UCF Physics PHZ 3150: Introduction to Numerical Computing
Fall 2021 Homework 6
Due September 30 2021

Goals: Become familiar with Python, lists, tuples, strings and plotting.
Reading and study: Read Think Python Chapters 8 and 11.

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 HW6 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 HW6 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 `hw6_<yourname>` under you `handin` folder. For this homework your main homework file is a Python file named `hw6_<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 also 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`). **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. Start your notebook by importing numpy.

Problem 2 (**15 points**). Import numpy and pyplot. Create a numpy array `x` that goes from 1 up to and including 100 (last element *must* be 100.0) with a step of 0.5. Create array y that is the log10 of x and array z that is equal to the square root of x. Plot y(x) and z(x) in the same plot. Manually specify **different** colors, line styles, line thicknesses markers (and their size) and tickmarks for your plot. Add titles to your plot axis. Make sure they are legible. Save it as a pdf file using the appropriate naming conventions.

Problem 3. (**15 points**) Create an array `q` that has the values: 45 24 5 30 3 67 33 60 65 13 82 75 21 77 67 8 86 62 23 70 11 70 21 15 84 51 6 79 78 66 2 93 49 74 23 85 25 38 1 89 . Print the array. Print the locations where `q` is larger than 50. Print in one command the elements of `q` that are larger than 50 and smaller than 70.

Make a list `test_list` out of `z`. Print the 12th up to and including the 14th elements of the list. Change element 28 of the list to be 42.0. Does it work? Why/ why not? Explain.

Make a tuple `test_tuple` out of `z` . Print the 20th element of `test_tuple`. Change element 21 of `test_tuple` to be 44.0. Does it work? Why/ why not? Explain.

Create a list of strings `word_list` that contains the words 'twinkle', 'twinkle', 'little', 'star'. Scan every word (one by one is fine, we haven't talked about for loops yet) of your list and find out which words contain a 'e' and which words contain an 'a', and the index of the letter 'e' and 'a' in the word (e.g., in Mary 'a' is on 1). Is word 'star' or 'bright' in your `word_list`? Write the code to test it.

Problem 4 (**15 points**). Recall the quadratic formula $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, which solves for the roots of $ax^2 + bx + c = 0$. Write a function that calculates and returns a **list** containing both of the roots, given the three coefficients. Be sure to include a docstring! What does it need to include? Calculate the roots of $x^2 - x - 12 = 0$**,** returning them directly into two variables. Print them.

Problem 5 (**10 points**). Prepare and submit your homework. Copy the finalized Jupyter notebook to the `handin/hw6_*` folder 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 `handin/hw6_*` 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 run the commands to make and submit the zip file. Turn the file in on WebCourses.