

Python: Day 03

Object-Oriented Programming

Previous Agenda

01

Lists & Tuple

Ordered Group

02

Dictionary & Set

Unordered Group

03

String

Handling Text

04

File Handling

Data outside code

05

Comprehension

Iteration Shortcut

06

Lab Session

Culminating Exercise

Agenda

01

Definition

Data-Centric Approach

02

Hierarchy

Organizing Data

03

Polymorphism

Handling data types

04

Encapsulation

Data Hiding

05

GUI

Introduction to Tkinter

06

Lab Session

Culminating Exercise

01

Definition

Programming with a focus on concepts

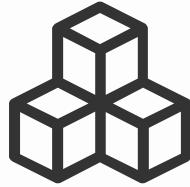
**What makes
something
something ?**



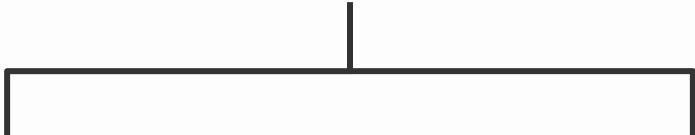




What is Object Oriented Programming?



Object



Attributes

Object's data

Methods

Object's actions

Has → Is

Functional Identity



Attributes

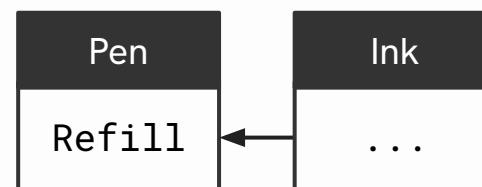
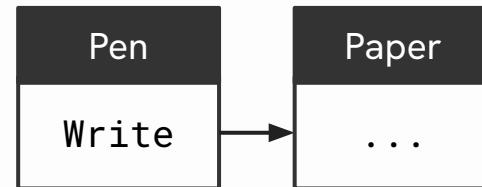
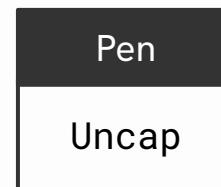
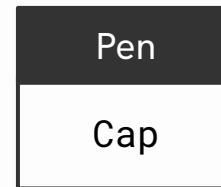
- Attributes are unique to one object

Pen	
brand	Pilot
color	Black
capped	False



Methods

- Methods can change itself or others



Object Similarities

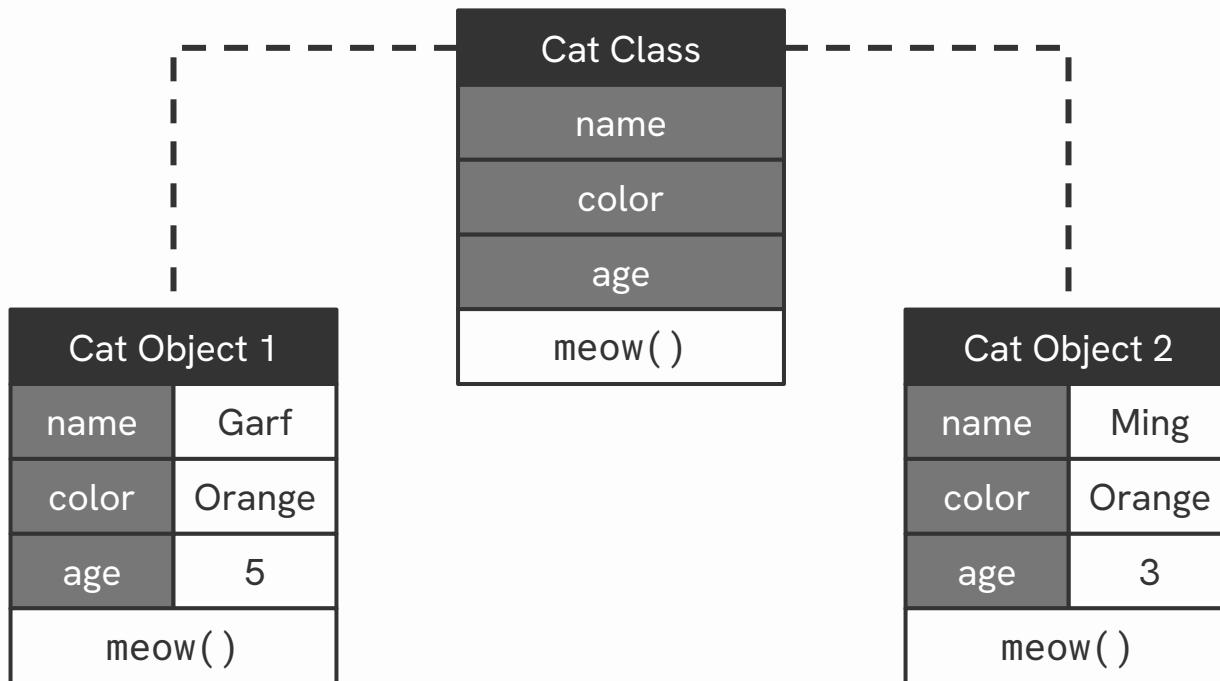
cat1	
name	Garf
color	Orange
age	5
meow()	

cat2	
name	Ming
color	Orange
age	3
meow()	

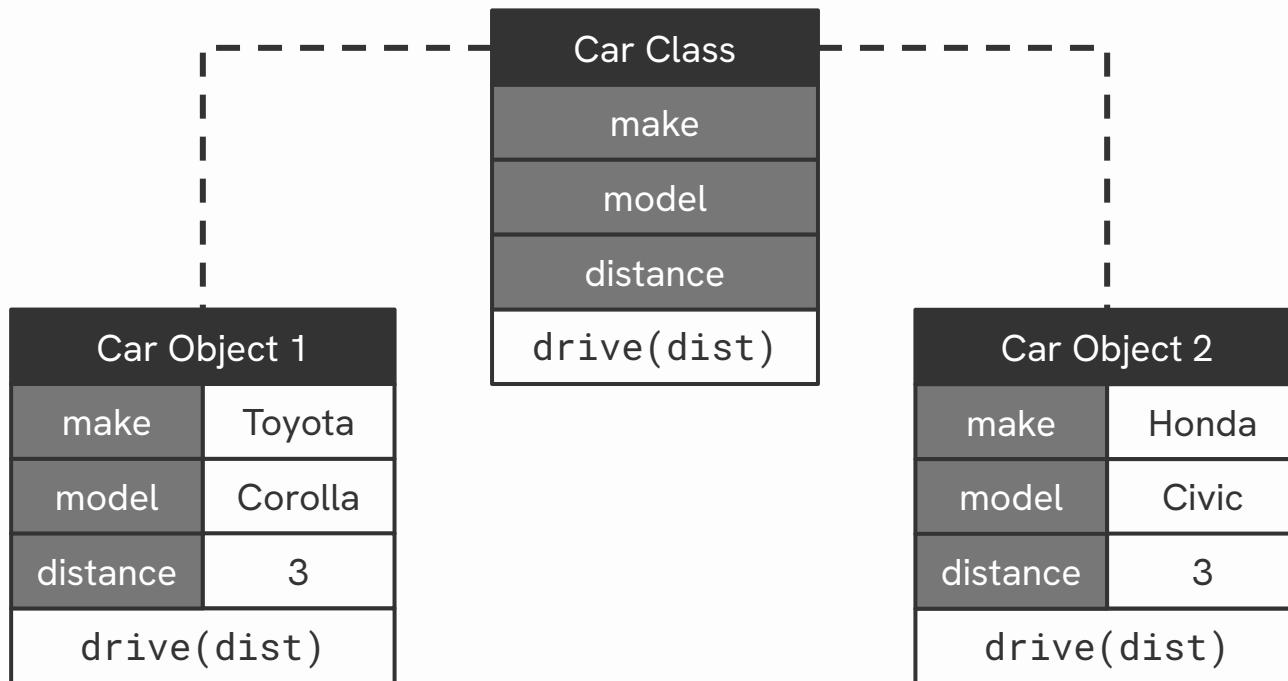
cat3	
name	Mona
color	Black
age	2
meow()	

What makes them different/same?

