UCF Physics PHZ 3150: Introduction to Numerical Computing
Fall 2022 - Homework 7
Due October 13 2022

Goals: Become familiar with Python, revisit functions, conditionals (IF) and loops (FOR/WHILE). Check the demos we did in class, and as always if you have any questions try finding the answer on the appropriate python.org websites or StackOverflow. If you cannot find the solution, come to office hours or email me!

Reading and study: Read Think Python Chapters 5 and 7.

Problem 1 (**5 points**). Make a new folder named `hw7_<yourname>` under you HW folder. As before, your main homework file is a Python file named `hw7_<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. 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). 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**). `For` loops automatically iterate over a parameter `i` (unlike while loops). They start from `i=0` (or whichever value you ask), do what you want them to do and then automatically do `i = i+1` (`i+=1`). Writing an extra `i = i+1` can create accidental bugs in `for` loops, while missing a `i = i+1` can make your while loops run an infinite time.

Code a program that scans the sentence: *"Deleting an item from a list or array while iterating over it is a Python problem that is well known to any experienced software developer"* and prints out the words it's made of.

Then, use a `for` loop to loop over the full sentence, and print - at the end - only the longest word of the sentence.
Do the same program, but now looping over the sentence with a `while` loop.

Create a program that scans only the first 6 words (so ""Deleting an item from a list") and prints only the UNIQUE letters in this sentence.

Problem 3 (**15 points**). Open a text file and name it `hw7_support_funct.py`. **Do not** write the function on the Jupyter notebook you may be using, as it will store the function in its memory and you may think that you imported from the `.py` file when you

didn't. If you chose to test the code on the Jupyter notebook, use a different name for your function in the two locations so that you can separate the two.

In the `hw7_support_funct.py` create a function `circle(x,x0,y0,r)` that takes as input an array `x`, the coordinates of the center of the circle `(x0,y0)` and a radius `r` and return all y coordinates of the circle with radius `r`. Remember that a circle follows the: $(x-x0)^2+(y-y0)^2 = r^2$. Write an appropriate informative docstring. Go in your main homework file and import the function `circle`. Call it for `(x0,y0)= (2,2)`, `x = -8.+0.1*np.arange(220)` and `r =10`. Use the y coordinates to plot the circle (if you get only half a circle, why is that? Explain and fix your function to return both values).

Problem 4 (**15 points**). In the `hw7_support_funct.py` create a function `order_array(input_array)` that takes as input an array of numbers and orders them from smaller to larger (don't use any predefined function -numpy or otherwise- though!). Write an appropriate and informative docstring. Save it in your `hw7_support_funct.py`. Import the function in the main homework folder and call it for the array: `np.array([4,5,2,10,42,22,8,12])`. Now use the appropriate numpy function to test your results.

Problem 5 (**5 points**). You are given array `my_data = np.arange( 1, 26 ).reshape( (5, 5) )`. Access and print the numbers 4 9 14 19 24. Scan `my_data` with a for/if structure and find the maximum. Calculate the mean of the `my_data` using a for/if. How could you get the maximum and mean, *much* faster?

Bonus problem 6 (**5 points**). Code a program that will print the following 1-0 pyramid.

```
1
1 0
1 0 1
1 0 1 0
1 0 1 0 1
1 0 1 0 1 0
1 0 1 0 1
1 0 1 0
1 0 1
1 0
1
```

Problem 7 (**10 points**). Prepare and submit your homework. Copy the finalized Jupyter notebook to the `handin/hw7_*` 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/hw7_* 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.