Algorithms and Introduction to C

I. Overview and Objectives

An algorithm is a set of well-defined steps or rules that you need to follow to obtain a predetermined result. For instance, when we talk about algorithms in computer programming, we already have our input and we know the expected output. Now, an algorithm would be all the defined steps to follow on the input to get the desired output.

The learning objective of this lab is to become familiar with algorithms to write two simple ones and implement one in C. For this lab, you are expected to complete the tasks assigned by hand, and write high-level, detailed, step-by-step algorithms to solve the problems.

Reading and related topics: Course slides lessons 01 and 02. Book chapters 1 and 2.

II. Lab Tasks and Submission Guideline

Solve the following three problems. Write the two algorithms for problems 1 and 3 and the two C programs for problems 2 and 3 and include all of them in one written lab report (the two algorithms, the two C source codes, and a cut/paste of the two program executions - screenshots are acceptable). Save your report in .pdf format and submit it on D2L. You should submit your lab at the end of your lab session or soon after. In all cases it must be submitted before the deadline indicated in the D2L dropbox or it will not be accepted for marking.

Problem 1: Suppose you have *n* two-digit numbers. For example, if *n* = 5, you may have the following 5 two-digits number: 24 11 57 17 46

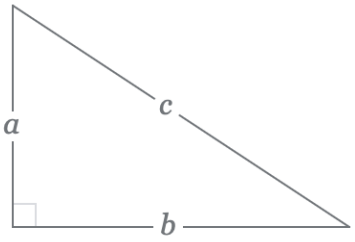
Your goal is to arrange your list in ascending order. So, for the example above, your final answer would be: 11 17 24 46 57

Think of a procedure to perform this task (your list can have repeated numbers). Test your idea with different values of *n*. Once you have decided how it can be done, write your solution as a sequence of steps that can be followed in order. How have you ensured that your algorithm eventually stops? Have you tested your algorithm on unusual data (like numbers that are all the same, or that are already sorted)? Number each step of your algorithm, and explain briefly what its role is in achieving your goal. Pick a list of numbers of your choice, and show by hand how your algorithm will achieve the sorting required.

Problem 2: The problems that you will get in labs for the rest of semester will consist of writing and executing C programs. Before doing this, you need to make sure that your programming environment is functional by trying a simple program.

Using Geany or the IDE of your choice, enter the C code found for "My first C program" (ihypress.net/programming/c/prog.php?chap=01&pgm=01). Compile, build, and execute the program. If all works well you are now ready for C programming.

Problem 3: Write a simple algorithm that calculates the perimeter and surface of a right triangle based on the length of the two shortest sides. Write your solution as a sequence of steps that can be followed in order.



$$c = \sqrt{a^2 + b^2}$$

Next, write a C program that asks the user to enter the two short sides and displays the perimeter and surface of the triangle with two decimal places (look online for the formulas to calculate these).

Have fun!