219116/117 Programming I

Lab 1

Answer the following 3 questions in a file named StudentID_Firstname_lab1_ans.pdf, where StudentID is your KU ID and Firstname is your given name

1. **OOP Review**

Without using computers, analyze the following code and predict the outcome:

```
class Student:
    students = 0 # this is a class attribute
    def __init__(self, name, ta):
        self.name = name # this is an instance attribute
        self.understanding = 0
        Student.students += 1
        print("There are now", Student.students, "students")
        ta.add_student(self)

    def visit_office_hours(self, staff):
        staff.assist(self)
        print("Thanks, " + staff.name)

class Professor:
    def __init__(self, name):
        self.name = name
        self.students = {}

    def add_student(self, student):
        self.students[student.name] = student

    def assist(self, student):
        student.understanding += 1
```

What will the following lines output?

>>> snape = Professor("Snape")

>>> harry = Student("Harry", snape)

Your answer: There are now 1 students

```
>>> harry.visit_office_hours(snape)
```

Your answer: Thanks, Snape

```
>>> harry.visit_office_hours(Professor("Hagrid"))
```

Your answer: Thanks, Hagrid

```
>>> harry.understanding
```

Your answer: 2

```
>>> for name in snape.students:
>>>     print(name)
```

Your answer: Harry

```
>>> x = Student("Hermione", Professor("McGonagall")).name
```

Your answer: There are now 2 students

```
>>> x
```

Your answer: Hermione

```
>>> for name in snape.students:
>>>     print(name)
```

Your answer: Harry

2. **Inheritance**

Without using computers, analyze the following code and fill in the blanks.

Consider the following Dog and Cat classes:

```
class Dog():
    def __init__(self, name, owner):
        self.is_alive = True
        self.name = name
        self.owner = owner
    def eat(self, thing):
        print(self.name + " ate a " + str(thing) + "!")
    def talk(self):
        print(self.name + " says woof!")

class Cat():
    def __init__(self, name, owner, lives=9):
        self.is_alive = True
        self.name = name
        self.owner = owner
        self.lives = lives
    def eat(self, thing):
        print(self.name + " ate a " + str(thing) + "!")
    def talk(self):
        print(self.name + " says meow!")
```

Notice that because dogs and cats share a lot of similar qualities, there is a lot of repeated code! To avoid redefining attributes and methods for similar classes, we can write a single superclass from which the similar classes inherit. For example, we can write a class called Pet and redefine Dog as a subclass of Pet:

```
class Pet():
    def __init__(self, name, owner):
        self.is_alive = True    # It's alive!!!
        self.name = name
        self.owner = owner
    def eat(self, thing):
        print(self.name + " ate a " + str(thing) + "!")
    def talk(self):
        print(self.name)

class Dog(Pet):
    def talk(self):
        print(self.name + ' says woof!')
```

```
class Cat(Pet):
    def __init__(self, name, owner, lives=9):


        # fill me in
        super().__init__(name, owner)
        self.lives = lives



    def talk(self):
        """ Print out a cat's greeting.

        """
        # fill me in
        print(self.name + ' says meow!')




    def lose_life(self):
        """Decrements a cat's life by 1. When lives reaches zero, 'is_alive'
        becomes False. If this is called after lives has reached zero, print
        out that the cat has no more lives to lose.
        """


        # fill me in
        if self.lives == 0:
            print('that cat has no more lives to lose.')
        self.lives -= 1
        if self.lives < 1:
            self.is_alive = False
```

>>> Cat('Thomas', 'Tammy').talk()

Thomas says meow!

```
class NoisyCat(Cat):
    """A Cat that repeats things twice."""


    def talk(self):
      """Talks twice as much as a regular cat."""


      # fill me in
        print(self.name + ' says meow!')
        print(self.name + ' says meow!')
```

>>> NoisyCat('Magic', 'James').talk()

Magic says meow!

Magic says meow!

3. More inheritance

Study the code in the file car.py and predict the outcome of the following code.

>>> deneros_car = Car('Tesla', 'Model S')
>>> deneros_car.model

Your answer: Model S

>>> deneros_car.gas = 10
>>> deneros_car.drive()

Your answer: Tesla Model S goes vroom!

>>> deneros_car.drive()

Your answer: Cannot drive!

>>> deneros_car.fill_gas()

Your answer: Gas level: 20

>>> deneros_car.gas

Your answer: 20

>>> Car.gas

Your answer: 30

>>> deneros_car = Car('Tesla', 'Model S')
>>> deneros_car.wheels = 2
>>> deneros_car.wheels

Your answer: 2

>>> Car.num_wheels

Your answer: 4

>>> deneros_car.drive()

Your answer: Cannot drive!

>>> Car.drive()

Your answer: TypeError: drive() missing 1 required positional argument: 'self'

>>> Car.drive(deneros_car)

Your answer: Cannot drive!

Verify your answer by executing the code with car.py. You can do this with Python interactive mode:

python3 -i car.py

```
>>> deneros_car = Car('Tesla', 'Model S’)
>>> deneros_car.model

...
```

Complete the following coding questions. Use the code skeleton provided with this lab.

4. **mint.py**

Complete the Mint and Coin classes so that the coins created by a mint have the correct year and worth.

- Each Mint instance has a year stamp. The update method sets the year stamp to the current_year class attribute of the Mint class.
- The create method takes a subclass of Coin and returns an instance of that class stamped with the mint's year (which may be different from Mint.current_year if it has not been updated.)
- A Coin's worth method returns the cents value of the coin plus one extra cent for each year of age beyond 50. A coin's age can be determined by subtracting the coin's year from the current_year class attribute of the Mint class.

The expected outcome is given in the Doctest for Mint class

Submission:

- ***Create StudentID_Firstname_lab1 folder, where StudentID is your KU ID and Firstname is your given name***
- ***Put the files to submit, StudentID_Firstname_lab1_ans.pdf and mint.py, into this folder***
- ***Zip the folder and submit the zip file to the course’s Google Classroom before the due date***