C200 Programming Exam

Dr. M.M. Dalkilic
Computer Science
School of Informatics, Computing, and Engineering

Indiana University, Bloomington, IN, USA

March, 1, 2023

Introduction

You are to complete this by yourself using only,

- The official Python documentation https://www.python.org/.
- Lecture slides from any section.
- Personal and class notes.
- Your homework

No other resources are allowed.

- We have pushed the midterm files in your repo. Pull the latest changes to your repo and access them under **Midterm** folder.
- The folder contains the starter code in **midterm.py**.
- Read the instructions for problems (starting next page) and implement the programs in midterm.py file.
- Remember to submit to the Autograder and push your work to the GitHub repository by **Thursday, March 2, 10:59 PM**.
- Since this is an exam so we won't answer questions about it on InScribe.

Note: If you don't see the Midterm folder or midterm.py in your repo then contact us immediately via InScribe.

Program

Please read the problem carefully. You should make some test cases yourself (using print) to check your program. Lastly, write all the print functions below main even though the examples do not (for sake of easiness of reading):

1. The function f takes a possibly empty list of objects (lists, numbers, strings, tuples) and returns a dictionary of the count of the digits no matter how the digit is used. The following shows three runs:

```
def f(lst):
    pass

data = [['0123456789'],[-0.1,"23",(4,5),[6,"7"],8-9j],[]]

for d in data:
    print(f(d))
```

gives output

```
{0: 1, 1: 1, 2: 1, 3: 1, 4: 1, 5: 1, 6: 1, 7: 1, 8: 1, 9: 1}
{0: 1, 1: 1, 2: 1, 3: 1, 4: 1, 5: 1, 6: 1, 7: 1, 8: 1, 9: 1}
{0: 0, 1: 0, 2: 0, 3: 0, 4: 0, 5: 0, 6: 0, 7: 0, 8: 0, 9: 0}
```

2. The Tsoilskovsky Rocket Equation is:

$$\Delta v \quad = \quad v_e \ln \frac{m_0}{m_1} \tag{1}$$

where m_0 is the rocket's mass with fuel (*wet mass*), m_1 is the rocket's mass after all the fuel is used (*dry mass*), v_e is the exhaust velocity of the fuel (usually a number from $2.5\frac{\text{km}}{\text{sec}}$ to $4.5\frac{\text{km}}{\text{sec}}$, and Δv is the speed of the rocket. If we're leaving Earth, we'll need $\Delta v = 13\frac{\text{km}}{\text{sec}}$ and $v_e = 4.5\frac{\text{km}}{\text{sec}}$. The space shuttle's dry mass is 74843 kilograms. Write a function that determines the mass of the fuel itself needed to carry the rocket into orbit given the mass of a rocket. Please use the math module for Euler's constant. Here is the necessary and sufficient data–you must work out the answer on your own. For this problem, use the math module ceiling function on your answer.

```
1  import math
2
3  def fuel_mass(mass_of_rocket, delta_v, v_e):
4      pass
5
6  delta_v = 13                  #km/sec
7  v_e = 4.5                     #km/sec
8  mass_of_rocket = 74843        #kg
```

will produces

Here is the total program:

```
1  import math
2
3  def f(xlst,n):
4      pass
5
6  def fuel_mass(mass_of_rocket, delta_v, v_e):
7      pass
8
9   if __name__ == "__main__":
10     '''add output below this line'''
11
12     #Problem 1
13     # data = [['0123456789'],[-0.1,"23",(4,5),[6,"7"],8-9j],[]]
14
15     # for d in data:
16     #     print(f(d))
17
18     #Problem 2
19     # delta_v = 13                #km/sec
20     # v_e = 4.5                   #km/sec
```

```
    # mass_of_rocket = 74843       #kg
    # print(fuel_mass(mass_of_rocket,delta_v,v_e))
```