What is OOP?

OBJECT-ORIENTED PROGRAMMING IN PYTHON

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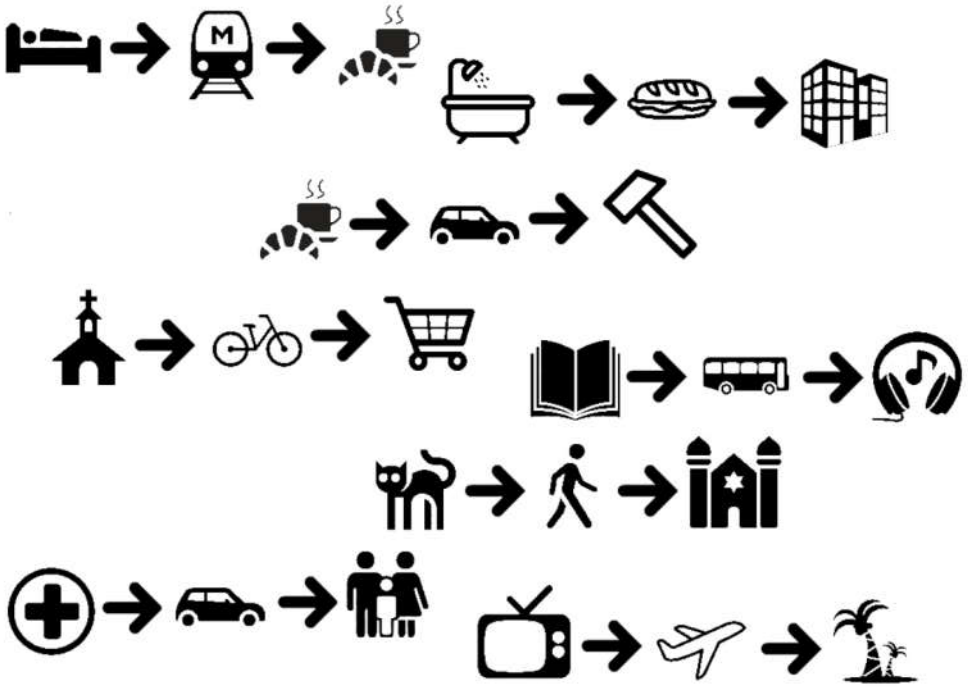
Procedural programming

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

Thinking in sequences



Procedural programming

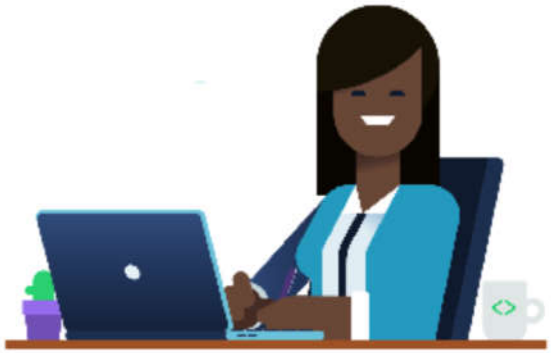
- Code as a sequence of steps
- Great for data analysis and scripts