Classes to Objects



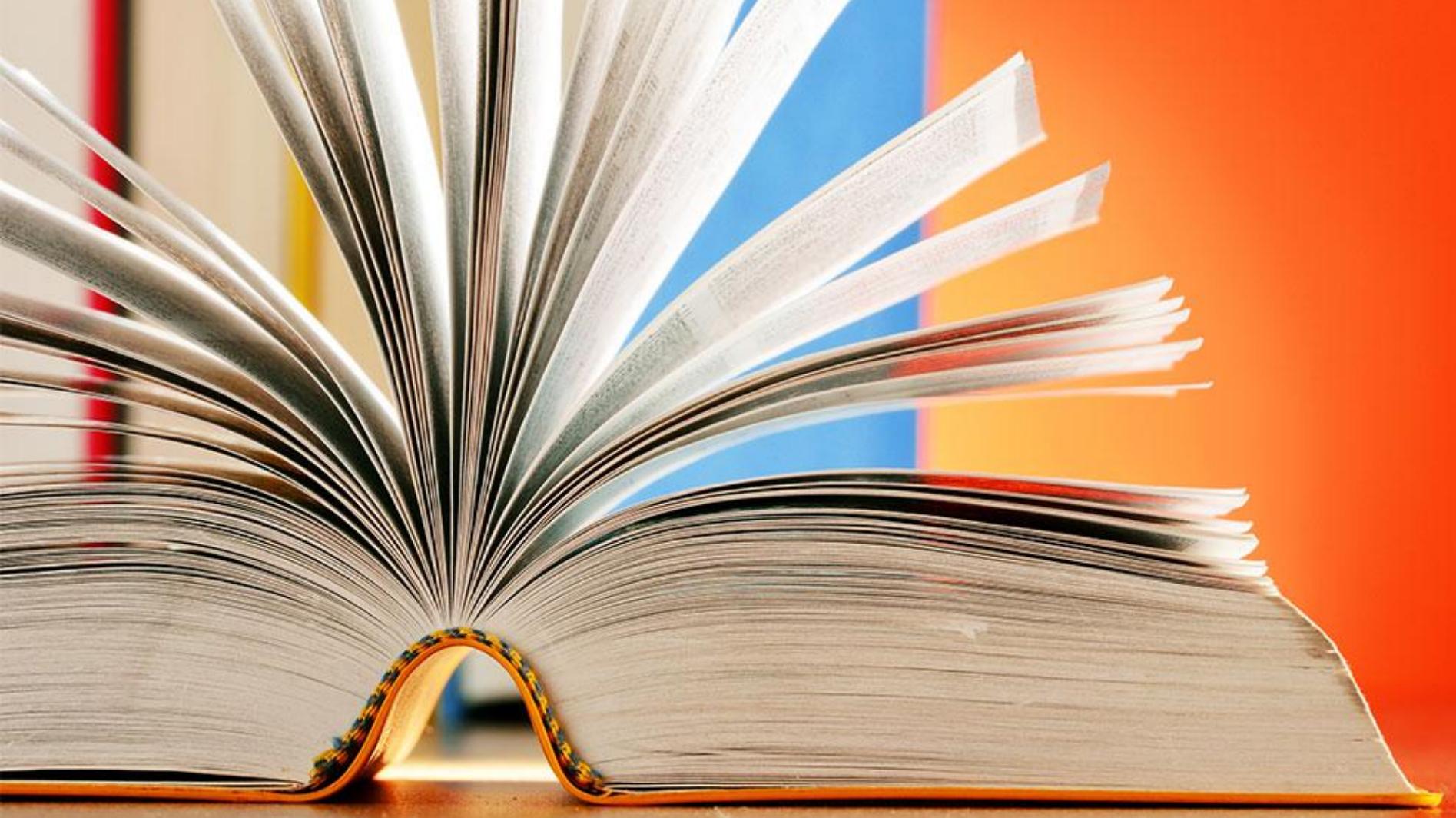
Classes to Objects





Modelling Exercise









BPI

BPI
Makati Main
Full ATM & Teller Services
Monday to Friday

OPEN
For
WELCOME

MONDAY

ATM
Teller
Services

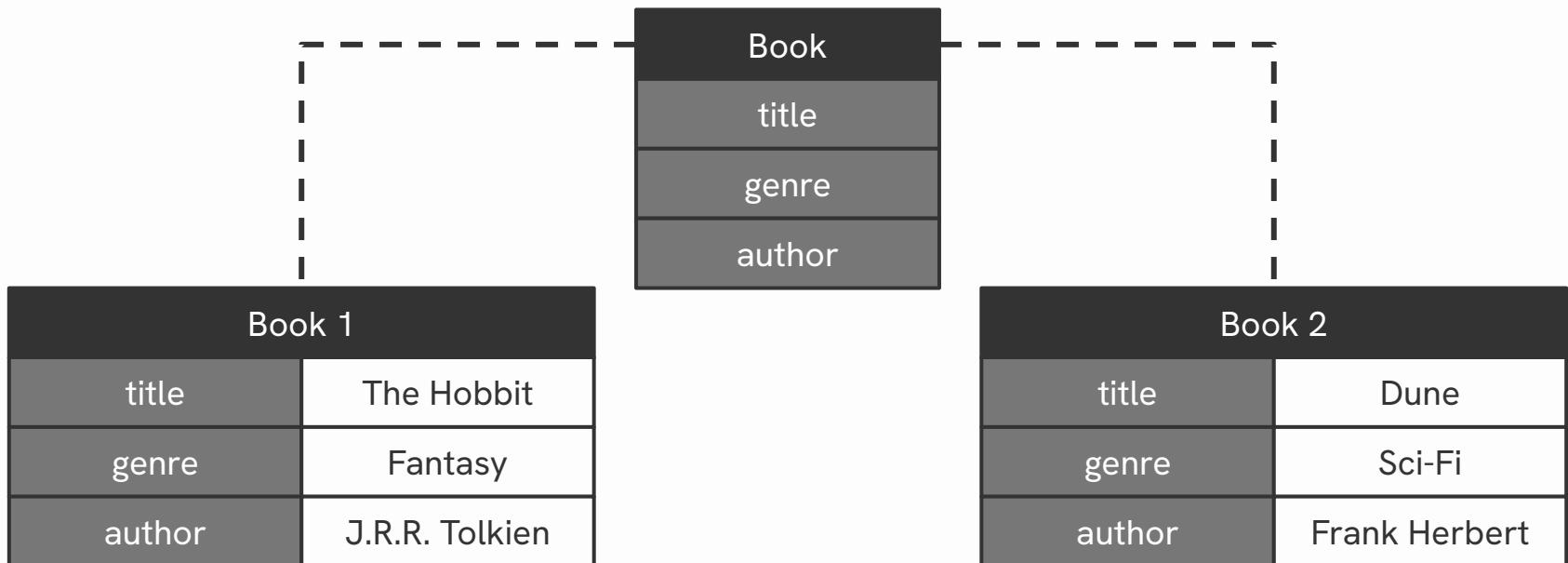
ATM

Teller

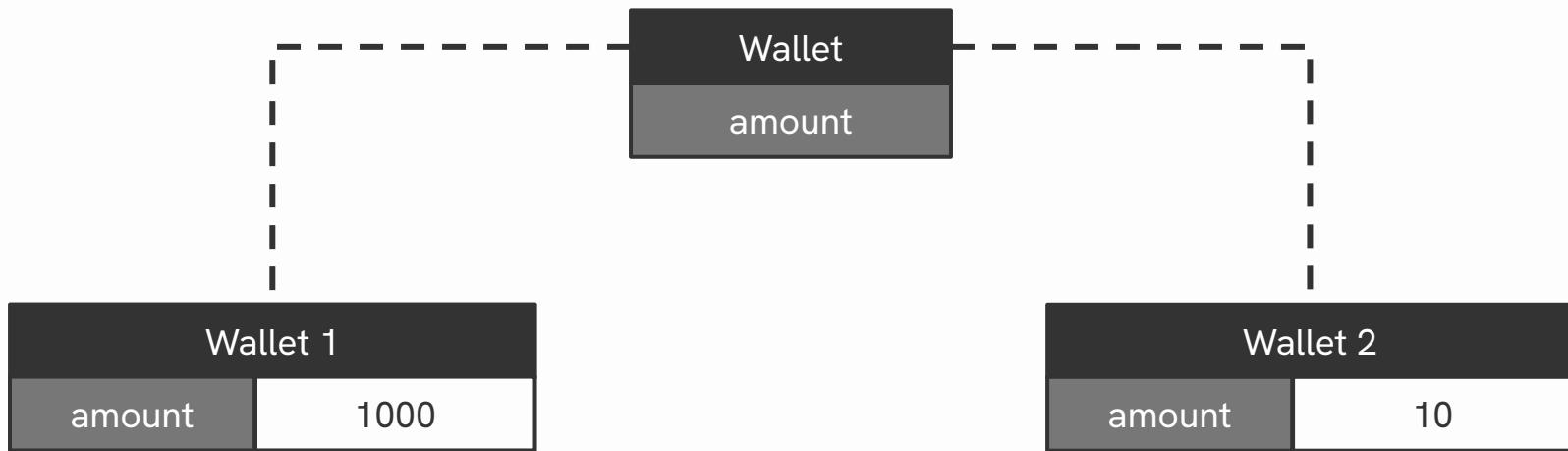
Services



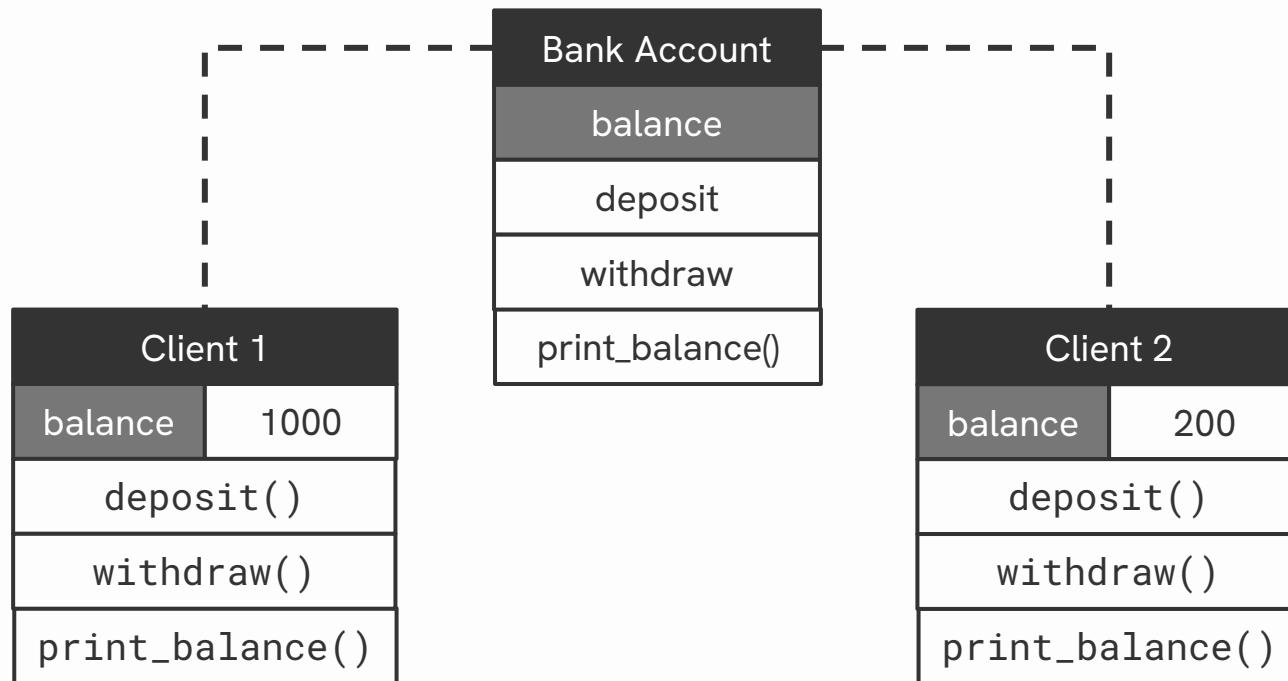
Book



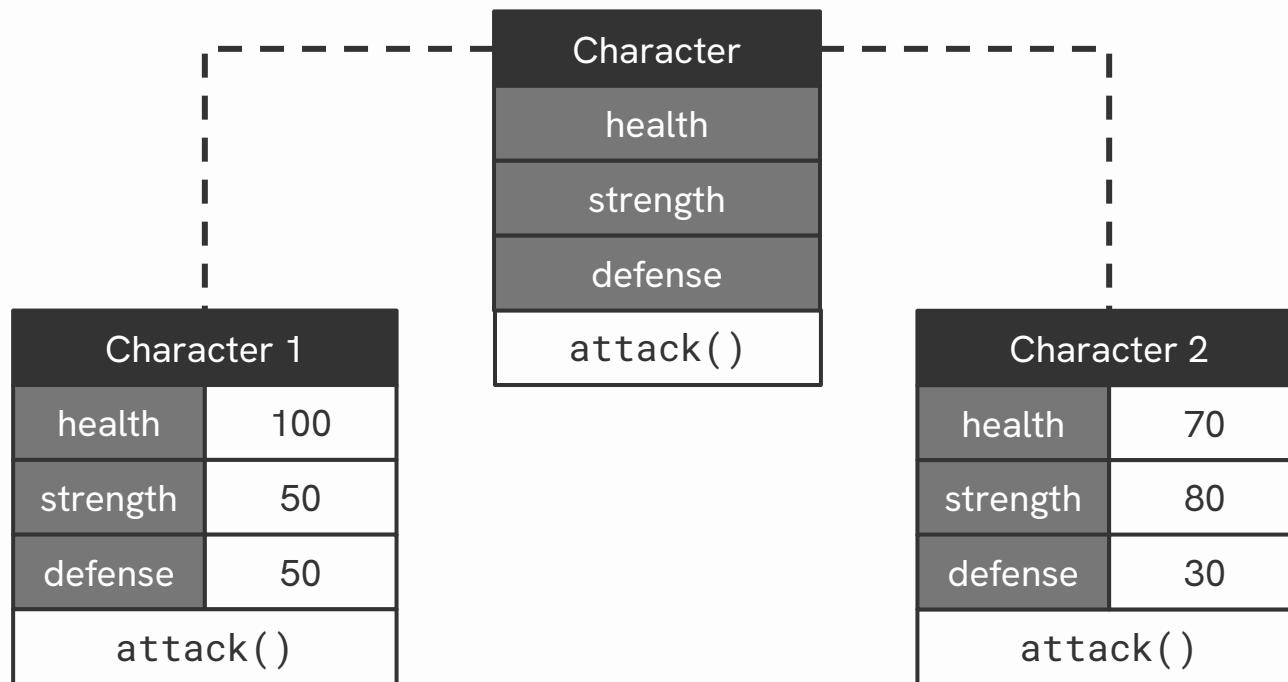
Wallet

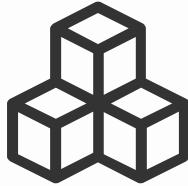


Bank Account

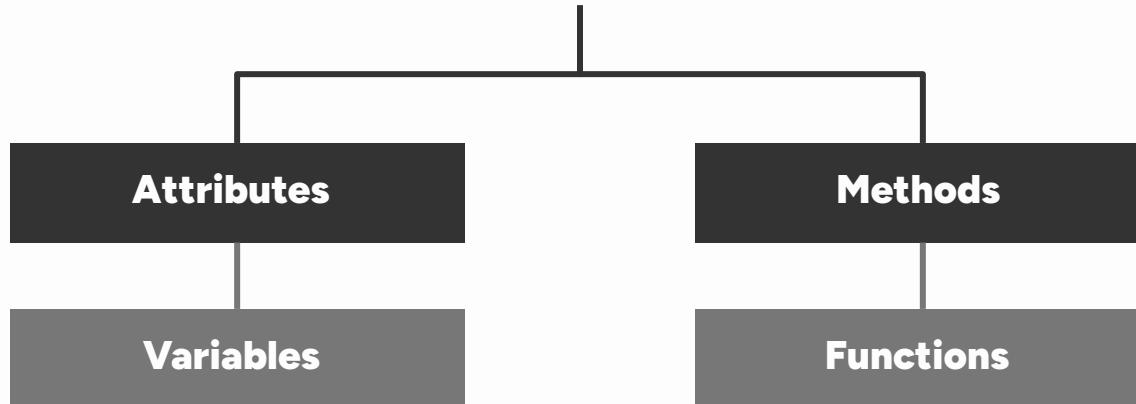


Game Character



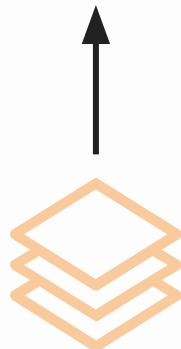


Object

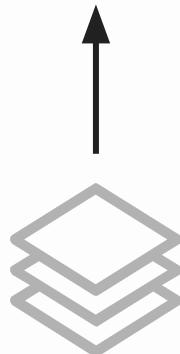


Functional Approach

```
paper_color = change_color(paper_color, marker_color)
```



paper_color



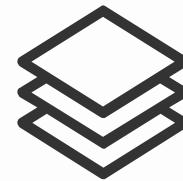
paper_color



painter_color

Object Oriented Approach

```
marker.change_color(paper)
```

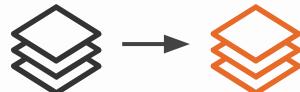


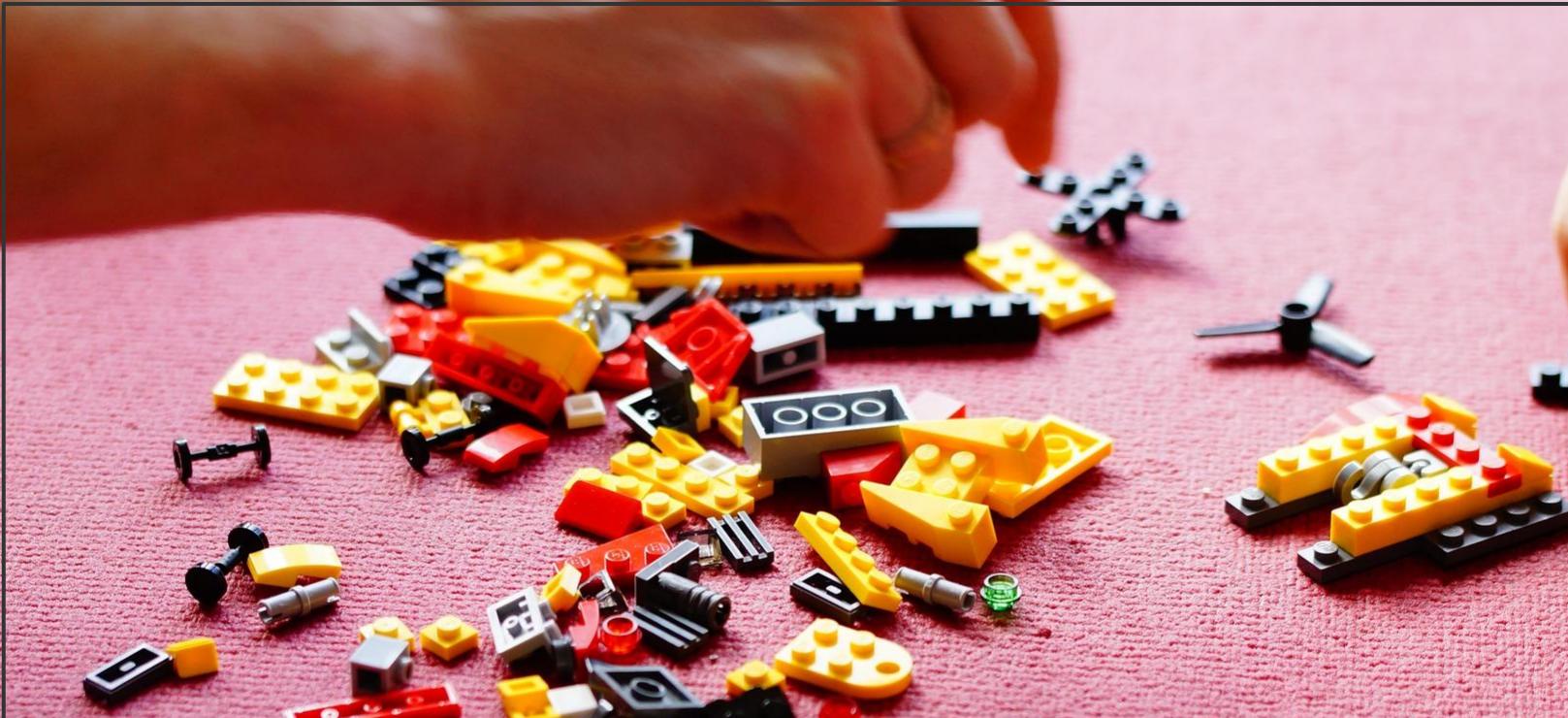
Color: Orange



Color: Orange

change_color ()





Building Exercise

Example Class

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15
```

Object Creation

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3  
4     employee1 = Employee()  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15
```

Multiple Object Creation

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3  
4     employee1 = Employee()  
5     employee2 = Employee()  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15
```

Class Constructor

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3     def __init__(self):  
4         print("Employee created")  
5  
6     employee1 = Employee()  
7     employee2 = Employee()  
8  
9  
10  
11  
12  
13  
