United International University
B.Sc. in Data Science

DS 1115: Object-Oriented Programming for Data Science

Final Exam: Summer 2024 Time: 2 Hours Marks: 50

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Answer all of the following questions.

1. (a) You are designing a robot named **Wall-E**. To control this robot , Write a Python function named **RemoteControl** which will take *direction & steps* as an input. Now , consider that Wall-E starts with 70% charge in its battery and each step in any direction depletes 2% of its battery. Create a custom exception named **BatteryDownError** and raise it from the function when Wall-E is under 20% batter. You should also write test code to call your function for different cases where these exceptions will be raised. [3+3=6]

   (b) Find the output of the following program. [4]

```
def process_input(x, y):
    try:
        result = 10 / x
        print(f"Outer try: result = {result}")

        try:
            if y < 0:
                raise ValueError("Negative value for y not allowed.")
            elif y == 0:
                raise ZeroDivisionError("y cannot be zero.")

            result = result / y
            print(f"Inner try: result = {result}")
        except ValueError as ve:
            print(f"Inner except ValueError: {ve}")
        except ZeroDivisionError as ze:
            print(f"Inner except ZeroDivisionError: {ze}")
        finally:
            print("Inner finally block executed.")

    except ZeroDivisionError as ze:
        print(f"Outer except ZeroDivisionError: {ze}")
```

```
        finally:
            print("Outer finally block executed.")

process_input(5, 2)
process_input(0, 2)
process_input(5, -1)
```

2. (a) You've bought a new earphone and want to give it to your grandmother. Now, you don't want her to listen to very loud noise. So, each time the earphone gets to play a sound, it detects the highest volume in that clip and attenuates that to a desired level. Use a decorator in the following code to support this. [5]

```
class Earphone:
    def __init__(self):
        self.desired_level = 85

    def check_volume(self, clip):
        return max(clip.volumes)

    def play(self, clip):
        pass
```

(b) Find the output of the following program. [5]

```
def outer_decorator(func):

    def wrapper_outer(*args):

        print("Outer decorator start")

        result = func(*args)

        print("Outer decorator end")

        return result

    return wrapper_outer


def inner_decorator(func):

    def wrapper_inner(*args):

        print("Inner decorator start")

        result = func(*args)
```

```
            print("Inner decorator end")
            return result
        return wrapper_inner

@outer_decorator
@inner_decorator
def calculate(a, b):
    print(f"Calculating {a} + {b}")
    return a + b

result1 = calculate(5, 3)
print(f"Result 1: {result1}")
print("-----------------")
result2 = calculate(7, 2)
print(f"Result 2: {result2}")
```

3. (a) Reading large files are memory intensive. These days file sizes are skyrocketing. Design a Python generator function that will be able to solve this memory problem by returning a single line each time. Also use this generator to count the total number of words in the file. [4]

   (b) Find the output of the following program. [6]

```
def myShell(func):
def wrapper(*args):
    print("----")
    for value in func(*args):
        if value % 2 == 0:
            yield value * 2
```

```
            else:
                yield value + 1
        print("----")
    return wrapper

@myShell
def number_generator(numbers):
    print("Hello")
    for num in numbers:
        yield num
    print("World")


gen = number_generator([1, 2, 3, 4])
print("Generated values:")
for val in gen:
    print(val)
```

4. You are given a dataset,*customer_satisfaction.csv*, that contains information about customers and their satisfaction scores based on several features. The following contains the description of some of the columns:

   i **income**: Annual income of the customer in USD (float, contains missing values).

   ii **purchase_history**: Total number of items purchased in the last year (integer).

   iii **satisfaction_score**: Customer satisfaction score (target column,integer, ranges from 1 to 10).

age	income	purchase_history	satisfaction_score	signup_date	loyalty_tier
25	55000	5	8	2015-06-12	Gold
45	NaN	15	6	2016-04-22	Silver
35	72000	10	NaN	2017-09-15	Bronze
23	45000	NaN	7	2018-12-11	G0ld
NaN	50000	8	9	2019-07-30	Bronz
120	85000	20	10	2015-11-01	Silver
42	62000	NaN	5	2016-08-14	Bronze
32	-30000	7	8	2018-01-25	Silver
NaN	NaN	NaN	NaN	2017-05-16	Silver
27	58000	12	6	2016-02-20	Silver

Table 1: Customer Satisfaction Dataset

(a) Write code to read the contents of the file into a Pandas DataFrame. [1]

(b) If you notice the data, you will see some cells have the value "NaN". Briefly explain NaN and point out if there's any other problems in the *income* column? [3]

(c) Identify the inconsistencies in *loyalty_tier* column. Write a single line of code that will solve these inconsistencies [2]

(d) Is there any Row or Column that can be dropped? Justify your answer [2]

(e) Write code to handle the null values in *satisfaction_score* column. Justify your answer briefly. [2]

5. Suddenly your father is concerned about the electricity bill and consumption of your home and he has given you the task to analyse based on the graphs from our very own DESCO dashboard.

