EXERCISES:

INHERITANCE

&

POLYMORPHISM

- define a derived class *Shifted_Circle*
  1. takes radius and (x, y, z) coordinates for the center
  2. defines new method *distance*() to compute its distance from $(0, 0, 0)$
  3. overrides its *__str__*() method

Solution:

```
import math
# for brevity, we omit some methods
class Circle():
    __pi = 3.14
    def __init__(self, radius = 3):
        self.__r  = radius

    def __str__(self):
        return "Circle with radius {}"\
                    .format(self.__r)

        def get_radius(self):
        return(self.__r)

    def area(self):
        return Circle.__pi * self.__r**2


class Shifted_Circle(Circle):
    def __init__(self,radius=1, x=0,y=0,z=0):
        Circle.__init__(self, radius)
        self.__x = x
```

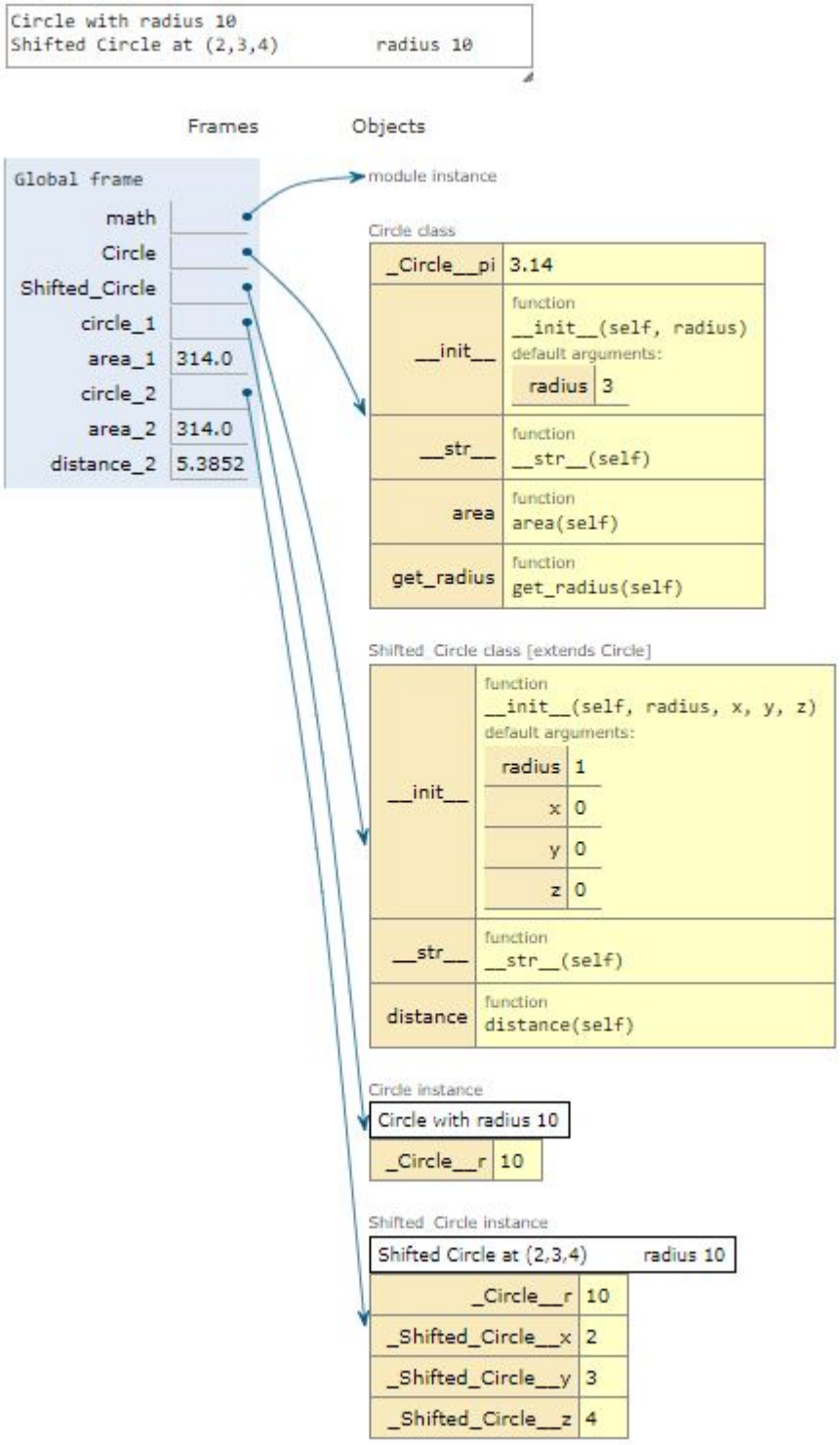
```
        self.__y = y
        self.__z = z


    def __str__(self):
        return 'Shifted Circle at ({},{},{}) \
                radius {}'.format(self.__x,
                self.__y, self.__z,
                Circle.get_radius(self))

    def distance(self):
            d = self.__x**2 + self.__y**2 + self.
        return(math.sqrt(d))

circle_1 = Circle(10)
area_1 = circle_1.area()
print(circle_1)

circle_2 = Shifted_Circle(10, 2,3,4)
area_2 = circle_2.area()
distance_2 = circle_2.distance()
print(circle_2)
```


Circle with radius 10
Shifted Circle at (2,3,4) radius 10
Frames
Objects
Global frame
math
Circle
Shifted_Circle
circle_1
area_1 314.0
circle_2
area_2 314.0
distance_2 5.3852
module instance
Circle class
_Circle__pi 3.14
__init__ function __init__(self, radius) default arguments: radius 3
__str__ function __str__(self)
area function area(self)
get_radius function get_radius(self)
Shifted_Circle class [extends Circle]
__init__ function __init__(self, radius, x, y, z) default arguments: radius 1 x 0 y 0 z 0
__str__ function __str__(self)
distance function distance(self)
Circle instance
Circle with radius 10
_Circle__r 10
Shifted_Circle instance
Shifted Circle at (2,3,4) radius 10
_Circle__r 10
_Shifted_Circle__x 2
_Shifted_Circle__y 3
_Shifted_Circle__z 4