CSCI-SHU 210 Data Structures

Recitation 1 Object-Oriented Programming Review

You have a series of tasks in front of you. Complete them! Everyone should code on their own computer, but you are encouraged to talk to others, and seek help from each other and from the Professor/TA.

"_____" means this is your task to complete!

Important topics for today:

- OOP
  - Please watch the videos as mentioned in our OOP review slides.
  - Why code in OOP
  - OOP syntax
  - Keyword "self" meaning
  - Operator overloading (__***__ functions)
  - Basic inheritance
- Misc Python topics
  - The purpose of if __name__ == "__main__"
  - The purpose of "__slots__"
  - "yield" keyword in Python and generator in Python

Topic 1 (Why OOP?):

- Just a different coding style
- More readable code
- …… _____easier to maintain, adaptability. encapsulation._____
  _____

Topic 2 (Creating a class):

Let us create **class Student** together. Open (OOP Create a class.py) file, write your code.

```
class Student:
    # Constructor / Initializer
    # name should be stored publicly;
    # age should be stored publicly;
    # GPA should be stored privately. (By convention)
    def __init__(self, name, age, GPA):
        # Your code
        _____________________________________________________

        _____________________________________________________

        _____________________________________________________

    # For private variables we need getters/setters. By convention.
    def get_GPA(self):
        # Your code
        _____________________________________________________

    def set_GPA(self, GPA):
        # Your code
        _____________________________________________________
```

```
# What does keyword self do in Python?
```

_____self identifies the instance upon which a method is invoked; By using the " self" keyword we can access the attributes and methods of the class in python. It binds the attributes with the given arguments.

_____

Topic 3 (underscore __*******__ functions):**

Python has some functions, by convention, has some other representation to make our coding easier. Those function names are reserved and looks like __*********__(self).

In this course, you will encounter some "underscore" functions much __init__,__len__,__str__,__detitem__,__setitem__,__getitem__, __iadd__,__add__ etc.

In Java/C++, those functions are called **operator overloading.
For example:

```
1.  class Pizza:
2.      def __init__(self, price):
3.          self.price = price
4.
5.      def __add__(self, other):          # Overload + operator
6.          new_pizza = Pizza(self.price)
7.          new_pizza += other
8.          return new_pizza
9.
10.     def __iadd__(self, other):         # Overload += operator
11.         self.price += other.price
12.         return self
13.
14.     def __str__(self):
15.         return "the price is, " + str(self.price)
16.
17. def main():
18.     pizza1 = Pizza(5)
19.     pizza2 = Pizza(6)
20.     pizza1 + pizza2
21.     pizza1 += pizza2
22.     print(pizza1)
23.
24. main()
```

a) What does the code above print? Don't run the program, try to predict the output first.

```
# What is the output for code above?
```

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b) Complete the following table, suppose the variable name is X. When will these underscore functions get called? Answer for 1st row has been given for your convenience.

"Underscore" function	other representation(Implicit call)
X.__getitem__(self, index)	X[index]
X.__setitem__(self, index, value)	X[index] = value
X.__delitem__(self, index)	del X[index]
X.__add__(self, other)	X + other
X.__iadd__(self, other)	X += other
X.__eq__(self, other)	X == other
X.__len__(self)	len(X)
X.__str__(self)	str(X)

`X.__repr__(self)`	`repr(X)`
`X.__contains__(self, value)`	`value in X`
`X.__iter__(self)`	`iter(X)`

Topic 4 (Inheritance):

Inheritance and the "Is a" relationship. A palm **is a** tree.

```
1.  class Tree:
2.      def __init__(self, name, age):
3.          self._name = name
4.          self._age = age
5.
6.      def get_name(self):
7.          return self._name
8.
9.  class Palm(Tree): # Palm(Tree) means, Palm inherits Tree.
10.     def __init__(self, name, age, color):
11.         # First you have to initialize the parent class. What should we write here?
12.
13.         super().__init__(name,age)
14.         self._color = color
15.
16.     def get_color(self):
17.         return self._color
18.
19. def main():
20.     palm1 = Palm("Lucky", 30, "green")
21.     print(palm1.get_name())    # What does this print (1)?
22.     print(palm1.get_color())   # What does this print (2)?
23.     tree1 = Tree("Funny", 20)
24.     print(tree1.get_name())    # What does this print (3)?
25.     print(tree1.get_color())   # What does this print (4)?
26.
27.
28. main()
```

What does the code above print? Don't run the program, try to predict the output first.

```
# What is the output for print (1)?
```

Lucky

```
# What is the output for print (2)?
```

green

```
# What is the output for print (3)?
```

Funny

```
# What is the output for print (4)?
```

None

Topic 5 (Misc):

```
# What does if __name__ == 'main' do in Python?
```

it determines whether the file is running individually, or is it being imported and used in another file. It's mainly for test purpose, if it's running on its own, the test code would run, vice versa.

```
# What does __slots__ do in Python? (Optional)
```

