CS 145 Day 19 worksheet – special methods and inheritance

Part A: the Rational class

Here is the `Rational` class from the slides. `math.gcd(2, 10)` is 2, the greatest common divisor of 2 and 10.

```
import math

class Rational:
    def __init__(self, num, den):
        g = math.gcd(num, den)
        self.num = num // g
        self.den = den // g

    def __str__(self):
        return str(self.num) + "/" + str(self.den)

    def __eq__(self, other):
        return self.num == other.num and self.den == other.den

    def __add__(self, other):
        return Rational(self.num * other.den + other.num * self.den,
                        self.den * other.den)
```

1. What does each line print?

Line of code	What it prints
`print(Rational(3, 6))`	1/2
`print(Rational(4, 4))`	1/1
`print(Rational(1, 4) + Rational(1, 4))`	1/2
`print(Rational(3, 6) == Rational(2, 4))`	True

2. Write the `__mul__` method, so that `a * b` returns a new `Rational`.
   To multiply fractions, multiply the tops and multiply the bottoms: `(a/b) · (c/d) = (a·c) / (b·d)`

```
def __mul__(self, other):
    """Returns self times other"""

    return Rational(self.num * other.num,
                    self.den * other.den)
```

Part B: which method runs?

Here are the `Pet`, `Dog`, and `Cat` classes from the slides. `Dog` and `Cat` are child classes of `Pet`.

```
class Pet:
    def __init__(self, name, age):
        self.name = name
        self.age = age

    def birthday(self):
        self.age = self.age + 1

    def speak(self):
        return "..."

    def __str__(self):
        return self.name + " says " + self.speak()
```

```
class Dog(Pet):
    def __init__(self, name, age, breed):
        super().__init__(name, age)
        self.breed = breed

    def speak(self):
        return "Woof"


class Cat(Pet):
    def speak(self):
        return "Meow"
```

These lines run in order:

```
1   d = Dog("Rufus", 5, "poodle")
2   c = Cat("Luna", 4)
3   print(d.speak())
4   print(d.age, c.age)
5   print(c)
```

3. For each call, whose method runs?

Call	Whose method runs: Pet's, Dog's, or Cat's?
`Dog("Rufus", 5, "poodle")` runs `__init__`	Dog's
then that `__init__` calls `super().__init__(name, age)`	Pet's
`Cat("Luna", 4)` runs `__init__`	Pet's
`d.speak()`	Dog's
`print(c)` runs `__str__`	Pet's
then that `__str__` calls `self.speak()`	Cat's

4. What do lines 3, 4, and 5 print?

Line 3 prints: Woof

Line 4 prints: 5 4

Line 5 prints: Luna says Meow