14  
15
```

Class Constructor

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3     def __init__(self, name):  
4         print(f"Employee {name} created")  
5  
6     employee1 = Employee("Richard")  
7     employee2 = Employee("Jelly")  
8  
9  
10  
11  
12  
13  
14  
15
```

Class Constructor

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3     def __init__(self, name, id):  
4         print(f"Employee {name} created with ID {id}")  
5  
6     employee1 = Employee("Richard", "1234")  
7     employee2 = Employee("Jelly", "9876")  
8  
9  
10  
11  
12  
13  
14  
15
```

Object Attributes

employee.py

```
1 class Employee:  
2     """Class representation for employee data"""  
3     def __init__(self, name, id):  
4         self.name = name  
5         self.id = id  
6         print(f"Employee {self.name} created with ID {self.id}")  
7  
8     employee1 = Employee("Richard", "1234")  
9     employee2 = Employee("Jelly", "9876")  
10    print("Employee 1 Name:", employee1.name)  
11    print("Employee 2 Name:", employee2.name)  
12  
13  
14  
15
```

Object Attributes

self .name

employee1 .name

Object Methods

employee.py

```
1 class Employee:
2     """Class representation for employee data"""
3     def __init__(self, name, id):
4         self.name = name
5         self.id = id
6         self.tasks = []
7         print(f"Employee {self.name} created with ID {self.id}")
8
9     def add_work(self, task):
10        print(f"Added work {task} to {self.name}")
11        return self.tasks.append(task)
12
13
14 employee1 = Employee("Richard", "1234")
15 employee2 = Employee("Jelly", "9876")
16 employee1.add_work("Create Slides")
17 employee1.add_work("Present report")
```

