CDS-230-001 - FALL 2023

PROBLEM SET 3

9/14/23

Instructions: Use the PS template provided in class to enter your name and your answers. When you are done run your script and make sure it executes without syntax errors. Note: You will need the **math** module to access math functions. Make sure you import it once at the top of your script.

Exercise 3.1: A one-parameter function (5 points)

Write a function that takes a single parameter x and returns the value y given by

$$y = \frac{1}{1 + e^{-x}}$$

Then, use a for-loop to call the function using integer values of x so that $-5 \leq x \leq 5$. Print the resulting x, y values as formatted ordered pairs (x, y). Use 2 decimal places of precision to print y.

Exercise 3.2: A two-parameter function (5 points)

Write a function that takes two parameters x and y and returns the value r given by

$$r = \sqrt{x^2 + y^2}$$

Then, use a for-loop to call the function for all integer values pairs of x, y, with $x = y$, so that $-5 \leq x, y \leq 5$ (i.e., (-5,-5), (-4,-4)...(4,4), (5,5)). Print the resulting r values for (x, y) = (-5,-5), (0,0), and (5,5). Use 2 decimal places of precision to print your results.

Exercise 3.3: Getting a name's initials (10 points)

Suppose you are given a string variable with a person's name in **lowercase** letters. For example, for me that would be *name = "carlos cruz"*. Your task is to use *name* to generate the name's *initials* in upper case; in my case that would be *"CC"*.

To do so you will write a **function** that takes in a *name* and returns the *initials*.

Test the function with your name (some of you have 3 names, thus you should get 3 initials). Just to make it clear, your solution should include: (1) the function implementation, (2) testing the function, (3) printing the result. Note that steps (2) and (3) can be done in one line of code.

Exercise 3.4: Function that returns a dictionary (10 points)

Given a sequence, write a function that counts the occurrence of each element in the sequence and returns a dictionary that shows the count of each element.

Test with the following sequences:

```
text = "Mississippi"
num_list = [72, 70, 75, 70, 72, 72, 71]
```

For example in the second case your output should be

```
{72: 3, 70: 2, 71: 1, 75: 1}
```

Your solution should include: (1) the function implementation, (2) testing the function for each case, (3) printing the result for each case.

Exercise 3.5: Return multiple values from a function(10 points)

Write a function named **list_stats** that accepts a list of numbers and returns the minimum, maximum and average values of the list. For example if list_input = [2,-1,10,5] then the function will return -1,10,4 corresponding to the minimum, maximum and average values of list_input.

Call your function using the following test lists: [2,-1,10,5], [10,8,6,4,2,0,-2,-4,-6,-8,-10], [4], [1,1,2,3,5,8,13] and make sure you print out the returned values using an informative print statement. Your solution should include: (1) the function implementation, (2) testing the function for each case, (3) printing the result for each case.

Hint: Use Python's intrinsic functions min(), max(), sum() and len()

Exercise 3.6: Computing sum of n terms (10 points)

Suppose you want to compute the value of the following sum

$$\sum_{i=1}^{n} 1/i^{p} \tag{1}$$

where i is an integer raised to a power p, for example i^1, i^2 or $i^{\frac{1}{2}}$.

For example, if $p = 1$, then your sum is

$$\sum_{i=1}^{n} \frac{1}{i^1} = \sum_{i=1}^{n} \frac{1}{i} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + ... + \frac{1}{n} \tag{2}$$

Your task is to write a function that takes in two arguments, n, the number of terms in the sum, and p, a power. The function will return the value of the sum.

Test with $n = 200$ and with the following values of $p = \frac{1}{2}, 1, 2, 3$

Do the values of the sums make sense? If so, why? Explain in one or two sentences.