Object-oriented programming

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

Objects as data structures

$$\text{Object} = \text{state} + \text{behavior}$$



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

place order
cancel order

Encapsulation - bundling data with code operating on it

Classes as blueprints

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

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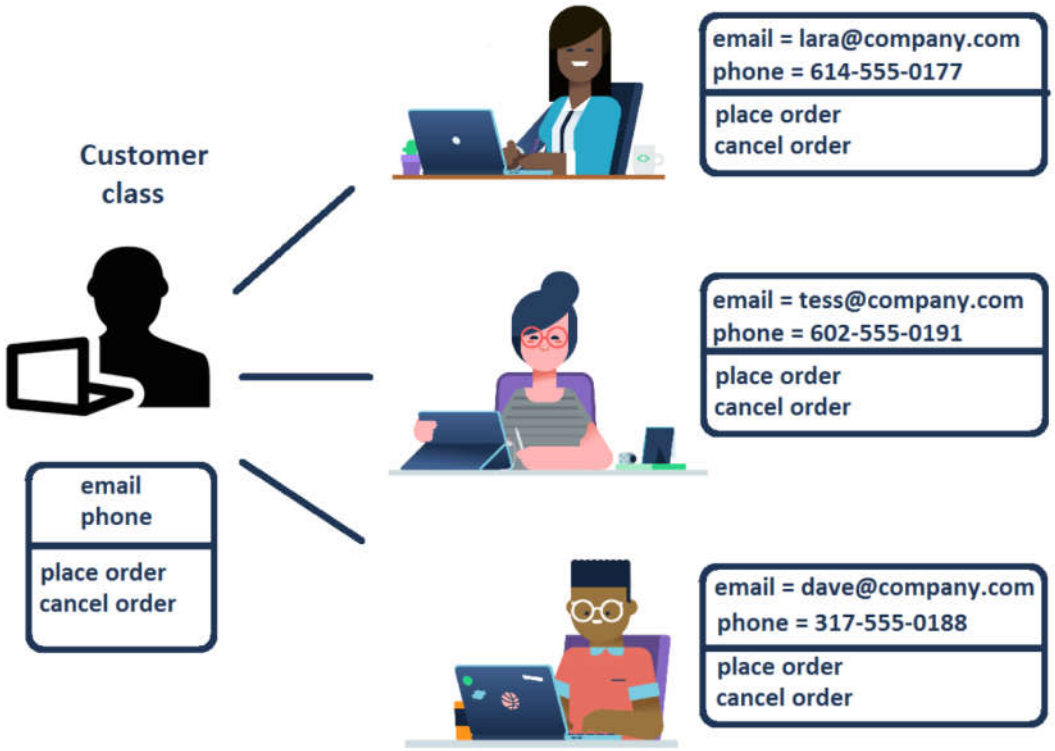

Objects in Python

- *Everything in Python is an object*
- Every object has a class
- Use `type()` to find the class

```
import numpy as np
a = np.array([1,2,3,4])
print(type(a))
```

```
numpy.ndarray
```

Object	Class
`5`	`int`
`"Hello"`	`str`
`pd.DataFrame()`	`DataFrame`
`np.mean`	`function`
...	...

Attributes and methods

State ↔ attributes

```
import numpy as np
a = np.array([1,2,3,4])
# shape attribute
a.shape
```

```
(4,)
```

Behavior ↔ methods

```
import numpy as np
a = np.array([1,2,3,4])
# reshape method
a.reshape(2,2)
```

```
array([[1, 2],
       [3, 4]])
```

- Use `obj.` to access attributes and methods

Object = attributes + methods

- attribute ↔ **variables** ↔ `obj.my_attribute` ,
- method ↔ **function()** ↔ `obj.my_method()` .

```
import numpy as np
a = np.array([1,2,3,4])
dir(a)                # <--- list all attributes and methods
```

```
['T',
 '__abs__',
 ...
 'trace',
 'transpose',
 'var',
 'view']
```

Let's review!

OBJECT-ORIENTED PROGRAMMING IN PYTHON

Class anatomy: attributes and methods

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A basic 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

```
c1 = Customer()
c2 = 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 1st argument in method definition**

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

```
I am Customer Laura
```

- ignore `self` when calling 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, how to refer data of a particular object?
- `self` is a stand-in for a particular object used in class definition
- should be the first argument of any method
- Python will take care of `self` when method called from an object:

`cust.identify("Laura")` *will be interpreted as* `Customer.identify(cust, "Laura")`

We need attributes

- **Encapsulation**: bundling data with methods that operate on data
- E.g. `Customer` 's' name should be an attribute

Attributes are created by assignment $(=)$ 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
      self.name = new_name          # <-- will create .name when set_name is called
```

```
cust = Customer()                   # <--.name doesn't exist here yet
cust.set_name("Lara de Silva")      # <--.name is created and set to "Lara de Silva"
print(cust.name)                    # <--.name can be used
```

```
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.___`

```
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.

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

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

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

```
class Customer:
        def __init__(self, name, balance):  # <-- balance parameter added
         self.name = name
         self.balance = balance              # <-- balance attribute added
         print("The __init__ method was called")
cust = Customer("Lara de Silva", 1000)     # <-- __init__ is called
print(cust.name)
print(cust.balance)
```

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

```
class Customer:
       def __init__(self, name, balance=0):  #<--set default value for balance
        self.name = name
        self.balance = balance
        print("The __init__ method was called")

cust = Customer("Lara de Silva") # <-- don't specify balance explicitly
print(cust.name)
print(cust.balance) # <-- attribute is created anyway
```

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

Attributes in methods

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

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

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

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)
```

- easier to know all the attributes
- attributes are created when the object is created
- *more usable and maintainable code*

Best practices

1. Initialize attributes in `__init__()`

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2. Naming

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

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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(kitty, attr):
        kitty.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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