Object Methods

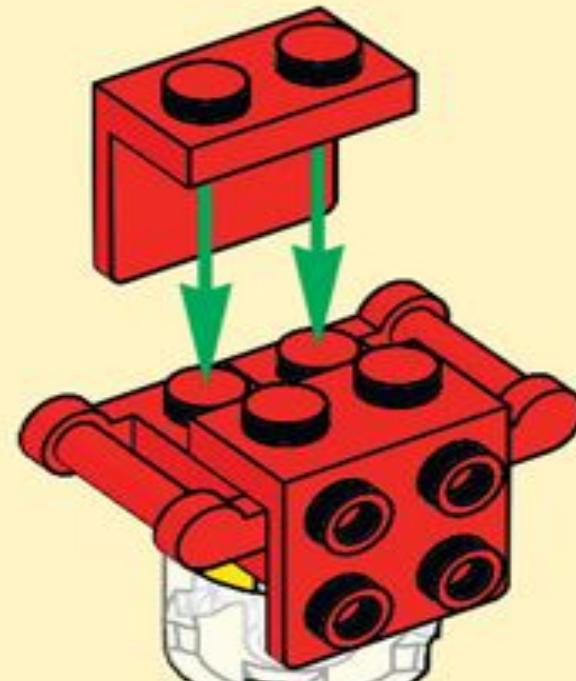
employee .add_work (task)
add_work (employee, task)

1

H1



4

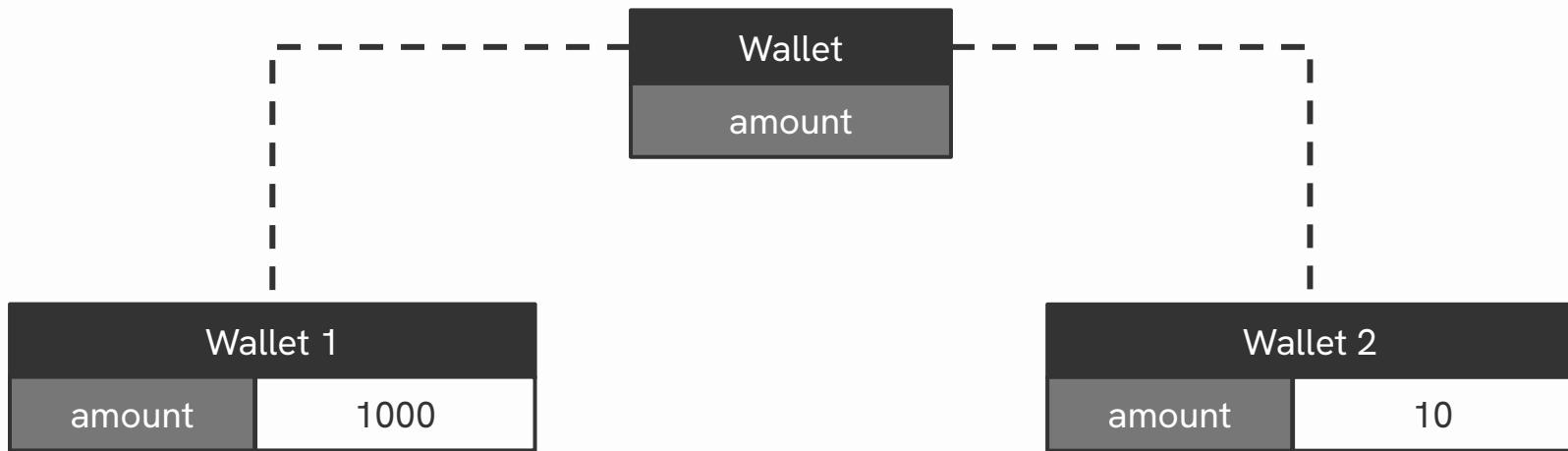


2

Hands-On Building



Wallet

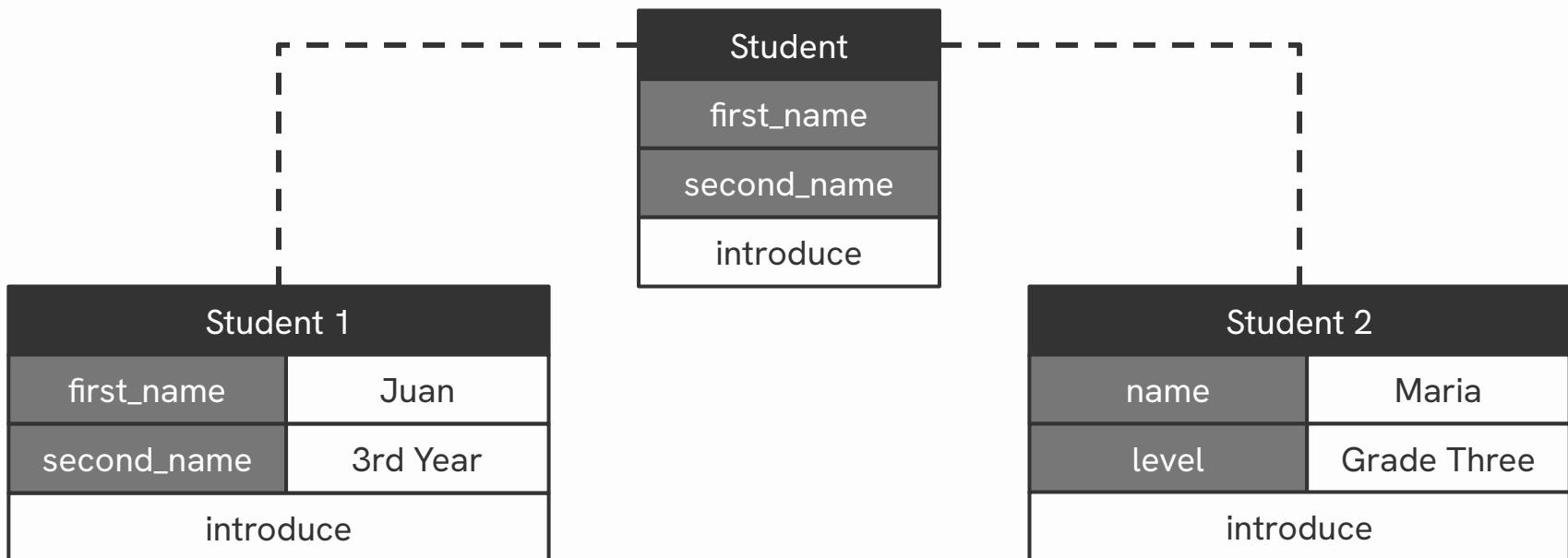


Implement : Wallet

wallet.py

```
1 class Wallet:  
2     def __init__(self, initial_amount=0):  
3         self.amount = initial_amount  
4  
5 food_wallet = Wallet(250)  
6 food_wallet.amount += 1_000  
7  
8 print("Food Budget:", food_wallet.amount)
```

