What is OOP?

INTRODUCTION TO OBJECT-ORIENTED PROGRAMMING IN PYTHON

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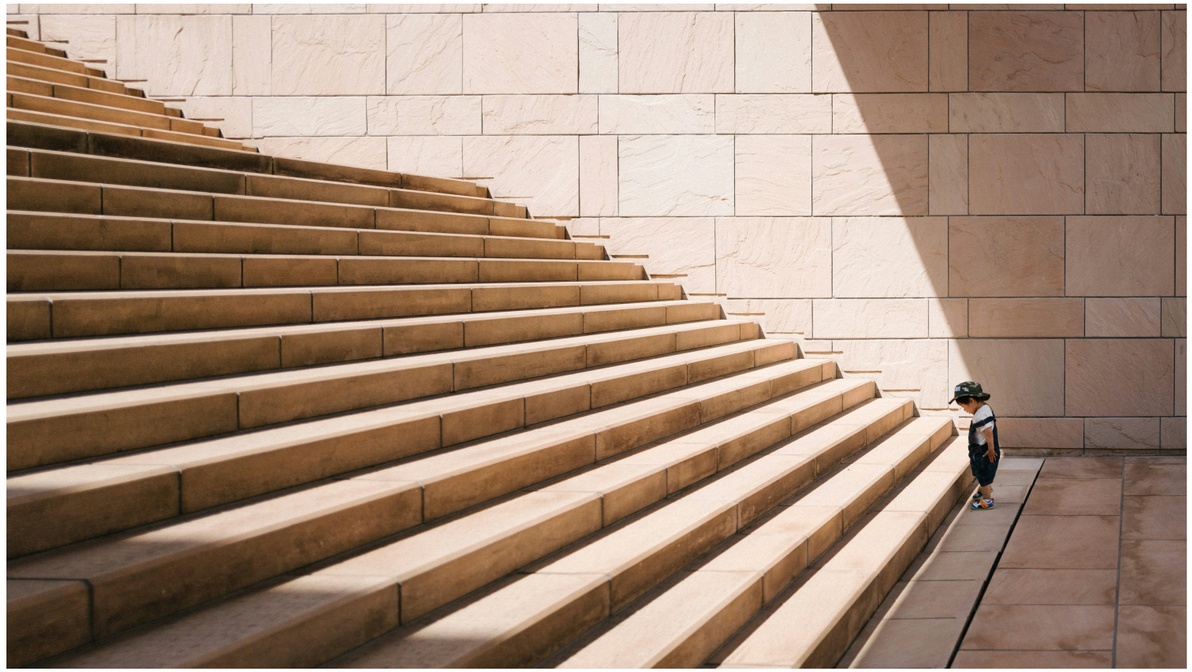
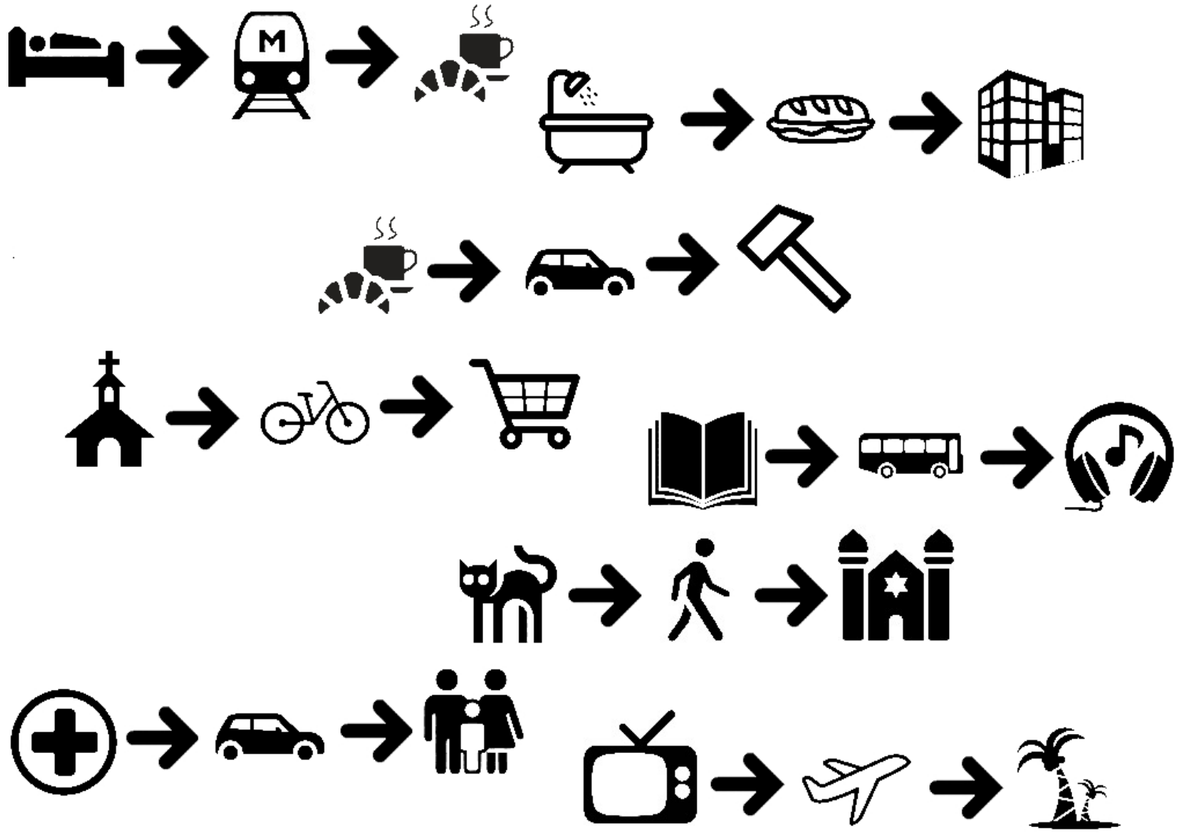
Procedural programming

