CptS 121 - Program Design and Development

Lab 5: Wonderful World World World of Iterative Statements in C

Assigned: Week of May 20th, 2019
Due: At the end of the lab session

I. Learner Objectives:

At the conclusion of this programming assignment, participants should be able to:

- Compose iterative statements (“while” and “for” statements)
- Derive flowcharts for a given problem
- Apply top-down design and structure charts for a given problem

II. Prerequisites:

Before starting this programming assignment, participants should be able to:

- Compose decision statements (“if” conditional statements)
- Create and utilize compound conditions
- Open and close files
- Read, write to, and update files
- Manipulate file handles
- Apply standard library functions: fopen (), fclose (), fscanf (), and fprintf ()
- Declare and define functions

III. Overview & Requirements:

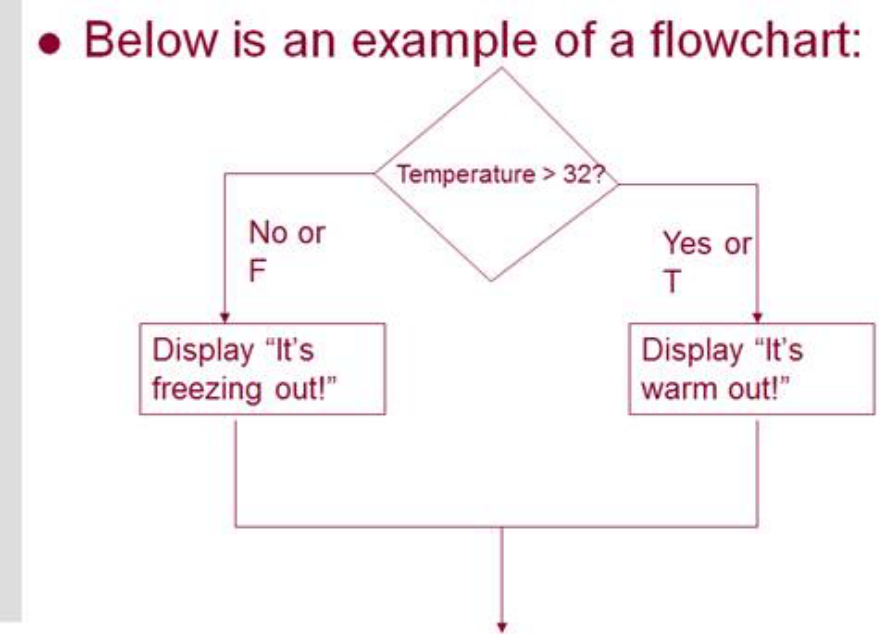
This lab, along with your TA, will help you navigate through applying iterative statements in C. Once again we will take a modular approach to designing solutions to the problem below. As part of the lab you will need to decide which C selection structure and iterative structure is best suited for a particular function. You will have the option to use "if", "switch", "while", "do-while", and/or "for" statements for the below problem.

Labs are held in a “closed” environment such that you may ask your TA questions. Please use your TAs knowledge to your advantage. You are required to move at the pace set forth by your TA. Please help other students in need when you are finished with a task. You may work in pairs if you wish. However, I encourage you to compose your own solution to each problem. Have a great time! Labs are a vital part to your education in CptS 121 so work diligently.