Person

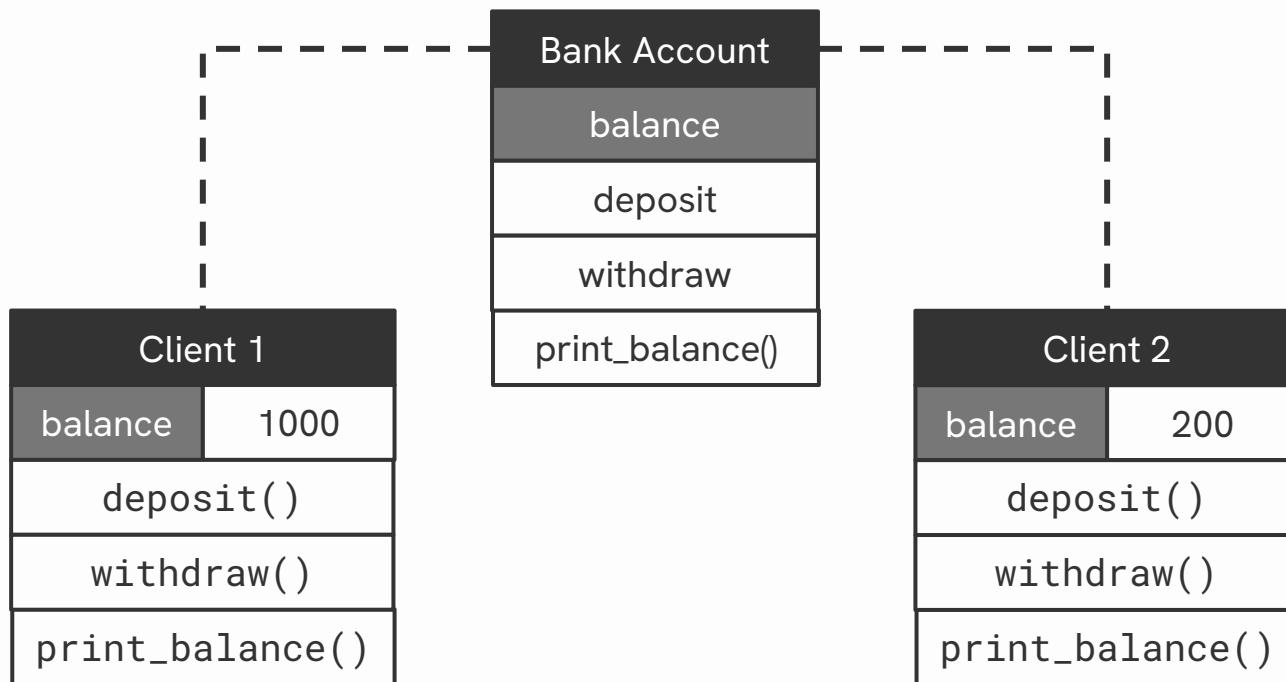


Implement : Student

person.py

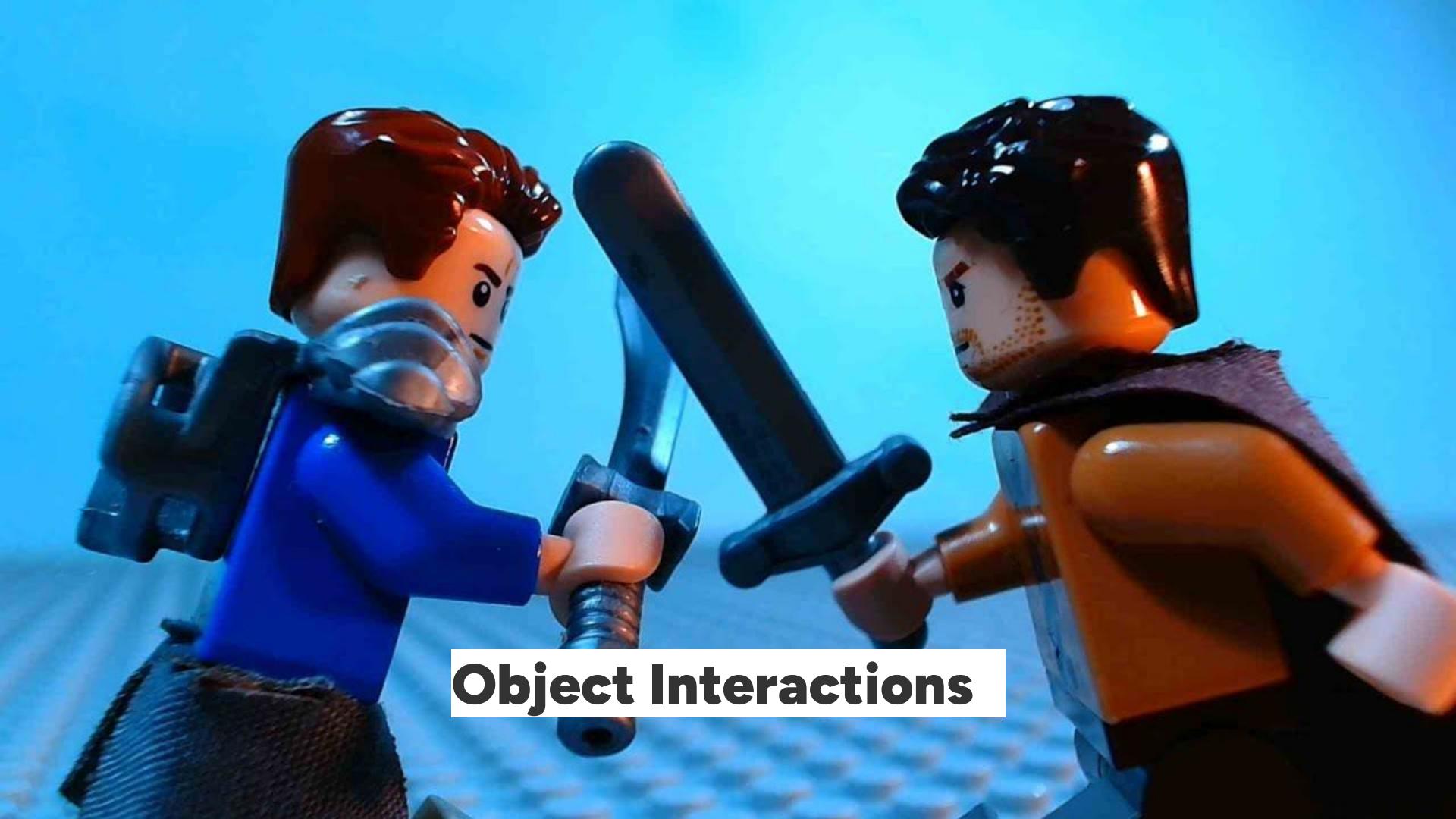
```
1 class Person:  
2     def __init__(self, first_name, last_name):  
3         self.first_name = first_name  
4         self.last_name = last_name  
5  
6     def sleep(self):  
7         print("I will sleep for eight hours")  
8  
9     def introduce(self):  
10        print(f"I'm {self.first_name} {self.last_name}!")
```

Bank Account



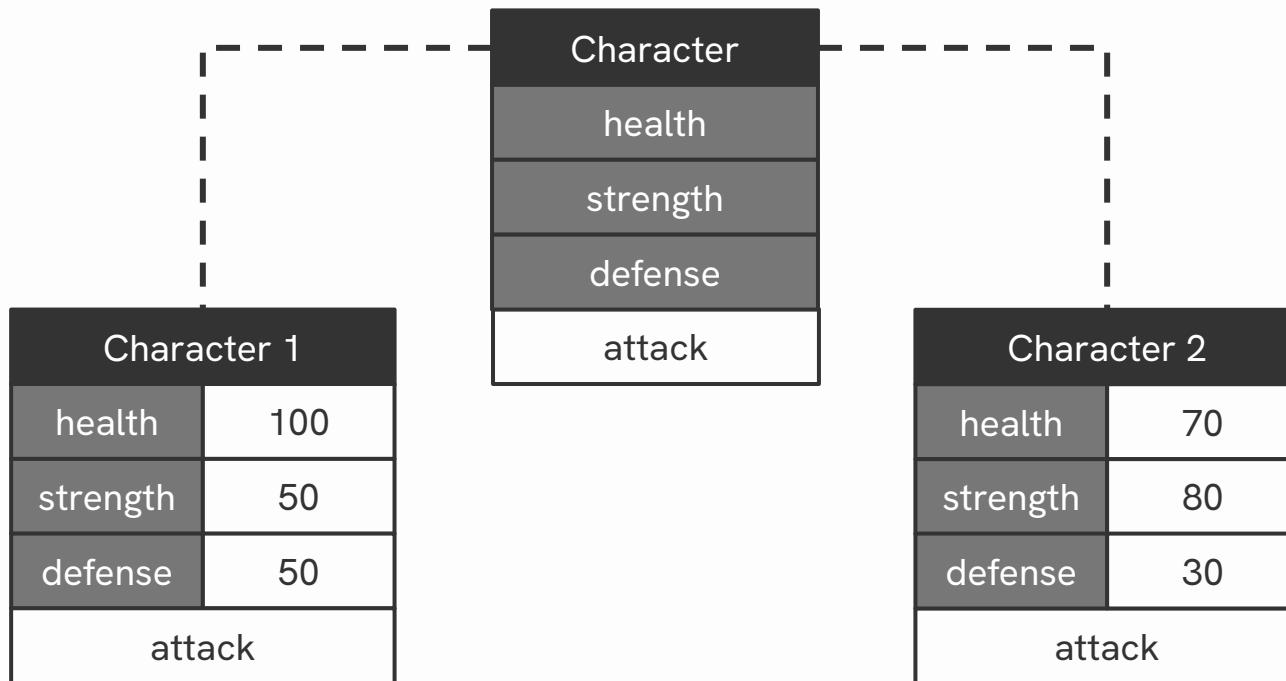
Implement : Bank Account

```
1 class BankAccount:  
2     def __init__(self, initial_balance=0):  
3         self.balance = initial_balance  
4  
5     def deposit(self, amount):  
6         if amount < 0:  
7             raise ValueError()  
8         self.balance += amount  
9  
10    def withdraw(self, amount):  
11        if amount < 0:  
12            raise ValueError()  
13        self.balance -= amount  
14  
15    def print_balance(self):  
16        print(self.balance)
```

A photograph of two LEGO minifigures engaged in a sword fight against a blue background. The figure on the left has brown hair and wears a blue tunic over a brown vest. The figure on the right wears a black helmet and a brown tunic with a fur-trimmed hood. Both are holding long-sabre style swords. A white rectangular box containing the text "Object Interactions" is overlaid at the bottom center.

Object Interactions

Game Character



Implement: Character

character.py

```
1 class Character:
2     def __init__(self, health=10, strength=10, defense=10):
3         self.health = health
4         self.strength = strength
5         self.defense = defense
6
7     def attack(self, other):
8         damage = self.strength - other.defense
9         other.health -= damage
10
11 player = Character(strength=100)
12 enemy = Character()
13
14 player.attack(enemy)
15 print(enemy.health)
```



2x

62

H2

2x

6019155



4x

4226876



8x

6195183



2x

6273152



6x

6172366



1x

6092565



3x

302221



2x

4540040



2x

6096682



1x

6258135



4x

6117074



1x

6105976



3x

403224



4x

Hands-Off Building



5x



3x



1x



1x



3x

Code-Along: Inventory Tracker

Inventory
items
def create(self, item)
def read(self, index)
def delete(self, index)
def show(self)
def save(self, filepath)
def load(self, filepath)

Item
name
price
quantity
details
def total_cost(self)
def as_dict(self)

02

Hierarchy

Reducing redundancy in classes

Inheritance

Explicit class structure

Code Redundancy

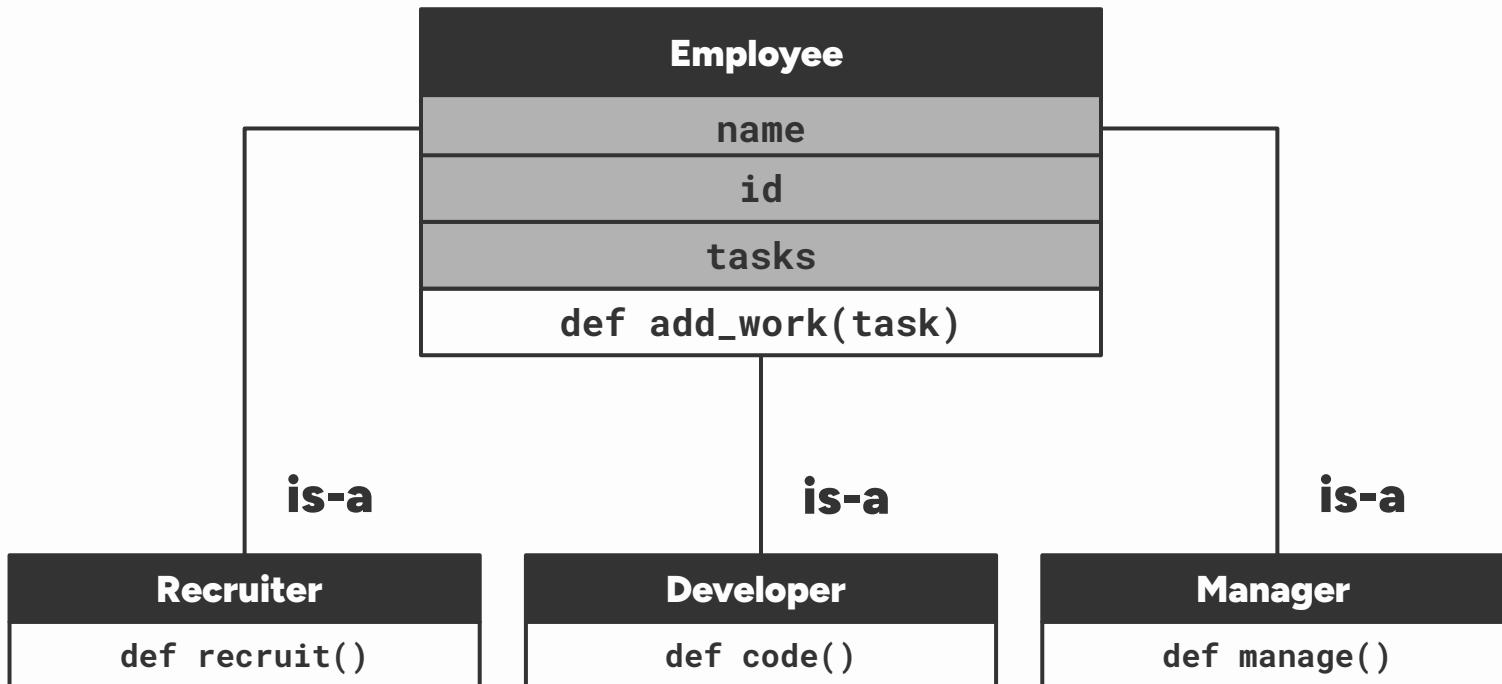
```
class Recruiter:  
    def __init__(self, name, id)  
    def add_work(self)  
    def recruit(self)
```

```
class Manager:  
    def __init__(self, name, id)  
    def add_work(self)  
    def manage(self)
```