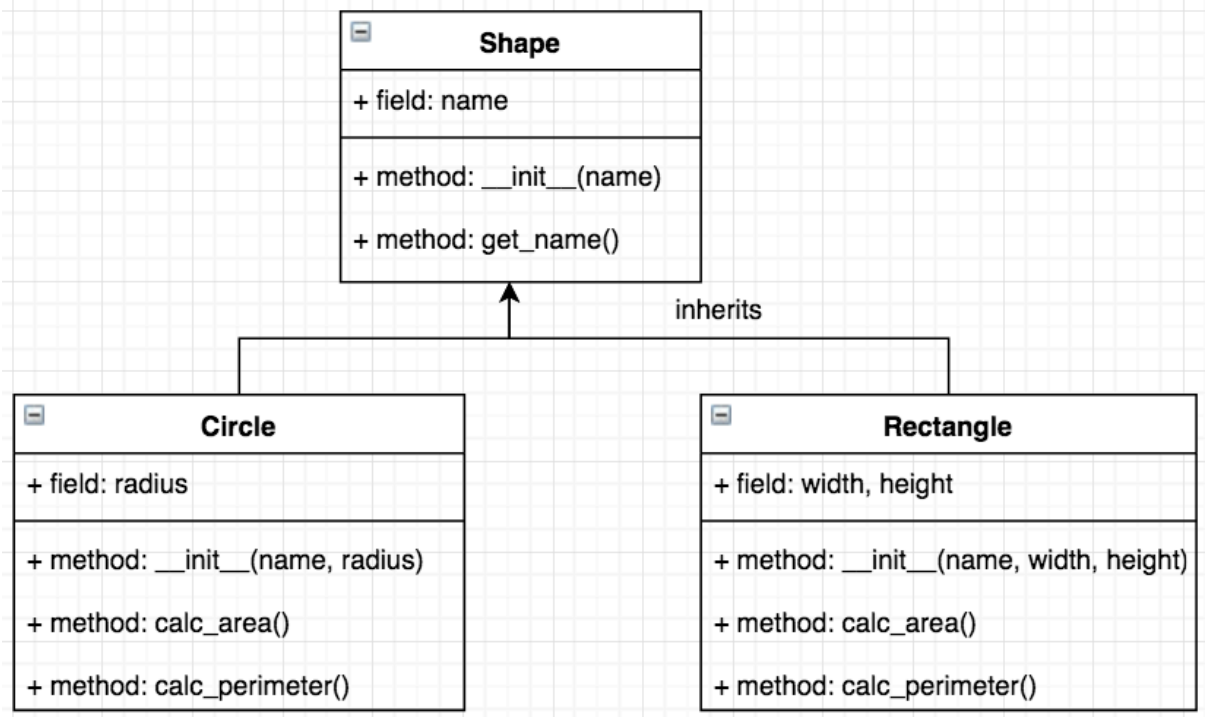
it could assign a fixed sequence of strings that serve as names for instance variables, it saves memory.

Coding 1 (Creating a class using UML Diagram, and then use this class.):

Now, open your favorite python editor, implement the following class hierarchy:
Shape, Circle, and Rectangle. Open **(OOP Shape.py) file and write your code.**

Note: Both Circle, Rectangle inherits Shape.

Once finished, test your **Shape, Circle, and Rectangle** and see if they work correctly.



 # This problem is challenging, try this problem only when you are already confident with previous problems.

Coding 2 (Creating a class using example calls):

Design and implement class Polynomial. Open (**OOP Polynomial.py**) file and write your code. It should behave like the following way:

```
1.  class Polynomial:
2.      def __init__(self, coeffs):
3.          self.coeffs = coeffs
4.      ###### To do ######
5.
6.
7.
8.  def main():
9.      # 1x^4 + 2x^3 + 3x^2 + 4x + 5
10.     coeffs = [1,2,3,4,5]
11.     poly = Polynomial(coeffs)
12.     print(poly.evaluate_at(2))   # Outputs: 57
13.     print(poly.evaluate_at(3))   # Outputs: 179
14.     print(poly)  # Outputs: 1x^4 + 2x^3 + 3x^2 + 4x^1 + 5
15.
16.     # 4x^3 + 6x^2 + 8x^1 + 10
17.     coeffs = [4,6,8,10]
18.     poly2 = Polynomial(coeffs)
19.     print(poly2)     # Outputs: 4x^3 + 6x^2 + 8x^1 + 10
20.     poly += poly2
21.     print(poly)    # Outputs: 1x^4 + 6x^3 + 9x^2 + 12x^1 + 15
```

Suppose I want to represent $1x^4 + 2x^3 + 3x^2 + 4x + 5$, then I input `python list [1,2,3,4,5]` into class Polynomial, my Polynomial should represent $1x^4 + 2x^3 + 3x^2 + 4x + 5$.

If I want to evaluate this polynomial, given `x = 2`, I simply call `Polynomial.evaluate_at(2).`

If I want to display my polynomial, I simply `print` it.

I should also be able to add one polynomial to another using `+=.`