DISCUSSION 07

OOP, String Representation

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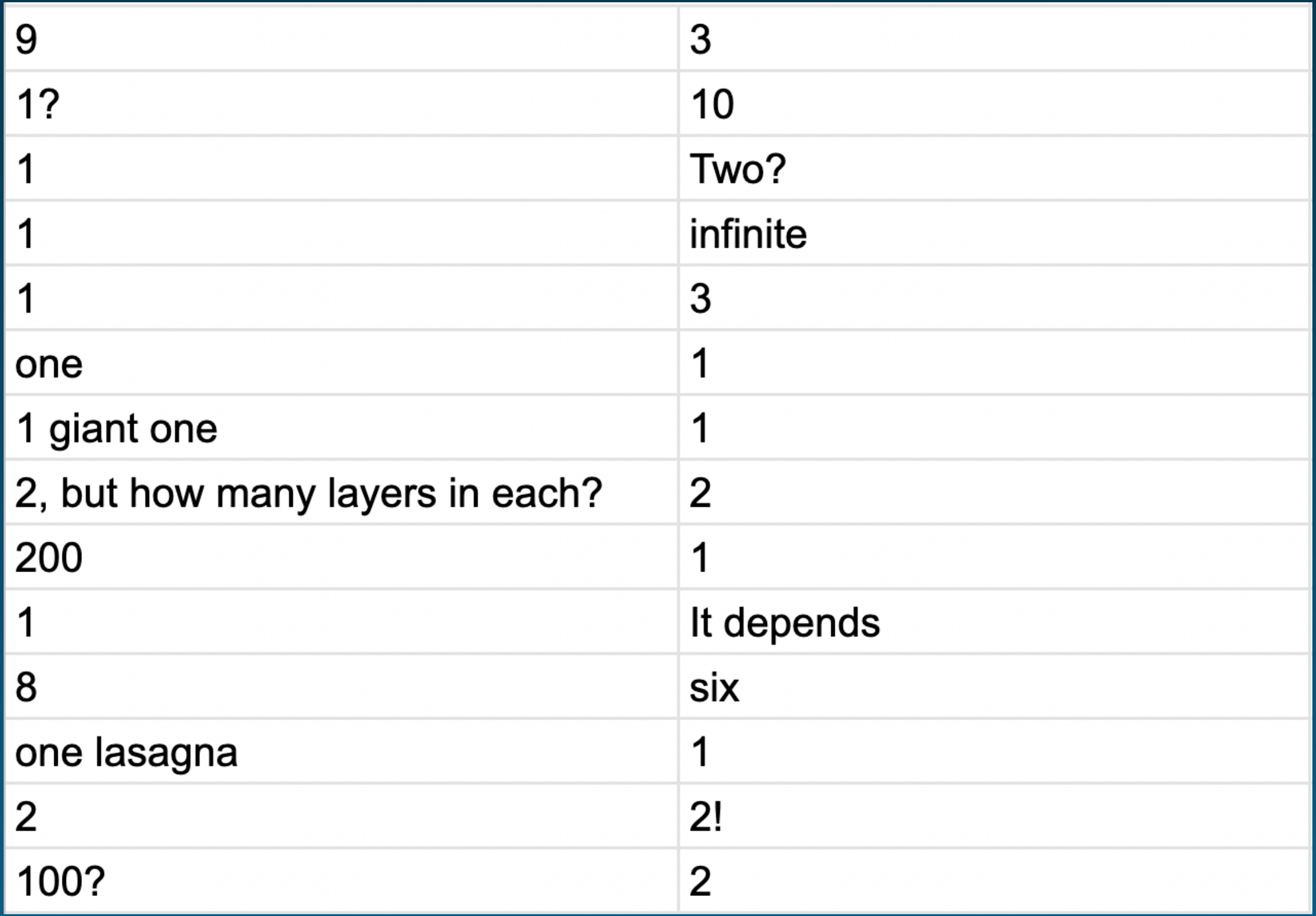
LOGISTICS 🏡

- Homework 05 due today 10/13
- ANTS is released!
    - Checkpoint 1 due tomorrow 10/14
    - Checkpoint 2 due next Tue 10/18
    - The whole project due next Fri 10/21
    - Submit by next Thu 10/20 for one extra point!
    - There's one extra credit question, worth 2 pts - if you want the extra credit from early submission AND this question, make sure to finish this question by next Thursday as well!
- Reminder - Homework 04 recovery (Ed post #1757)

FROM LAST TIME... 👀

When you put one lasagna on top of another, how many lasagna do you end up with?



9	3
1?	10
1	Two?
1	infinite
1	3
one	1
1 giant one	1
2, but how many layers in each?	2
200	1
1	It depends
8	six
one lasagna	1
2	2!
100?	2

FROM LAST TIME... 👀

Other feedback:

- Some of you liked the new lab format!
- Some of you preferred the old style because there's more time to think independently
- If you have other feedback for our section/for me, please do leave them in the attendance form (or use this anonymous feedback form if you wish!)