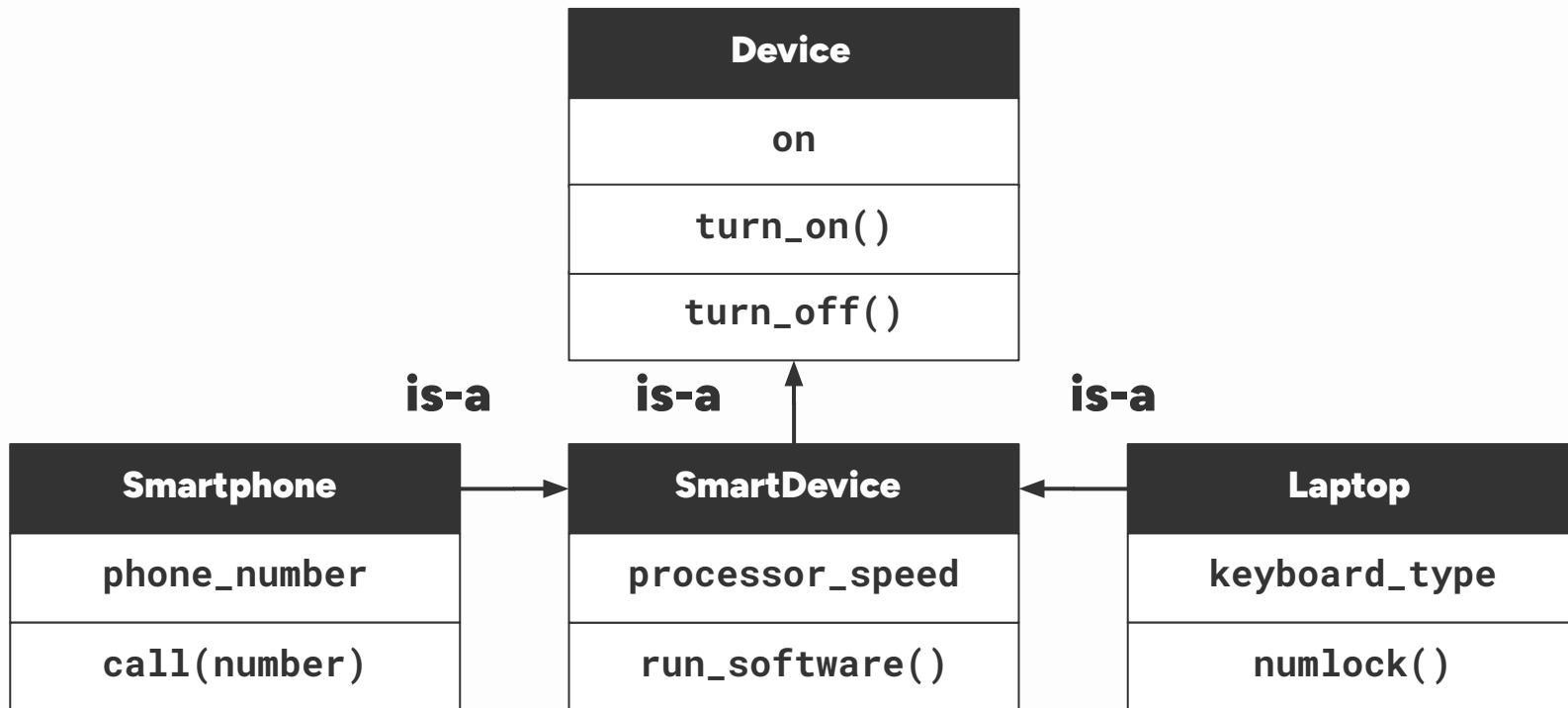
```
class Developer:  
    def __init__(self, name, id)  
    def add_work(self)  
    def code(self)
```

```
class Designer:  
    def __init__(self, name, id)  
    def add_work(self)  
    def design(self)
```

Hierarchy Example



Hierarchy Example 2

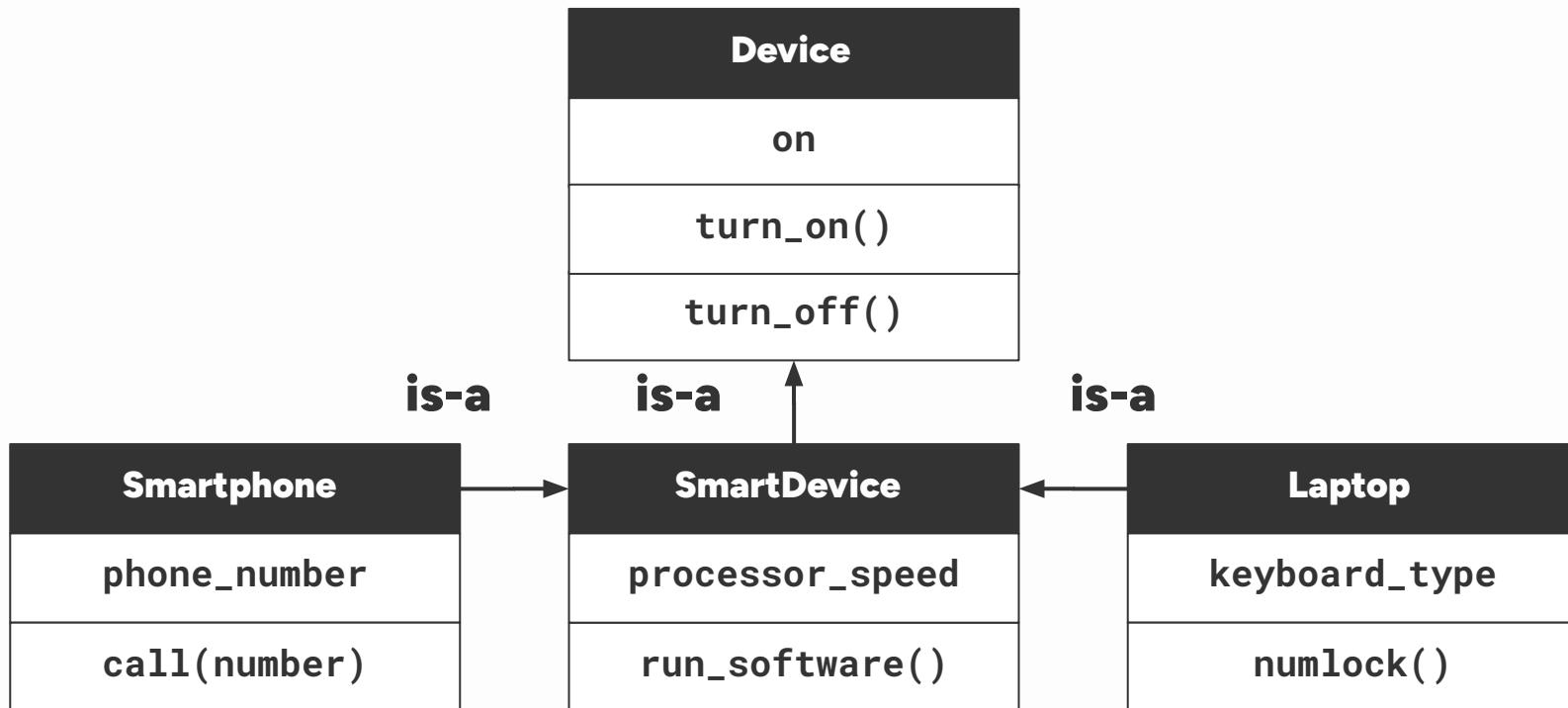




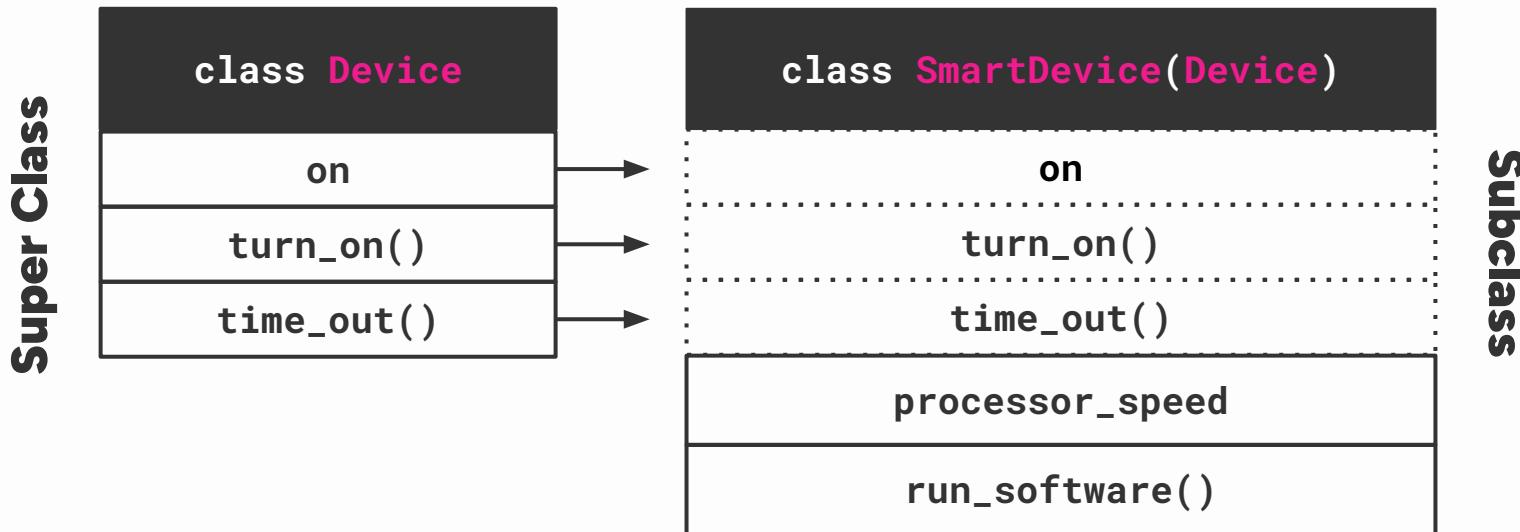




Hierarchy



Class Inheritance



Implement: Student Class

student.py

```
class Person:  
    def __init__(self, first_name, last_name):  
        self.first_name = first_name  
        self.last_name = last_name  
    def sleep(self):  
        print("I will sleep for eight hours")  
    def introduce(self):  
        return f"I'm {self.first_name} {self.last_name}!"  
  
class Student(Person):  
    def __init__(self, first_name, last_name, level):  
        self.first_name = first_name  
        self.last_name = last_name  
        self.level = level  
    def introduce(self):  
        return super().introduce() + f" I'm a {self.level} student."
```

