**Name: Session:**

**Programming I**

**Lab Exercise 12/14/2023**

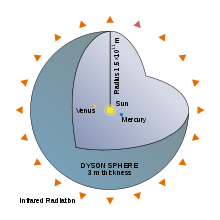
You are to write programs to solve the following problems. Print out your source code, attach to this sheet and turn it in. Make sure that each program is clearly documented with your name and problem number.

Hint: On the first two problems, consider writing a factorial function.

1. Compute the following value:  
     1 + 1/1! + 1/2! + 1/3! + 1/4! + ... + 1/10!

Note: ! means factorial. 4! = 4 \* 3 \* 2 \* 1

1. Write code to print the first 10 factorials, in reverse order. In other words, write code that prints 10!, then prints 9!, then prints 8!, ..., then prints 1!.
2. A **Dyson sphere** is a hypothetical megastructure originally described by Freeman Dyson. Such a "sphere" would be a system of orbiting solar-power satellites meant to completely encompass a star and capture most or all of its energy output. Dyson speculated that such structures would be the logical consequence of the long-term survival and escalating energy needs of a technological civilization, and proposed that searching for evidence of the existence of such structures might lead to the detection of advanced intelligent extraterrestrial life.



Write a program that will find the mass of a Dyson sphere built in our solar system per the diagram above. Assume it is made of iron and encompasses our Sun as well as Venus and Mercury and is 3 meters thick with a radius of 1 Astronomical Unit (1.5 x 1011 meters). The density of iron is 7.874 grams/cm3. The following equations might be helpful (but not necessarily).



Mass of Dyson Sphere = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kilograms

1. Write a function that determines the molecular weight of a hydrocarbon based on the number of hydrogen, oxygen, and carbon atoms. You should use the following atomic weights:

|  |  |
| --- | --- |
| **Atom** | **Weight (grams/mole)** |
| **H** | **1.0079** |
| **C** | **12.001** |
| **O** | **15.9994** |

The user should enter a string of the form C6H12O6 and you are to extract the number of atoms of each and return the molecular weight. Hint: find the index of C, H, and O then use string slicing.

def molecularWeight(formula):

TO DO: Add code here

return moleWeight

1. Write a program to find the sum of the cube roots of the first n natural numbers, where the value of n is provided by the user. Remember that the nth root of a real number is that number raised to the 1/n power.
2. Write a Python program that will print the following using a for loop:

|  |
| --- |
| 10  11 12  13 14 15  16 17 18 19  20 21 22 23 24  25 26 27 28 29 30  31 32 33 34 35 36 37  38 39 40 41 42 43 44 45  46 47 48 49 50 51 52 53 54 |

1. Create a big box out of *n* rows of little o's for any desired size n. Use an input statement to allow the user to enter the value for n and then print the properly sized box.

|  |
| --- |
| e.g. n = 3  ooo  o o  ooo  e.g. n = 8  oooooooo  o o  o o  o o  o o  o o  o o  oooooooo |