Assignment 5

CS161

For each of the problems below be sure to design your solution before you write any Python code. Follow the software development stages:

1. Analyze the problem
2. Determine the specifications for your solution
3. Create a design for your solution in pseudocode
4. Implement your design in Python
5. Test/debug your solution

Each Python module you turn in must begin with a block, called a *docstring*, that looks like the example below (see PEP 257 for more details). The module docstring must follow the shebang and coding statements in your module; i.e. it must be the first actual line of code in the module.

In your module docstring show the work you did following the software development stages above. Make notes about the problem as you analyze it; write specifications for what your program must do to find a solution; write your program out in pseudocode *before* you start to write Python; and design a set of test data that you can use to prove your program is producing correct results. Only after you've done all of this should you try to translate your pseudocode to Python.

```
#! /usr/bin/env python3
# coding=utf-8

"""
Brief, prescriptive, one sentence description of what the module does.

A more detailed explanation of what the module does. Use complete sentences and
proper grammar. Treat this as if it is documentation someone else will be reading
(because it is). Include any notes from your problem analysis as well as your
program specifications here.

Pseudo code, to be written before any actual Python code.

Assignment or Lab #

Firstname Lastname
Firstname Lastname of partner (if applicable)
"""
<two blank lines>
<your code>
```

Every function or method you write must also include its own docstring. That header will also use triple quotes and begin with a prescriptive, one sentence description of what the function or method does. If the function or method takes arguments, they should be described as well as any non-obvious return value(s). See examples below or PEP 257 for more details).

```
def print_greeting():
    """Print a greeting to the user."""
    print(“Hello out there in userland!”)


def hypotenuse(side_a, side_b):
    """
    Calculates the length of the hypotenuse of a right triangle using
    the formula c^2 = a^2 + b^2.

    side_a – the length of side A of the triangle
    side_b – the length of side B of the triangle
    """
    c = a**2 + b**2
    return math.sqrt(c)
```

Pair Programming

In this assignment we are going to use **pair programming**.

> *Pair programming is an agile software development technique in which two programmers work together at one workstation. One, the **driver**, writes code while the other, the **observer** or **navigator**, reviews each line of code as it is typed in. The two programmers switch roles frequently.*
>
> *While reviewing, the observer also considers the "strategic" direction of the work, coming up with ideas for improvements and likely future problems to address. This is intended to free the driver to focus all of their attention on the "tactical" aspects of completing the current task, using the observer as a safety net and guide.*

Choose one partner in the lab to work with. You can pair program in one of two ways:

1. Two people can work at one computer, occasionally switching the driver and observer roles. It is *critical* that both members be engaged in the work. You should take turns being in the driver and observer roles with only the driver typing and the observer making comments or driving the direction of the code.
2. Two people can work at separate machines using Visual Studio Live Share. Live Share, available as a free plug-in for VS Code and already installed on the school’s Surface devices, enables you and your partner to collaborate on the same codebase without the need any difficult configuration. When you share a collaborative session, your partner sees the context of the workspace in their editor. This means they can read the code you shared without having to clone a repo or install any dependencies your code relies on. They can use rich language features to navigate within the code; not only just opening other files as text but using semantic analysis-based navigation like Go to Definition or Peek. Again, you should take turns being in the driver and observer roles with only the driver typing and the observer making comments or driving the direction of the code.

Assignment

1. Write a program that can report the number of times a certain letter appears in a string. Prompt the user for the string and the letter to search for and display the number of times that letter appears.

   Save your program in a file named `character_count.py`.

2. Write a program that can report the number of times a certain word appears in a file. Prompt the user for the file name and the word to search for and display the number of times the word appears in the file. Use the `getopt` module to allow the user to provide the name of a text file, preceded by a `-f` flag, and the word to be counted, preceded by a `-w` flag at the command line.

   Save your program in a file named `word_count.py`.

3. Write a function that calculates the distance in miles between to cities, given the latitude and longitude coordinates of each. Then, write a program that prompts for the coordinates of two cities, uses the function to calculate the distance, and outputs the result. Think about what kind of rounding accuracy might be appropriate.

   Save your program in a file named `distance.py`.

4. A Caesar cipher is a simple substitution cipher based on the idea of shifting each letter of the plaintext message a fixed number (called the key) of positions in the alphabet. For example, if the key is 2, the word "cat" would be encoded as "ecv" and the word "Sourpuss" would be encoded as "Uqwtrwuu." The original message can be recovered by "reencoding" the ciphertext using the negative of the key.

   A good Caesar cipher handles the shifts the plaintext in a circular fashion where the next character after "z" is "a." Your program should behave in this manner. *Hint:* Pythons built-in `ord()` and `chr()` functions may prove handy, as well as a little modulo math.

   You can assume the plaintext will consist only of upper- and lower-case letters and punctuation.

   Write a GUI program using the `graphics.py` library from Chapter 4 that allows the user to select a text file containing plaintext using a File Dialog (see page 164 of your text). You program should then encrypt the text and write the ciphertext out to a new file also specified by the user using a Save Dialog.

   Save your program in a file named `caesar.py`.

Submission

Submit all your Python script files, and any other necessary files, in the appropriate folder in Google Drive as demonstrated by your instructor.