Student Class

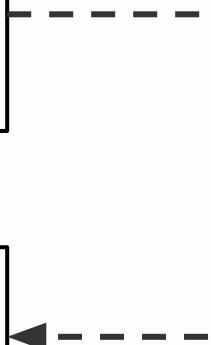
student.py

```
class Person:  
    def __init__(self, first_name, last_name):  
        self.first_name = first_name  
        self.last_name = last_name  
    def sleep(self):  
        print("I will sleep for eight hours")  
    def introduce(self):  
        return f"I'm {self.first_name} {self.last_name}!"  
  
class Student(Person):  
    def __init__(self, first_name, last_name, level):  
        super().__init__(first_name, last_name)  
        self.level = level  
    def introduce(self):  
        return super().introduce() + f" I'm a {self.level} student."
```

Silent Inheritance

```
class Person:  
    def sleep(self):  
        print("I will sleep for eight hours")
```

```
class Student(Parent):  
    def sleep(self):  
        print("I will sleep for eight hours")
```



Overriding

```
class Person:  
    def sleep(self):  
        print("I will sleep for eight hours")
```

```
class Student(Parent):  
    def sleep(self):  
        print("I will sleep for six hours")
```

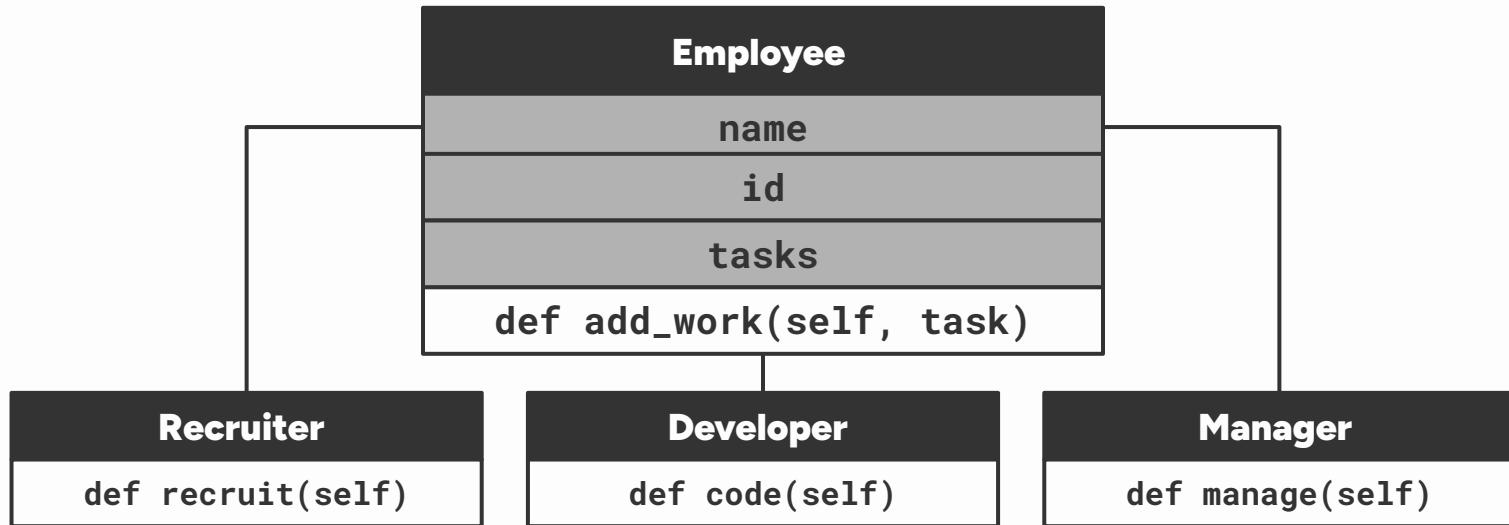


Example: Writer

user.py

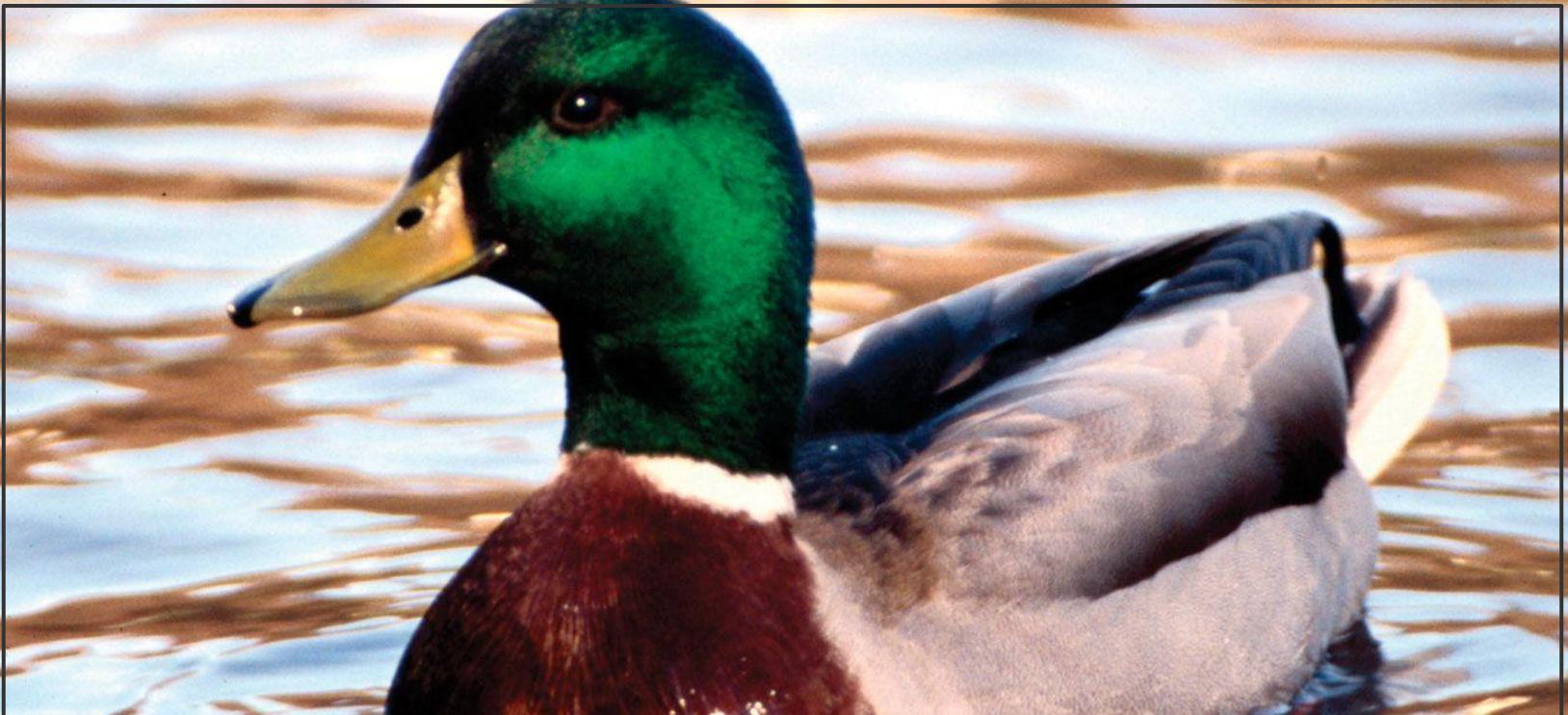
```
class User:  
    def __init__(self, username, email):  
        self.username = username  
        self.email = email  
  
    def display_info(self):  
        return f"User: {self.username} Email: {self.email}"  
  
class Writer(User):  
    def __init__(self, username, email, articles):  
        super().__init__(username, email)  
        self.articles = articles  
  
    def write_article(self, title):  
        print(f"{self.username} is writing '{title}'...")  
        self.articles += 1
```

Implement: Employees



Duck Typing

Informal Polymorphism



Duck?



Duck?



Duck?



Duck?

"""If it looks like a duck, swims like a
duck, and quacks like a duck, then it
probably is a duck."""

