Introduction

One of the most important things to make your life as a software programmer easier is to spend time thinking about the problem BEFORE you ever sit in front of a development environment. In today's lab, we will give you practice at breaking down a problem through two ways: working with others in the class to brainstorm approaches, then synthesizing the results on your own. When planning solutions to a programming problem, it often helps to describe how you'd approach solving the problem using plain English---that is, avoid using overly technical terms like variables. *If you can't describe what you want to do in simple English, you are also likely to have trouble coming up with the code!*

Lab Objectives

By successfully completing today's lab, you will be able to:

- Conduct a brainstorming session with one or two individuals in the class.
- Create a planning document outlining your solution to the code.
- Implement a programming project that uses integers, floating point numbers, and formatted output.
- Get to know people in your 1011 lab section.

Prior to Lab

- You should know how to create a new .c file in UNIX as well as compile and run a program.
- You should know about assignment operators and be able to conduct simple arithmetic.
- The lab corresponds with zyBooks Chapter 2.

Deadline and Collaboration Policy

- Part 2 of this assignment is due by 11:59 PM on Tuesday (9/10/2019) via Canvas.
- Part 3 of this assignment is due by 11:59 PM on Friday (9/13/2019) via Canvas
    - More instructions on what and how to submit are included at the end of this document.
- You should write your solutions to Part 2 and Part 3 of this lab by yourself. In this lab, you will talk at a high level with others in your lab about a solution. However, you will create all code by yourself and you should not talk about specific code to anyone but a course instructor or lab teaching assistant.
- Your zyBooks and lecture slides are available resources you can use to assist you with this lab.

Lab Instructions

The Problem:

Our new Constitution is now established, and has an appearance that promises permanency; but in this world nothing can be said to be certain, except death and taxes. – Benjamin Franklin

Congratulations! You just breezed through your interviews and received an offer for a part-time job at the brand new MegaCorp offices opening in Clemson, South Carolina. You're a college student, however, so you don't have that much free time. Luckily your hiring manager has been understanding of your schedule, so they've given you the caveat: *you* need to request what your hours should be. However, if you go too high and work too much, you might not have enough time to study, and if you go too low, you're going to have a difficult time paying all your bills. After all, you're a Clemson student and need money for the Smoking Pig.

No problem! Today's lab assignment will help you determine your answer. We'll write a program to calculate how much you make depending on how much you work.

If you haven't worked a job before, the first paycheck you receive is often both really exciting and disappointing. It's exciting because you're making money! It's disappointing because it's often not as much money as you expected due to taxes, which can cover:

- Federal government Income Tax withholding
- State Income Tax withholding (for our program, we'll be taxed in for South Carolina)
- FICA (Social Security) taxes
- Medicare taxes

In this week's lab, you'll ultimately create a C program that will compute how much a person will gross (totally make), net (receive after taxes), and calculate the various amounts of taxes that will be withheld. Ultimately, your program should look like the sample output below.

Sample Output

```
Hours per Week:         30
Hourly Rate:            $7.25
Gross Pay:              $217.50
Net Pay:                $176.06

Deductions
Federal:                $21.75
State:                  $3.05
FICA:                   $13.49
Medicare:               $3.15
```

```
Hours per Week:         15
Hourly Rate:            $7.25
Gross Pay:              $108.75
Net Pay:                $88.03

Deductions
Federal:                $10.88
State:                  $1.52
FICA:                   $6.74
Medicare:               $1.58
```

In order to do this though, we need to make sure we're thorough. This week's lab is structured to have substantial planning on the first day, and finish with you coding your solution on the second day:

Lab 03 Structure	
Tuesday	Thursday
30 minutes: work with 1-2 other individuals on Part 1 20 minutes: work individually on Part 2 Submit results of Part 2 to Canvas by 11:59 PM	50 minutes: work individually on Part 3 Submit to Canvas by 11:59 PM on Friday.

Part 1: Planning with a Group (First 30 minutes)
**** Do not use a computer or calculator in this part *****

Work with 1-2 other people in the room seated nearby. Examine the output in the prior section and start brainstorming ways that you could "solve" the problem---that is, what is the information you would need to have in order to write a program to accomplish the task. Then answer the questions below.

First of all, find out some information about your partner(s)

- First and Last Name
- Which is their "home" lecture section
- An interesting factoid about each person

Next, break down the problem.

- What is the overall problem?
  - What are the sub problems you need to solve?
- What information do you need in order to make these calculations?
- How do you acquire this information?
- What information presented in prior classes or labs is useful in solving the problems?