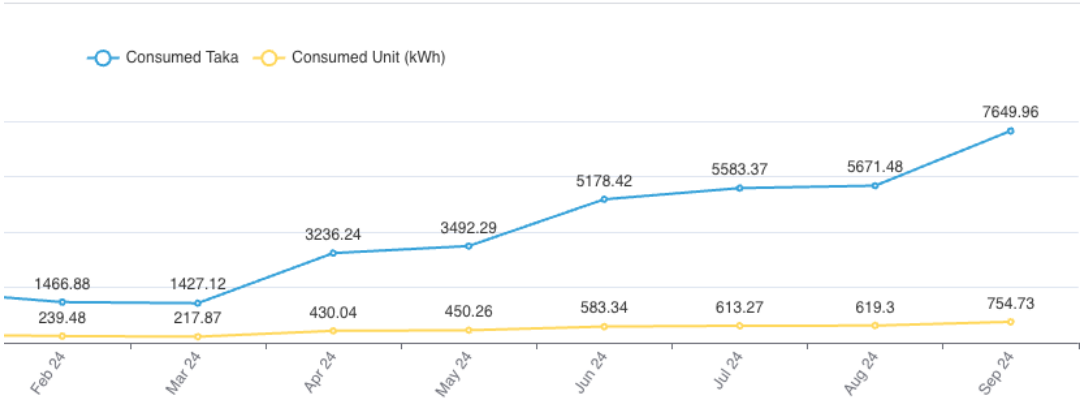

Figure 1: Consumption & Bill Amount

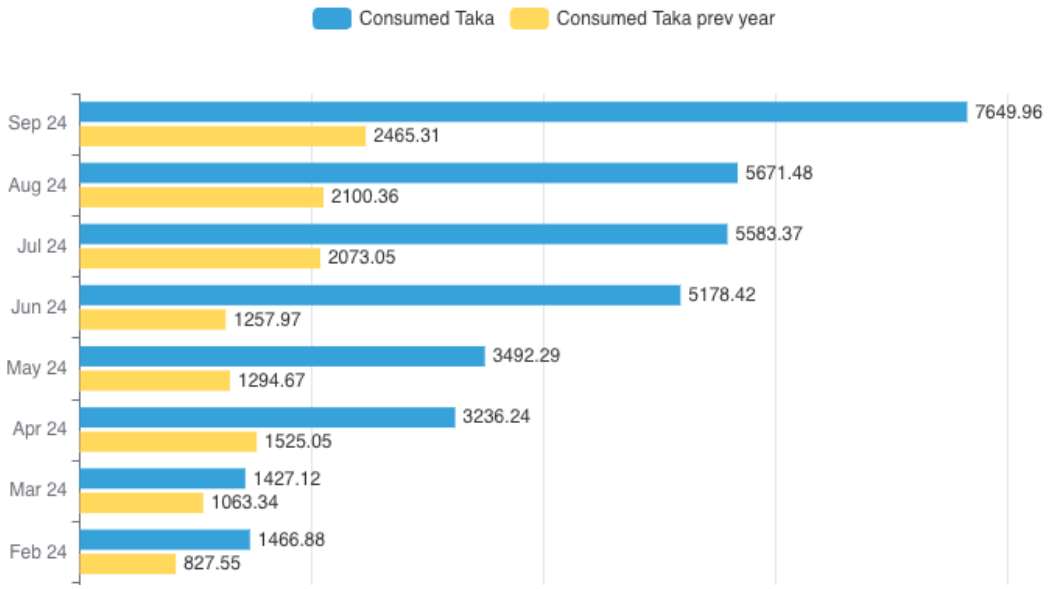

Figure 2: Monthly Bill Comparison

(a) Write down the type of the graphs in Figure 1 & Figure 2. [2]

(b) You are confused whether the per unit bill the government increased or the total consumption per month increased in your home in the past months. Justify your answer using these two graphs. Find out the per unit cost for month September 24. [5]

(c) Write down the necessary codes to replicate Monthly Consumption Comparison graph. [3]