- Code as a sequence of steps
- Great for data analysis



[1] Image source: https://unsplash.com/@tateisimikito

Thinking in sequences



Procedural programming

- Code as a sequence of steps
- Great for data analysis

Object-oriented programming

- ***Code as interactions of objects***
- Great for building software
- *Maintainable and reusable code!*

Objects

$$\text{Object} = \text{data} + \text{functionality}$$

email = lara@company.com
phone = 614-555-0177

place order
cancel order

State - an object's *data*

Behavior - an object's *functionality*

Objects in Python

- *Everything in Python is an object*

Object	Type
`5`	`int`
`"Hello"`	`str`
`pd.DataFrame()`	`DataFrame`
`sum()`	`function`
…	…

Classes as blueprints

- **Class:** a blueprint for objects outlining possible states and behaviors

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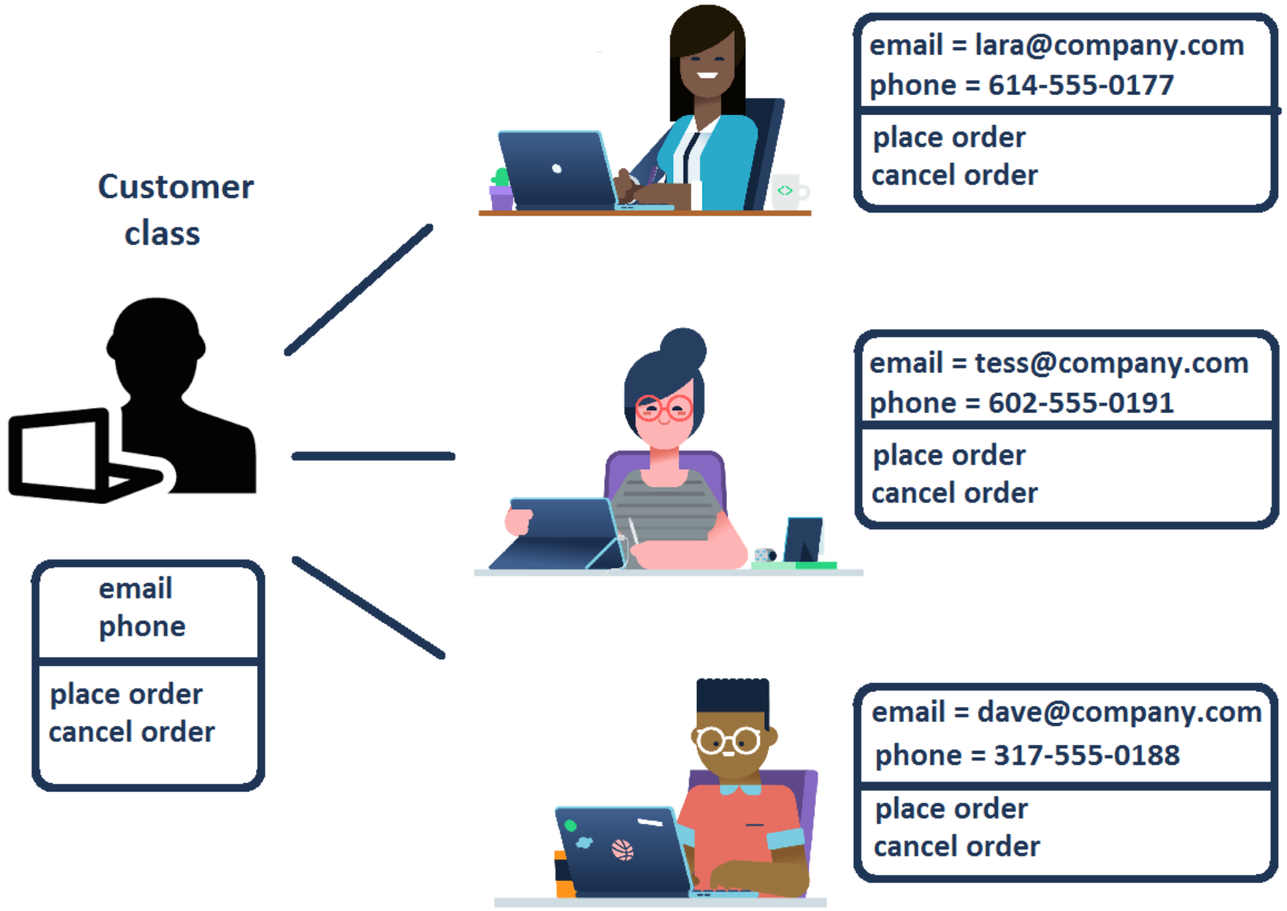