Part 2: Planning on Your Own (20 minutes of Tuesday Lab)
***** It's okay to use a computer and/or calculator for this portion ******

Taking the information that was created during your brainstorm, write your own solution *in psuedocode*. How you choose to structure the planning document is of your choice, but you need to do the following:

- Review the explanation of *pseudocode* in the Safari playlist for this lab (https://learning.oreilly.com/playlists/1480ac0b-84d1-4ef6-97f4-f6936af15daf) or using the pseudocode.pdf document in Canvas.
- *Pseudocode* is NOT code. It is structured English that where you convey the key parts of your algorithm. For example, consider this *pseudocode* to calculate the average grade given 10 grades:

```
Set total to zero
Set grade counter to one

While grade counter is less than or equal to ten
    Input the next grade
    Add the grade into the total
    Add one to the grade counter
End While

Set the class average to the total divided by ten
Print the class average
```

- Thoroughly consider all the issues you need to fully create a program as specified above (such as how to make the formatting look correct, how many variables do you need, what type, etc.).
- Include the following mandatory header:
    - Your First (or preferred name) Name and Last Name
    - Your Lab and Lecture Section
    - Lab 03 – Part 2
    - Today's Date
    - Collaboration Statement: In this statement you indicate who you worked with, and which lecture sections these individuals report to.

Submit this part of the assignment to Canvas by 11:59PM (as specified in the submission Guidelines).

Part 3: Implementation (50 minutes on Thursday).

Lab Exercise

Using your planning document from Part 2, you will create a C program called lab03a.c that calculates the gross and net pay given a user-specified number of hours worked, at minimum wage.

You should test your program with various hours and make sure your program always produces the correct output. Throughout the semester, when you work on programs like this, you will be tasked with ensuring your program is error free. This means:

- Your program should compile without any errors or warnings (e.g., **syntax errors**)
- Your program should not contain logical errors such as subtracting values when you meant to add (e.g., **logical errors**)
- Your program should not crash when running (e.g., **runtime errors**)

When you run your program, your output should look like this:

```
Hours per Week:         30
Hourly Rate:            $7.25
Gross Pay:              $217.50
Net Pay:                $176.06

Deductions
Federal:                $21.75
State:                  $3.05
FICA:                   $13.49
Medicare:               $3.15
```

Note, in the above output, the only value the user provides is the one highlighted in green.

From this lab forward, each C source code file that you submit for grading must have a header that contains the following information.

```
/*
* filename.c
* Author: Your Name
* Lecture, Lab Section: Insert Lecture Section #, Insert Lab Section #
* Lab #: Insert Lab #
* Submitted on: Insert Date
*
* Purpose: 1 or 2 sentences stating what the program does.
*
* Academic Honesty Declaration:
* The following code represents my own work and I have neither received nor given assistance that violates the
collaboration policy posted with this assignment. I have not copied or modified code from any other source
other than the lab assignment, course textbook, or course lecture slides. Any unauthorized collaboration or use
of materials not permitted will be subjected to academic integrity policies of Clemson University and CPSC
1010/1011.
*
```

* I acknowledge that this lab assignment is based upon an assignment created by Clemson University and that any publishing or posting of this code is prohibited unless I receive written permission from Clemson University.
*/

Bonus Exercise

Create a copy of your lab03a.c file called lab03b.c. Modify and extend your program so that it prompts for both the hours per week and hourly rate and performs the necessary calculations. An example is below, and again, the only values the user should input are highlighted in green.

Hours per Week:	40
Hourly Rate:	$19.95
Gross Pay:	$798.00
Net Pay:	$645.98
Deductions	
Federal:	$79.80
State:	$11.17
FICA:	$49.48
Medicare:	$11.57

Submission Guidelines

- Part 1: No submission, but hopefully you've made a friend!
- Part 2: Submit your writeup to the Canvas assignment associated for this lab by 11:59 PM on Tuesday (9/10/2019). You should check within Canvas to make sure your submission was uploaded correctly and in its entirety.
- Part 3: Submit your lab03a.c program to Canvas assignment associated for this lab by 11:59 PM on Friday (9/13/2019). You should verify within Canvas to make sure your submission was uploaded correctly and in its entirety.
    - If you opt to complete lab03b.c, submit the program to the associated Canvas assignment by 11:59 PM on Friday (9/13/2019). Please submit both lab03a.c and lab03b.c to the assignment if you choose to complete the optional bonus.

Grading Rubric

- If you are not present and attending lab during Part 1 and Part 2 of this lab on Tuesday, you will not receive credit for the planning portion of this lab.
- If your document for Part 2 is not submitted successfully to Canvas by the due date, you will not receive credit for the planning portion of this lab.
- If your code for Part 3 is not submitted successfully to Canvas by the due date, you will not receive credit for the coding portion of this lab.
- Your assignment will be graded out of 100 points. The approximate grading distribution is:

- Brainstorming document completeness/accuracy — 40 points
- Program lab03a.c
  - Program operates correctly — 20 points
  - Output is formatted correctly — 20 points
- Program compiles without errors or warnings — 10 points
- Proper code formatting and commenting — 10 points
- Optional bonus exercise lab03b.c — up to + 10 bonus points
  - Requires lab03a.c to be submitted

Additional Resources

- The GNU manual for formatting output may be helpful with making your output look as desired. You may be especially interested in reading "Formatted Output Basics and "Floating Point Conversions." The manual pages are accessible here: https://www.gnu.org/software/libc/manual/html_node/Formatted-Output.html
- Cplusplus.com also has good reference material on the printf function which may also be helpful http://www.cplusplus.com/reference/cstdio/printf/
- Tax rates in South Carolina are publicly available on the web.