7×10^{27} atoms. The number of atoms of each element however is distributed differently. For instance, only 24% of the number of atoms in the human body are oxygens, whereas 62% of the number of atoms are hydrogens.

Write a Java program in this file that uses the information above to answer the following questions:

- What percentage of the mass of the human body is phosphorus?
- What percentage of the mass of the human body are elements other than the ones specified?
- What percentage of the number of atoms of the human body are elements other than the ones specified?
- For a 70kg person, what are the mass (as fractional numbers) and the number of atoms of the elements with the highest two ratios?

Remember that computers are great at doing calculations fast and correctly. So, you **must avoid** doing any calculations **yourself**, instead program the computer to do so. The output should look the same (except for perhaps some minor difference due to rounding) as the following sample run:

```
Phosphorus makes up 0.3999999999999915 percent of the mass in the human
body.
Elements other than oxygen, carbon, hydrogen, nitrogen, calcium and
phosphorus make up 1.4000000000000057 percent of the mass with an atom
count of 9.800000000000001E26.

For a person of 70.0 kg the mass of the elements are:
Oxygen: 45.5kg
Carbon: 12.95kg

whereas the number of atoms of some elements in this person are:
Hydrogen: 4.34E27
Oxygen: 1.68E27
```

Assume the distribution of the percentages of the mass and the number of atoms in the human body are constant values and are declared accordingly. The weight of a particular human, however, should be a variable.

Notice that integers cannot hold very large numbers; long variables might not be sufficient to hold certain values in this program either. So you might have to use doubles.