Classes in Python

- Python objects of the same type behave in the same way
- `lists` are a class
  - Created with comma-separated values `[1, 2, 3, 4, 5]`
  - Share the same methods, e.g., `.append()`
- Use `type()` to find the class

```
type([1, 2, 3, 4, 5])
```

```
<class 'list'>
```

Attributes and methods

State ↔ attributes

```
import pandas as pd
df = pd.DataFrame({"a": [1,2,3],
                   "b": [4,5,6]})
# shape attribute
df.shape
```

```
(3, 2)
```

- Use `obj.` to access attributes and methods

Behavior ↔ methods

```
import pandas as pd
df = pd.DataFrame({"a": [1,2,3],
                   "b": [4,5,6]})
# head method
df.head()
```

```
   a  b
0  1  4
1  2  5
2  3  6
```

Displaying attributes and methods

```
# Display attributes and methods
dir([1, 2, 3, 4])
```

```
['__add__',
 '__class__',
 '__contains__',
 '__delattr__',
 ...
 'pop',
 'remove',
 'reverse',
 'sort']
```

```
# Display attributes and methods
dir(list)
```

```
['__add__',
 '__class__',
 '__contains__',
 '__delattr__',
 ...
 'pop',
 'remove',
 'reverse',
 'sort']
```

Cheat sheet

Term	Definition
Class	A **blueprint**/template used to build objects
Object	A combination of *data* and *functionality*; An **instance** of a class
State	*Data* associated with an object, assigned through **attributes**
Behavior	An object's *functionality*, defined through **methods**

Let's review!

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Class anatomy: attributes and methods

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A Customer class

```
class Customer:
    # Code for class goes here
    pass
```

- `class <name>:` starts a class definition
- Code inside `class` is indented
- Use `pass` to create an "empty" class

```
c_one = Customer()
c_two = Customer()
```

- Use `ClassName()` to create an object of class `ClassName`

Add methods to a class

```
class Customer:
    def identify(self, name):
        print("I am Customer " + name)
```

- Method definition = function definition within class
- **Use `self` as the first argument in method definition**

```
cust = Customer()
cust.identify("Laura")
```

```
I am Customer Laura
```

- Ignore `self` when calling a method on an object

```
class Customer:
    def identify(self, name):
        print("I am Customer " + name)

cust = Customer()
cust.identify("Laura")
```

What is self?

