UCF Physics PHZ 3150: Introduction to Numerical Computing
Homework 4
Due September 15 2022 - 12:01 pm

Goals: Become familiar with Python, functions, lists and tuples.
Reading and study: Read Think Python Chapters 2 and 3 (you can also start reading 10).

Problems to Hand In: For this assignment, your log is part of your homework. In one of the entries, it should identify the start and end of HW4 and list the problem numbers in order. Keep notes about what you are doing for each exercise/problem, as well as the answers to the problems. If you made a HW4 entry in your log in a prior session and want to change it, just copy it to the current (last) session, and edit there. We will grade the last entry only. All text related to one assignment should be in one entry, with the problems done in order.

Problem 1 (**5 points**). Make a new folder named `hw4_<yourname>` under you `homework` folder. For this homework your main homework file is a Python file named `hw4_<username>.ipynb`. Save it in your homework folder. Remember to commit your files and push to GitHub (also, great backup!).

Your name, assignment number, and the date should appear as comments at the top of the notebook. At the start of every problem write the problem number using markdown comments. Any remarks or written answers you may make should be written with markdown. If you need to comment something in the code (for coding clarity) do so with a normal comment (i.e., `# this is a comment`). Remember that using comments is good coding practice, and it will be taken into account during the grading process.

Print the problem number (as in "Problem 1:") before each problem's output. Use the print() function to print, don't just type the expression. Below you can see an example of what your notebook should look like.

Problem 2:

We have a body of mass m (kg). When a force F (N) acts on it, according to Newton's second law, the body will get an acceleration a (m/s2). Remember that F=ma. Write an expression that 1. Calculate F for the following mass and acceleration pairs:

- 10 -> 5
- 15 -> 10
- 20 -> 5
- 40 -> 3

```
7]: print( 'Problem 2 ')
    #write the expression: F = m * a
```

```
Problem 2
```

Problem 2 (**15 points**). We have a body of mass `m` (kg). When a force `F` (N) acts on it, according to Newton's second law, the body will get an acceleration `a` (m/s^2).

Remember that `F=ma`. Write an expression that calculates F for the following mass and acceleration pairs:

m [kg]	a [m/s²]
10	5
15	10
20	5
40	3

Then, make a function `force_to_acceleration` that calculates the acceleration of a body of mass `m[kg]` when a force `F[N]` is applied on it. Remember to use a good docstring! Also, remember to write enough comments throughout your code. Calculate the acceleration of a body of mass 150kg when forces `F` of 100, 22 and 450 (N) are applied to it.

Problem 3 (**20 points**). The acceleration of a body can be approximated by the ratio of the change of a body's speed (u2-u1) over a time span (t1-t1) as: a=(u2-u1)/(t2-t1). Write a function called `acceleration(u1,u2,t1,t2)` that takes the different speeds (u1,u2) of a body at times t1 and t2 and calculates the acceleration of the body. Save it in a **separate .py file**, not your main homework file. Remember to start the function with a good docstring. In your main homework file, import the function and calculate the acceleration of a body for the following times and speeds

t1 [s]	t2 [s]	u1 [m/s]	u2 [m/s]
0	2	10	13
10	14	15	30
14	16	32	36
28	32	42	20
0	10	20	22

Calculate these numbers some other way to check that they are correct (in general, always check your code in this way). State in comments how you checked (calculator, web site, etc.). Name 2 test cases you could use to verify the code works as it should. Don't forget to use comments in your code, when appropriate!

Problem 4 (**15 points**). Create a list `velocity` with numbers starting from 0 to 100 with a step of 10. Print it.
Create a list `time` with numbers from 0 to 1000 with a step of 100. Print it. Print the 3rd up to and including the 5th element, and the 8th velocity element.

Using the acceleration function you created above, call the function and calculate the acceleration of a target for each of these velocity pairs (so the 3rd-4th, 4th-5th, 5th-8th element), using the corresponding times. Remember that Python starts counting from 0!

Change the 5th element of velocity to 90 and print velocity. Does it work? Why/ why not?

Problem 5. (**10 points**) Prepare and submit your homework. Save the finalized Jupyter notebook and don't forget to commit and push it to GitHub. Explain what you did to do that in your log. Make a screenshot that shows you committed the file and add it to your `hw4_<yourname>` folder (remember to use an appropriate name for the screenshot!). Write what you did to make and submit the zip file into your log. When satisfied, close the log, copy it to your homework directory one last time, and make the zip file. Turn the file in on WebCourses.