OBJECT-ORIENTED PROGRAMMING 🥫

OBJECT-ORIENTED PROGRAMMING

OOP - a programming paradigm that allows us to treat code as objects, extending the idea of data abstraction.

- class - a template for objects
- instance - a single object created from a class
- attributes
    - instance variable - a data attribute of an object, specific to an instance
    - class variable - a data attribute of an object, shared by all instances of a class
    - method - a bound function that may be called on all instances of a class

CLASS/INSTANCE ATTRIBUTES VS. OTHER VARIABLES

- Attributes = class/instance variables + methods
- Class variables - use `ClassName.variable` or `InstanceName.variable` to access
    - The latter only works if the instance does not have an instance variable of the same name as the class variable
- Instance variables - use `InstanceName.variable` to access
- Other variables - arguments to a method, or otherwise initiated elsewhere, but are not class/instance variables

```
class Car:
    num_wheels = 4
    gas_level = 30

    def __init__(self, model):
        self.model = model
        self.num_wheels = Car.num_wheels
        self.gas = Car.gas_level
```

WORKSHEET Q1, 2

INHERITANCE 👩‍👧‍👦

INHERITANCE

- To avoid redefining attributes and methods for similar classes, we can write a single base class from which the similar classes inherit. A subclass *is a* more specific version of the base class.
- `SubClass(BaseClass)`
- By default, a subclass has the same behavior as its base class - unless we override/add additional attributes
- Overriding attributes
    - Class variables - reassign
    - Methods - **redefine the method with the same function signature (name and arguments)** in the subclass, but different function bodies. Use `super()` to call the same method from the base class when necessary (DRY - Don't Repeat Yourself!)

INHERITANCE

- `super().method(args)`
  - Used to call the corresponding `method` from the base class
  - Can only be used inside of a class method
  - `self` is implicitly bound to the instance on which the `method` is called - no need to pass it in
- `Class.method(instance, args)`
  - Used to call the specific `method` from a specific `Class` (can be any class - doesn't have to be the base class!)
  - Can be used anywhere
  - Need to explicitly pass in the `instance`

INHERITANCE

```
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)

# A dog is a pet!
class Dog (Pet) :
    def talk (self):
        super().talk()
        print('This Dog says woof!')
```

WORKSHEET Q3, 4

CLASS METHODS 🎒

DECORATORS

- A decorator is a function that takes in a function and returns another function
- The `@decorator` syntax is a syntax sugar

```python
def f(arg):
    ...
f = classmethod(f)
# Above and below are equivalent ways of
# using the classmethod decorator
@classmethod
def f(arg):
    ...
```

CLASS METHODS

- Instead of receiving the instance as the first argument (`self`), the method will receive the class itself (`cls`)
- Commonly used to create "factory methods": methods that construct and return a new instance of the class.
- Use the `@classmethod` decorator to turn a method into a class method

```
class Dog(Pet):
        # With the previously defined methods not written out
        @classmethod
        def robo_factory(cls, owner):
                return cls("RoboDog", owner)
```

With `Dog.robo_factory(owner_name)`, we can create a Dog instance with the name `"RoboDog"` whose owner has the name `owner_name`, without having to call the Dog constructor with the dog name `"RoboDog"` every time (`Dog("Robodog", owner_name)`)

WORKSHEET Q5

REPRESENTATION 🎭

REPRESENTATION

- To produce a string representation of an object in, we use `str()` or `repr()`
- `str(obj)`
  - Returns `obj.__str__()`
  - Used to describe the object in a human-readable form
  - Called when an object gets printed - `print(obj)` is essentially `print(str(obj))`
    - If `__str__` is not defined for `obj`, use `repr(obj)` instead
- `repr(obj)`
  - Returns `obj.__repr__()`
  - Used to describe the object in a computer-readable form
  - Evaluating an object in the interpreter is essentially `print(repr(obj))`
  - By convention, this should return a string that, when evaluated, returns an object with the same value

INHERITANCE

```
class Rational:
    def __init__(self, numer, denom):
        self.numer = numer
        self.denom = denom
    def __str__(self):
        return f"{self.numer}/{self.denom}"
    def __repr__(self):
        return f"Rational({self.numer}, {self.denom})"

>>> a = Rational(1, 2)
>>> str(a)
'1/2'
>>> repr(a)
'Rational(1, 2)'
>>> print(a)
1/2
>>> a
Rational(1, 2)
```

WORKSHEET Q6

ATTENDANCE! 🤠

go.cs61a.org/mingxiao-att

- The attendance form and slides are both linked on our section website!
- Once again, please do remember to fill out the form by midnight today!!