

Challenge Lab 1!

This lab is your first challenge lab. What that means is that it is **OPTIONAL**. If you decide to do it and you are successful, you can obtain up to 50 points to be added to your total number of lab points. This will definitely increase your final grade for labs!

Important: since this is an optional lab, you are expected to work on it outside your lab sessions, unless you are completely done with the current assigned lab.

We hope you enjoy being challenged!



This lab is not in replacement of the regularly assigned labs. Regularly assigned labs should be your priority and only once you are done, you should work on this challenge lab. You should expect to work about 3 to 4 hours to complete this assignment.

Real Life Problem

Back in the days when our ancestors were counting the mammoths they had gathered, they didn't have a very structured base system for counting. So if they gathered three mammoths, they would count ||| mammoths. If they wanted to count to ten mammoths, they would simply think of ||||| mammoths. This is the simplest way of counting.

As civilizations started to evolve, you will understand that they needed better ways of representing quantities. The Egyptians, for example, started to use a \cap to represent ten instead of ten sticks; and the Romans used an X for ten. There are many more symbols in every civilization, but the key point here is that there are many ways to encode the number 10.

||||| = 10

\cap = 10

X = 10

Today, when we talk about counting money, years, etc., we use a 10 based system. Which is basically 10 symbols (which we call digits – 0, 1, 2, 3, 4, 5, 6, 7, 8, 9) that have a different value depending on their position. For example, 24:

Position	1	0
Digit	2	4

the digit 4 in the position 0 represents ||||

the digit 2 in the position 1 represents ||||| |||||

24 represents ||||| ||||| + ||||

24 can also be represented as $2 * 10^1 + 4 * 10^0$

Because we multiply by 10, our system is base 10. But there are other systems that we regularly use today. Time uses base 60 for minutes (00 – 59) and base 24 for hours. There are other systems that we use indirectly and we might not even realize such as base 2 and base 16, which are widely used by computers.

We use base 10 in our lives to count things, probably because humans have 10 fingers and it is easy. Computers use base 2 and/or base 16 because of the way computers are built. Because counting is important for our daily lives and representation of numbers is equally important for better understanding of quantities, in this lab you will learn how to convert one number of base x to base y.

Lab description - Converting numbers to different bases.

In this activity, you will design and implement a method called Conversion whose aim is to practice the conversion of numbers from one given base to another base.

Method Conversion takes the following inputs:

- The number the user plans to convert;
- The original base (an integer); and
- The target base (an integer);

And it returns the number, given in the original base, now translated in the target base.

Note: the base numbers can be anything between 2 and 36.

Examples:

Conversion(111,2,10) → 7

Conversion(31,10,2) → 11111

Conversion(A3,16,10) → 163

Conversion(1A,16,2) → 11010

Conversion(27,10,16) → 1B

Important note: When manipulating the number given as an input, you are not allowed to use built-in functions from Java, outside of length() (for Strings), possibly charAt() (for Strings), power function, floor/ceiling.

Goals of this activity:

1. Design a solution for the problem (pseudocode) with testing cases.
2. Implement your solution using Java.

What you have to turn in:

- A docx file in which you describe the pseudocode of the above conversion method, along with a set of test cases designed to challenge your implementation and ensure that it works properly (i.e., as expected).
- A single java file that contains the conversion method as well as a main file.

Important notes:

- Indent your code properly following guidelines available at: <http://www.oracle.com/technetwork/java/javase/documentation/codeconventions-136091.html>. 15% of your grade will be reserved for correct indentation. Failing to indent properly puts you at risk of losing 15%.
 - Spend time working on your pseudocode as pseudocode weighs 50% of the grade on this lab.
 - Spend time designing your test cases as the quality of your test cases weighs 20% of the grade on this lab.
 - Do not write your methods inside the main method. Each method has to be written where instructed in the code provided to you. Failing to do so puts you at risk of losing 20% off your lab grade.
 - Do not submit more than the files that are requested from you: one docx file and one java file.
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That's it! Looking forward to seeing you in lab!