- Classes are templates
- `self` should be the first argument of any method
- `self` is a stand-in for a (not yet created) object
- `cust.identify("Laura")` *will be interpreted as* `Customer.identify(cust, "Laura")`

We need attributes

- OOP bundles data with methods that operate on data
  - `Customer` 's' name should be an attribute

$$\text{Attributes are created by assignment } (=) \text{ in methods}$$

Add an attribute to class

```
class Customer:
    # Set the name attribute of an object to new_name
    def set_name(self, new_name):
        # Create an attribute by assigning a value
        # Will create .name when set_name is called
        self.name = new_name
# Create an object
# .name doesn't exist here yet
cust = Customer()
# .name is created and set to "Lara de Silva"
cust.set_name("Lara de Silva")
print(cust.name)
```

```
Lara de Silva
```

Old version

```
class Customer:



    # Using a parameter
    def identify(self, name):
        print("I am Customer" + name)
```

```
cust = Customer()

cust.identify("Eris Odoro")
```

```
I am Customer Eris Odoro
```

New version

```
class Customer:
    def set_name(self, new_name):
        self.name = new_name

    # Using .name from the object it*self*
    def identify(self):
        print("I am Customer" + self.name)
```

```
cust = Customer()
cust.set_name("Rashid Volkov")
cust.identify()
```

```
I am Customer Rashid Volkov
```

Let's practice!

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Class anatomy: the __init__ constructor

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Methods and attributes

- Methods are function definitions within a class
- `self` as the first argument
- Define attributes by assignment
- Refer to attributes in class via `self.___`
- Calling lots of methods could become unsustainable!

```
class MyClass:
    # function definition in class
    # first argument is self
    def my_method1(self, other_args...):
        # do things here
    def my_method2(self, my_attr):
        # attribute created by assignment
        self.my_attr = my_attr
        ...
```

Constructor

- Add data to object when creating it
- **Constructor** `__init__()` method is called every time an object is created
  - Called automatically because of `__methodname__` syntax

```
class Customer:
    def __init__(self, name):
        # Create the .name attribute and set it to name parameter
        self.name = name
        print("The __init__ method was called")
```

Constructor

```
# __init__ is implicitly called
cust = Customer("Lara de Silva")
print(cust.name)
```

```
The __init__ method was called
Lara de Silva
```

Attributes in methods

```
class MyClass:
    def my_method1(self, attr1):
        self.attr1 = attr1
        ...

    def my_method2(self, attr2):
        self.attr2 = attr2
        ...

obj = MyClass()
# attr1 created
obj.my_method1(val1)
# attr2 created
obj.my_method2(val2)
```

Attributes in the constructor

```
class MyClass:
    def __init__(self, attr1, attr2):
        self.attr1 = attr1
        self.attr2 = attr2
        ...
# All attributes are created
obj = MyClass(val1, val2)
```

- Generally we should use the constructor
- Attributes are created when the object is created
- *More usable and maintainable code*

Add arguments

```
class Customer:
    # Add balance argument
    def __init__(self, name, balance):
        self.name = name

        # Add the balance attribute
        self.balance = balance
        print("The __init__ method was called")
```

Add parameters

```
# __init__ is called
cust = Customer("Lara de Silva", 1000)
print(cust.name)
print(cust.balance)
```

```
The __init__ method was called
Lara de Silva
1000
```

Default arguments

```
class Customer:
    # Set a default value for balance
    def __init__(self, name, balance=0):
        self.name = name
        # Assign the new attribute
        self.balance = balance
        print("The __init__ method was called")
```

Default arguments

```
# Don't specify the balance explicitly
cust = Customer("Lara de Silva")
print(cust.name)
# The balance attribute is created anyway
print(cust.balance)
```

```
The __init__ method was called
Lara de Silva
0
```

Best practices

1. Initialize attributes in `__init__()`

Best practices

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2. Naming

`CamelCase` for classes, `lower_snake_case` for functions and attributes

Best practices

1. Initialize attributes in `__init__()`

2. Naming

`CamelCase` for class, `lower_snake_case` for functions and attributes

3. Keep `self` as `self`

```
class MyClass:
    # This works but isn't recommended
    def my_method(george, attr):
        george.attr = attr
```

Best practices

1. Initialize attributes in `__init__()`

2. Naming

`CamelCase` for class, `lower_snake_case` for functions and attributes

3. `self` is `self`

4. Use docstrings

```
class MyClass:
    """This class does nothing"""
    pass
```

Let's practice!

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