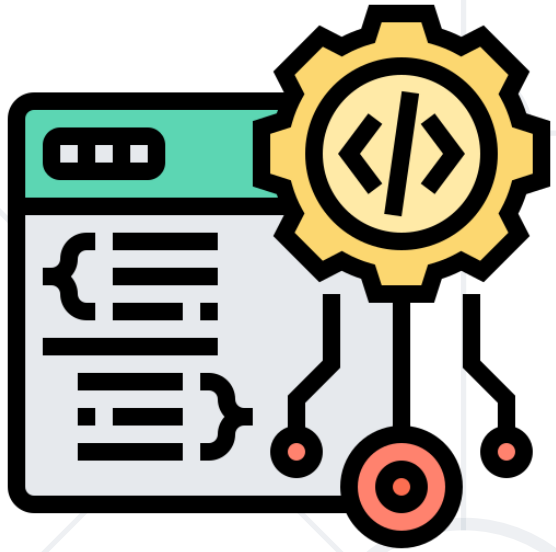
Class and Static Methods



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Static Methods

- It **knows nothing** about the **class** or **instance** it is called on
- It **cannot modify** object state or class state
- It could be put outside the class, but it is inside the class where it is **applicable**
- To turn a method into a static, we add a line with `@staticmethod` in front of the method header

Example: Static Methods

- To call a static method, we could use both the **instance**, or the **class**

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

    @staticmethod
    def is_adult(age):
        return age >= 18

print(Person.is_adult(5))    # False
girl = Person("Amy")
print(girl.is_adult(20))     # True
```

It does not take a self parameter

Benefits

- Shows that a particular method is **independent** of everything else around it
- Often helps to **avoid accidental modifications** that go against the original design
- Communicates and enforces **developer intent** about the **class design**
- It is much **easier to test** since it is completely independent from the rest of the class

Problem: Calculator

- Follow the instructions in the lab document and create a class called `Calculator` with the following `static` methods
  - `add(*args)`
  - `multiply(*args)`
  - `divide(*args)`
  - `subtract(*args)`

Skeleton: Calculator

```
class Calculator:
    @staticmethod
    def add(*args):
        pass
    @staticmethod
    def multiply(*args):
        pass
    @staticmethod
    def divide(*args):
        pass
    @staticmethod
    def subtract(*args):
        pass
```

Class Methods

Class Methods

- It is **bound to the class** and not the object of the class
- It can **modify a class state** that would apply across all the instances of the class
- To turn a method into a class method, we add a line with `@classmethod` in front of the method header

Example: Class Methods

- We generally use class method to **create factory methods**

```
class Pizza:
    def __init__(self, ingredients):
        self.ingredients = ingredients

    @classmethod
    def pepperoni(cls):
        return cls(["tomato sauce", "parmesan", "pepperoni"])

    @classmethod
    def quattro_formaggi(cls):
        return cls(["mozzarella", "gorgonzola", "fontina", "parmigiano"])


first_pizza = Pizza.peperoni()
second_pizza = Pizza.quattro_formaggi()
```

We could create different pizzas easily

Benefits

- Simply provide a **shortcut** for creating new instance objects
- Ensures **correct instance creation** of the derived class
- You could **easily follow** the Don't Repeat Yourself (DRY) principle using class methods

Problem: Shop

- Follow the instructions in the lab document and create a class called **Shop** with the following methods
  - `small_shop(name: str, type: str)`
  - `add_item(item_name: str)`
  - `remove_item(item_name: str, amount: int)`
  - `__repr__()`

Skeleton: Shop

```
class Store:
    def __init__(self, name, type, capacity):
        pass
    @classmethod
    def small_shop(cls, name, type):
        pass
    def add_item(self, item_name):
        pass
    def remove_item(self, item_name, count):
        pass
    def __repr__(self):
        pass
```

Problem: Integer

- Follow the instructions in the lab document and create a class called `Integer` with the following methods
  - `from_float(value)`
  - `from_roman(value)`
  - `from_string(value)`

Skeleton: Integer

```
class Integer:
    def __init__(self, value):
        self.value = value
    @classmethod
    def from_float(cls, float_value):
        pass
    @classmethod
    def from_roman(cls, value):
        pass
    @classmethod
    def from_string(cls, value):
        pass
```

Overriding Using Class Methods

Overriding Using Methods

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```
class Person:
    min_age = 0
    max_age = 150

    def __init__(self, name, age):
        self.name = name
        self.age = age

    @staticmethod
    def __validate_age(value):
        if value < Person.min_age or \
           value > Person.max_age:
            raise ValueError()

    @property
    def age(self):
        return self.__age

    @age.setter
    def age(self, value):
        self.__validate_age(value)
        self.__age = value
```

```
class Employee(Person):
    min_age = 16
    max_age = 150

    def __init__(self, name, age):
        self.name = name
        self.age = age

    @staticmethod
    def __validate_age(value):
        if value < Employee.min_age or \
           value > Employee.max_age:
            raise ValueError()

    @property
    def age(self):
        return self.__age

    @age.setter
    def age(self, value):
        self.__validate_age(value)
        self.__age = value
```

Override all the methods below

Overriding Using a Class Method

- If the methods **do not rely on state** and they **are the same**, they could be optimized using **@classmethod**

```
class Person:
    min_age = 0
    max_age = 150

    def __init__(self, name, age):
        self.name = name
        self.age = age

    @classmethod
    def __validate_age(cls, value):
        raise ValueError(f'{value} must be between '
                         f'{cls.min_age} and {cls.max_age}')
# __validate_age() takes the class attributes of class Person
```

Overriding Using a Class Method

```
    @property
    def age(self):
        return self.__age

    @age.setter
    def age(self, value):
        self.__validate_age(value)
        self.__age = value

class Employee(Person):
    min_age = 16
# __validate_age() takes the class attribute min_age of class Employee

    def __init__(self, name, age, salary):
        super().__init__(name, age) # when checking the age of the Employee
        self.salary = salary
```

Summary

- A static method is a method that knows nothing about the class or instance it is called on
- A class method, on the other hand, is bound to the class and not the object of the class

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