2 — PHY 494: Homework assignment (51 points total)

Due Thursday, January 30, 2020, 11:59pm.

Submit a PDF through Canvas (name it *lastname_firstname*_hw2.pdf).[1]
Homeworks must be legible or may otherwise be returned ungraded with 0 points.

This assignment contains **bonus problems**. A bonus problem is optional. If you do it you get additional points that count towards this homework's total, although you can't get more than the maximum number of points. If you don't do it you can still get full points. Bonus problems and bonus points are indicated with an asterisk "*".

Note: In general, for full credit you need to (1) show the commands that you used and (2) answer the question. Sometimes you should also copy and paste output.

2.1 Python operators (6 points)

(a) What does the following code output? What are the names of the four mathematical operations that are carried out in lines 4–7? [**4 points**]

```
1    a = 5.0
2    b = 10
3
4    result_1 = a + b
5    result_2 = a / b
6    result_3 = a ** b
7    result_4 = result_3 % result_1
8
9    print(result_1, result_2, result_3, result_4)
```

(b) What error does the following code produce and why? [**2 points**]

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[1] This is the last submission through Canvas. All future assignments will be submitted to your private git repository.

```
x = 1.234
y = -0.5

result = (x*y - (-y/x)**0.5)/(1 + (y//x)**3)
```

2.2 Very Simple Temperature Calculator (13 points)

Write a Python program `addtemperatures.py` that adds a temperature difference in Fahrenheit, $\Delta\theta$, to an absolute temperature, given in Kelvin, T, and returns the sum in Kelvin. The program should

- ask the user for two floating point numbers T (absolute temperature in Kelvin) and $\Delta\theta$ (temperature difference in degrees Fahrenheit) as input

- store the sum "$T + \Delta\theta$" in units of Kelvin (where $\Delta\theta$ must be converted to Kelvin) in a variable named `T_total` and also print it.

The conversion of an absolute temperature from Fahrenheit to Kelvin is (written with numbers T/K and $\theta/^\circ\mathrm{F}$)[2]

$$T/\mathrm{K} = \frac{5}{9}(\theta/^\circ\mathrm{F} - 32) + 273.15 \tag{1}$$

(a) Derive an expression for $\Delta T = T_2 - T_1$ as a function of $\Delta\theta = \theta_2 - \theta_1$ (where T_2, T_1, θ_2, and θ_1 are arbitrary and only introduced to make the connection to Eq. 1). Show that the *difference in Kelvin* is 5/9-th of the difference in Fahrenheit, [**3 points**]

$$\Delta T/\mathrm{K} = \frac{5}{9}\Delta\theta/^\circ\mathrm{F}. \tag{2}$$

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[2]We use "symbol/unit" to indicate a number without the unit so that we can write equations where all units correctly balance. For instance, if $T = 373$ K then T/K is the number 373. This approach is more precise than just saying "Take T as the temperature in Kelvin and θ in Fahrenheit."

(b) Use your result from the previous problem (i.e., Eq. 2) to derive a mathematical expression to compute the sum of T and $\Delta\theta$. [**2 points**]

(c) Write the `addtemperatures.py` program and copy and paste the code. [**7 points**]

(d) Show the complete input and output (copy and paste) for the input $\Delta\theta = 63°\mathrm{F}$ and $T = 265\,\mathrm{K}$. [**4 points**]

2.3 Version control with Git (9 points)

Keep your answers short, one or two sentences should be sufficient for questions (b)–(d).

(a) *Briefly* explain what a version control system such as Git does and how it can help you. (For your answer, it is sufficient to focus on three different aspects out of many — choose the ones that *you* find most important.) [**3 points**]

(b) Explain the difference between `git init` and `git clone`. [**2 points**]

(c) Explain the difference between `git add` and `git commit`. [**2 points**]

(d) Explain the difference between `git commit` and `git push` [**2 points**]

2.4 Be the Git (10 points)

In this problem you should state various outcomes when a number of git commands are run on the directory structure in Figure 1 (*Documents* is the top-level directory, sub-directories are indicated by blue folder icons, files are text):[3]

User dvader decides (quite sensibly) to use version control, namely **git**, for his Documents. The *Documents* directory was not under version control before. The first set of commands that he performs is:

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[3]You can pretend to be git or you can also create the directory structure yourself and run the commands.
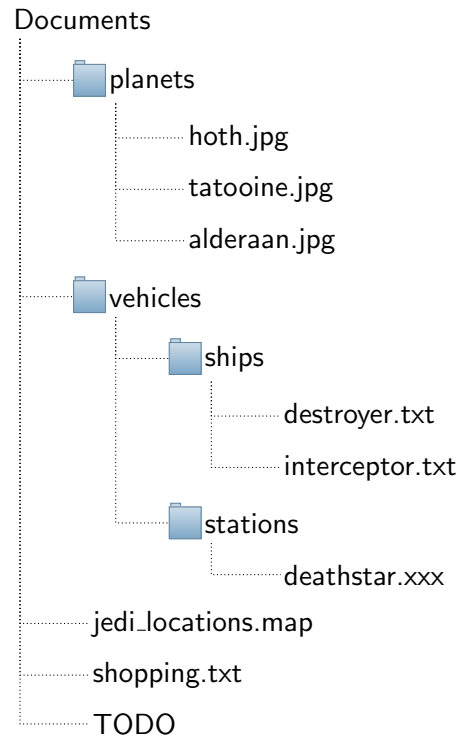
Figure 1. Part of the directory tree of user dvader. *Documents* is the top-level directory, sub-directories are indicated by blue folder icons, files are just shown as text with their file name, e.g., *TODO* or *hoth.jpg*.

```
cd Documents
git init
git add shopping.txt
git add planets/alderaan.jpg
```

To answer the following question, create a table where you list the command that is being executed, the *files in the git staging area* and the *files in the git repository*. After the initial commands, your table should look like this:

command	staging area	repository
git init		
git add shopping.txt	shopping.txt	
git add planets/alderaan.jpg	shopping.txt, planets/alderaan.jpg	

List *all* files that are in either staging area or repository, not just new ones. If there are no files (as in the repository during the first three `git` commands), leave the space empty.

Add the table above to your submitted solution and continue it by listing all the files in the staging area and in the repository, after each of the following commands have been carried out:

```
git commit
git add vehicles/stations
git commit
git add vehicles TODO
git commit
git rm planets/alderaan.jpg
git add planets
git commit
```

2.5 Your GitHub account (10 points)

As part of the last lesson you should have set up your own GitHub account on https://github.com (if you have not done it yet, do it now!). What is your **GitHub username**?

- Write down your GitHub username. [**10 points**]

- Take the survey PHY 494: Your GitHub account[4] if you have not done so already.

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[4]In case the link to the survey is not clickable: got to https://forms.gle/gt8PYQ931eU1ULFk9. You must be logged in with your ASU account. Log in to https://my.asu.edu first and then go to the survey.