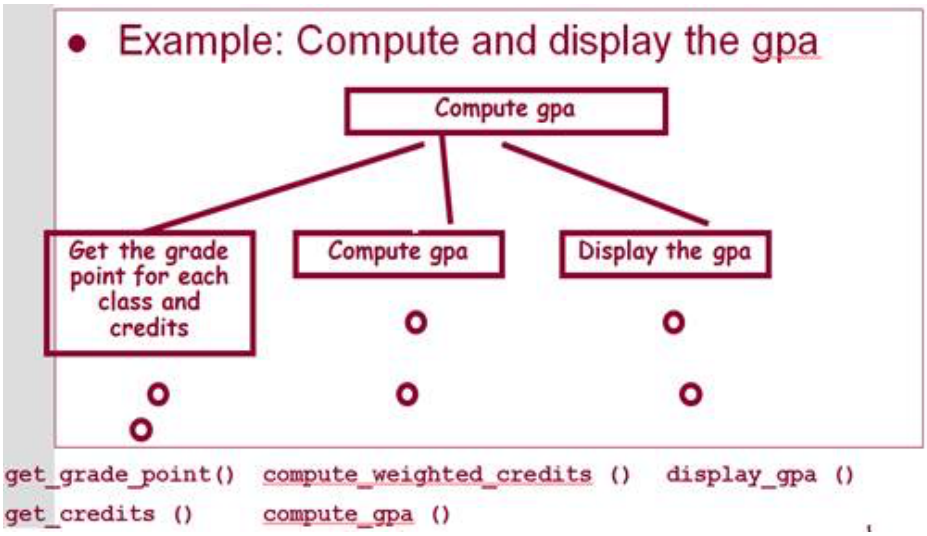
Tasks:

1. Before you implement any C code, in teams, draw a flowchart for the following problem. After you draw the flowchart, draw a structure chart to determine the functions necessary for the problem.

Recall what a flowchart looks like:



Below is an example of structure chart for the GPA problem we discussed in class:



Write a program that completes the following requirements:

a. opens a file called "salaries.txt" for reading
b. reads in four quarterly dollar salary payments from the file
c. sums the quarterly payments
d. determines the tax bracket → < $15,000 = low income; $15,000 - $200,000 = medium income; > $200,000 = high income
e. closes "salaries.txt"
f. displays 'l' for low income, 'm' for medium income, and 'h' for high income

2. Read in an unknown number of real values from a file called "data.txt". Calculate the average of the real numbers. Output the average of the real numbers to a file called "output.txt". Some skeleton code is provided for you below.

```
#include <stdio.h>
```

```
int main (void)
{
        FILE *infile = NULL;
        FILE *outfile = NULL;

        /* Fill in the code to open a file. Make sure you check that the file was open successfully. */

        while (!feof (infile))
        {
                /* Read in the real values. */
                /* Keep track of the number of values read and the sum of the values. */
        }

        /* Output average to a file named "output.txt". */
        /* Close your files. */

        return 0;
}
```

For the following problems: If you use a while ( ) loop to solve problem 3, use a for ( ) loop to solve problem 4 or vice versa.

3. Complete programming project 5 in Chapter 5 of the Hanly/Koffman Problem Solving & Program Design in C book. All input should be read from a file and output should be written to a file. Make sure that you design a function `greatest_common_divisor()` which calculates and returns the greatest common divisor of two integer numbers. Also, develop functions to read data from a file and to write data to a file.

Problem Statement:

The greatest common divisor (gcd) of two integers is the product of the integers' common factors. Write a program that inputs two numbers and implements the following approach to finding their gcd. We will use the numbers -252 and 735. Working with the numbers' absolute values, we find the remainder of one divided by the other.

252 / 735 = 0 R252

Now we calculate the remainder of the old divisor divided by the remainder found.
735 / 252 = 2 R231

We repeat this process until the remainder is zero.
252 / 231 = 1 R21
231 / 21 = 11 R0

The last divisor (21) is the gcd.

4. Write a program that reads all numbers from a file and determines the highest and lowest numbers. You must **NOT** use arrays to solve this problem! Write functions where appropriate.

IV. Submitting Labs:

- You are not required to submit your lab solutions. However, you should keep them in a folder that you may continue to access throughout the semester. You should not store your solutions to the local C: drive on the EME 120/128 machines. These files are erased on a daily basis.

V. Grading Guidelines:

- This lab is worth 10 points. Your lab grade is assigned based on completeness and effort. To receive full

credit for the lab you must show up on time and continue to work on the problems until the TA has dismissed you.