Lab 05 : Pointers and Advanced Functions

I. Overview and Objectives

As you have seen in lectures, pointers (also known as pointer variables) are special variables that are used to store addresses rather than values. Some C programming tasks are performed more easily with pointers, and other tasks, such as having functions that produce multiple results, cannot be performed without using pointers. So it becomes necessary to learn how to work with pointers to become a proficient C programmer.

The learning objective of this lab is to become familiar with pointers and their use in writing functions that give multiple results.

Reading and related topics: Course slides lesson 06. Book chapter 6.

II. Lab Tasks and Submission Guideline

Write complete C programs to solve the following two problems. Save the code you wrote to solve them, together with the result of it in a report. Make sure you include enough comments in your code.

For each problem, copy and paste the source code into your report (*text only, no image*) then copy and paste the execution results of each problem into your lab report (*must be a high resolution screenshot where numbers are easy to read*). 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: Write a C program that asks a user for three integer numbers. Your program will then call **one** function that will give three results: the highest value, the lowest value, and the middle value.

Then your program will print the three values in ascending order.

Test your program with the following sets of input data:

```
 56   78    23
 45  -20    22
-80  -40  -250
  8    0     2
 55   55    55
 88   77    66
 -8   33    -8
 12   13    1
```

Problem 2: Let's assume that you could travel to the Moon by car traveling at 100 km/h. How long would that take to get there? How about going to Mars or Venus? If you go there by rocket with a higher speed, it would obviously take less time.

To solve this problem you will need to write three user-defined functions, one for each destination. Each of the functions will take the traveling speed in km/h as the argument and give the time (in hours) it will take to get to the destination.

Note that because there are minimum (perigee) and maximum (apogee) distances between the Earth, the Moon, Mars and Venus, you will need to calculate the minimum and maximum travel times so the three functions will each produce two results.

Distances:
Earth to Moon > Perigee: 363,104 km. Apogee: 405,696 km
Earth to Mars > Perigee: 54.6 million km. Apogee: 401 million km

Earth to Venus > Perigee: 38 million km. Apogee: 261 million km

Write a C program that will present a menu with four options:
1. Traveling to the Moon
2. Traveling to Mars
3. Traveling to Venus
4. Exit program.

You will ask the user for the traveling speed after the user has chosen options 1, 2 or 3. Your program must keep presenting the menu until the user chooses option 4.

Run your program with the following speeds: 100 km/h (car), 500 km/h (airplane), and 41000 km/h (rocket).

Test Trial Run:
During the last half hour you will practice the test environment with a trial run test. The computer will be rebooted into the proprietary online exam system. Follow your lab TA instructions. You will see the test details from the link below in the exam environment. The exam environment for C programming is Geany on Unix (very similar to Geany on Mac or Windows).

Lab05_Practice_Test

Have fun!