—Duck Typing

Has → Is

Implement: Ducks

ducks.py

```
class Duck:  
    def __init__(self, beak):  
        self.beak = beak  
    def swim(self):  
        print("Swimming")  
    def quack(self):  
        print("Quack")
```

```
class RubberDuck:  
    def __init__(self, beak):  
        self.beak = beak  
    def swim(self):  
        print("Splish Splosh")  
    def quack(self):  
        print("Squeak Quack")
```

```
class DuckPerson:  
    def __init__(self, beak):  
        self.beak = beak  
    def swim(self):  
        print("Swim hehe!")  
    def quack(self):  
        print("Quack hehe")
```

```
class RoastedDuck:  
    def __init__(self, serving):  
        self.serving = serving
```

Informal Polymorphism

Objects demonstrate Informal Polymorphism when they have similar function signatures that can react appropriate for their own type

```
ducks = [  
    Duck(beak="Real"),  
    RubberDuck(beak="Rubber"),  
    DuckPerson(beak="Costume"),  
]  
  
for duck in ducks:  
    duck.quack()
```

Implement: Knight

character.py

```
1 class Character:  
...  
17  
18 class Knight:  
19     def __init__(self, health=10, defense=10):  
20         self.health = health  
21         self.defense = defense  
22     def attack(self, other):  
23         damage = self.defense - other.defense  
24         other.health -= damage  
25  
26 player = Knight(defense=30)  
27 enemy = Character()  
28 player.attack(enemy)  
29 print(enemy.health)
```

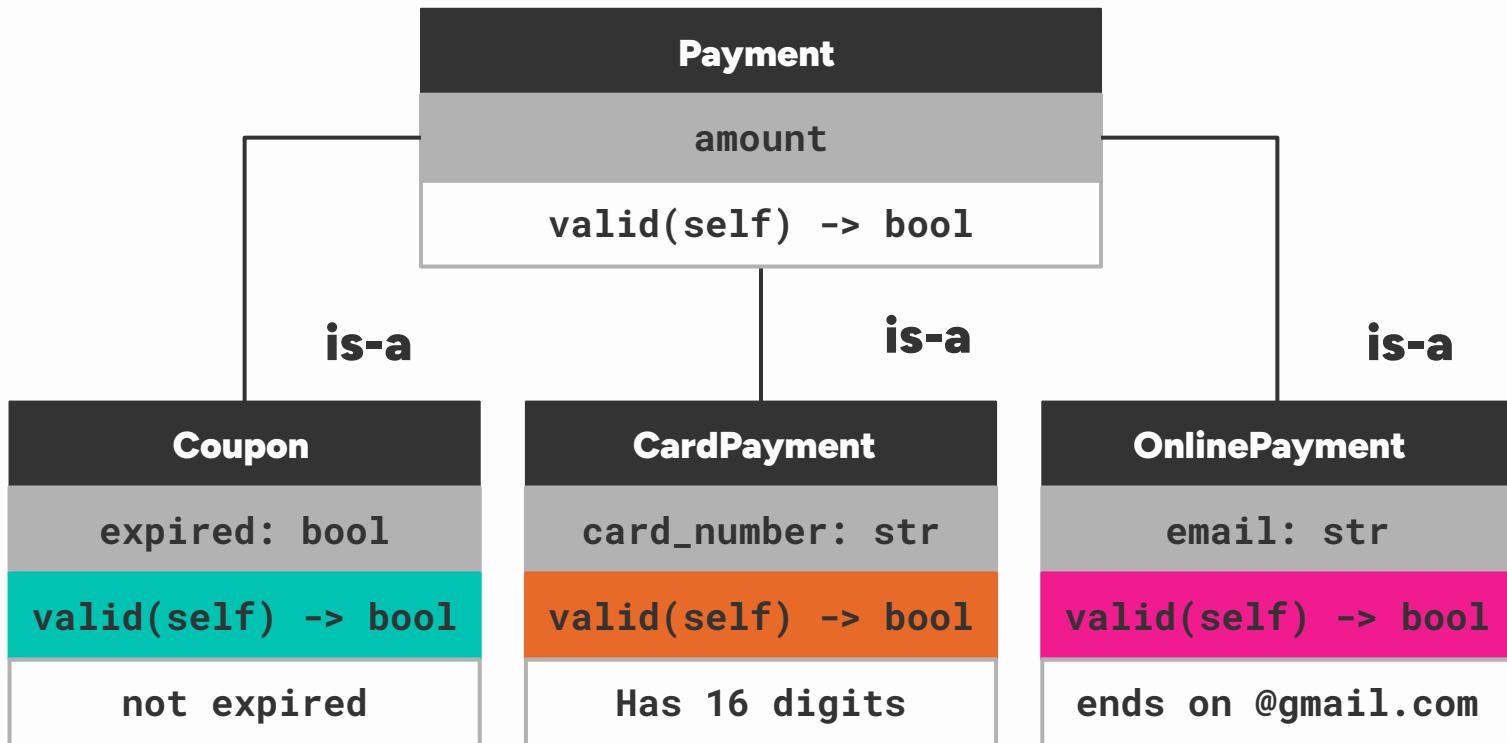
H3

Payment Time

Yes, it's time to pay



payment.py



03

Structure

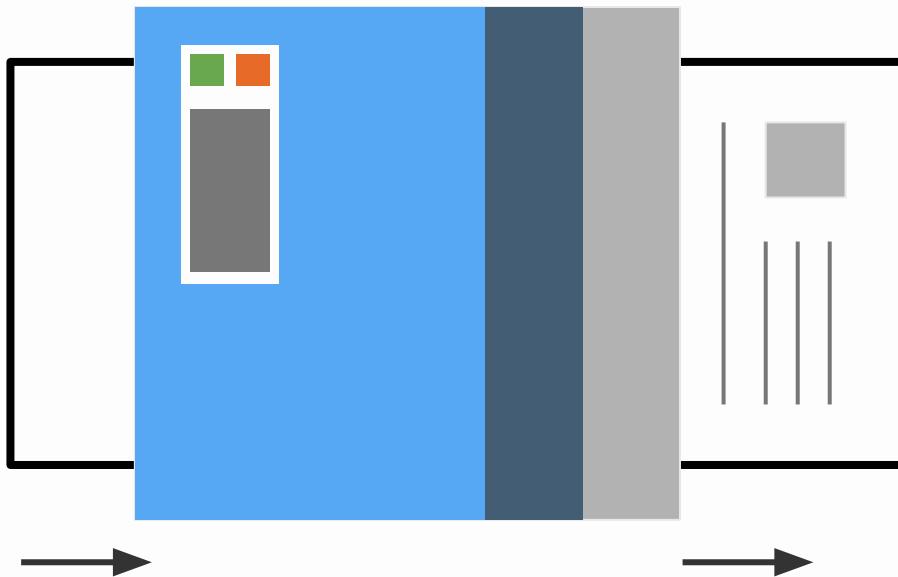
Appropriate Data Representation

Encapsulation

Manage which parts are accessible to the public

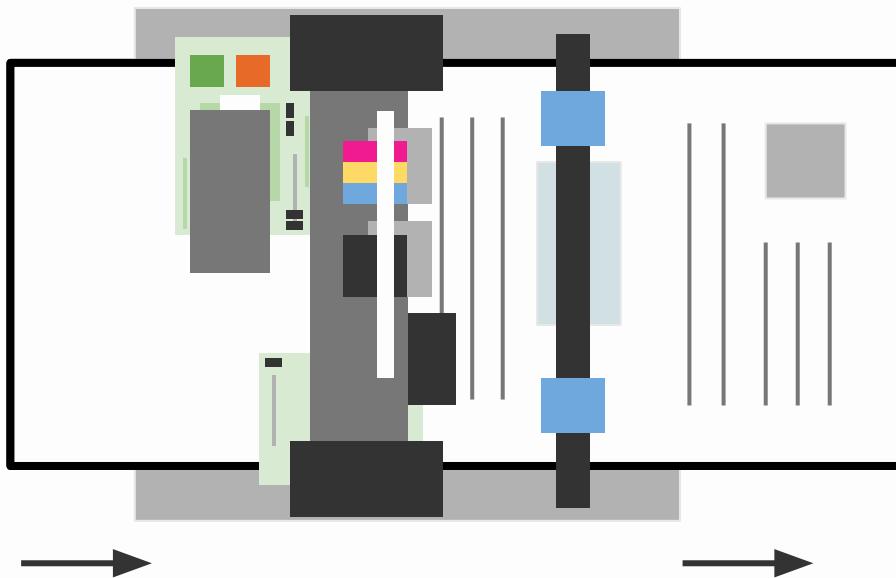
Strategic Data Hiding

Manage which variables are accessible to the public



Strategic Data Hiding

Manage which variables are accessible to the public



**Why not
show the
parts of a
printer?**

Reasons to Encapsulate



Code Security

Prevent unauthorized read or write operations to sensitive data and processes within the code



Simplification

Not every detail of a process needs to be known. Classes can set up their own logic to handle changes



Maintainability

Less access to data means less suspects when debugging problems or issues when developing

Public Attribute

```
1 class Counter:  
2     def __init__(self):  
3         self.value = 0
```

Example Class

`self.value`

Other Class



Protected Attribute

```
1 class Wallet:  
2     def __init__(self, initial_amount=0):  
3         self._amount = initial_amount
```

Wallet

self._amount

OnlineWallet

self._amount

Wallet

```
1 class Wallet:  
2     def __init__(self, initial_amount=0):  
3         self._amount = initial_amount  
4  
5 food_wallet = Wallet(250)  
6 food_wallet.amount += 1_000  
7  
8 print("Food Budget:", food_wallet.amount)
```

Update: Wallet

wallet.py

```
1 class Wallet:
2     def __init__(self, initial_amount=0):
3         self._amount = initial_amount
4
5     def get_amount(self):
6         print(f"Showing amount: {self._amount}")
7         return self._amount
8
9     def set_amount(self, amount):
10        print(f"Setting amount to {amount}")
11        self._amount += amount
12
13 food_wallet = Wallet(250)
14 food_wallet.set_amount(food_wallet.get_amount() + 1_000)
15
16 print("Food Budget:", food_wallet.get_amount())
```

Update: Wallet

wallet.py

```
1 class Wallet:
2     def __init__(self, initial_amount=0):
3         self._amount = initial_amount
4
5     @property
6     def amount(self):
7         print(f"Showing amount: {self._amount}")
8         return self._amount
9
10    @amount.setter
11    def amount(self, amount):
12        print(f"Setting amount to {amount}")
13        self._amount += amount
14
15 food_wallet = Wallet(250)
16 food_wallet.amount += 1_000
17
18 print("Food Budget:", food_wallet.amount)
```

Private Attribute

```
1 class Account:  
2     def __init__(self, initial_balance=0):  
3         self.__balance = initial_balance
```

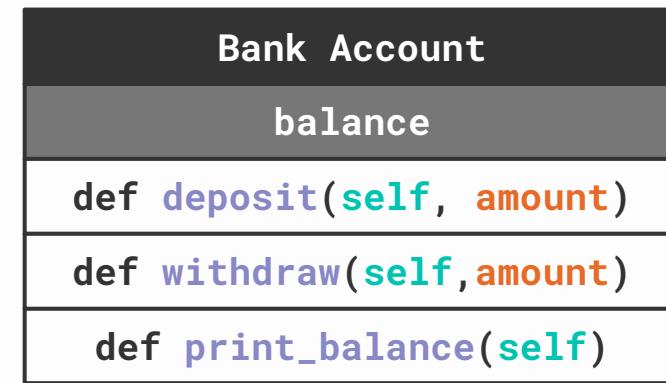
Account

self.__balance

PremiumAccount



Refactor: Prevent unnecessary changes



bank_account.py

H4



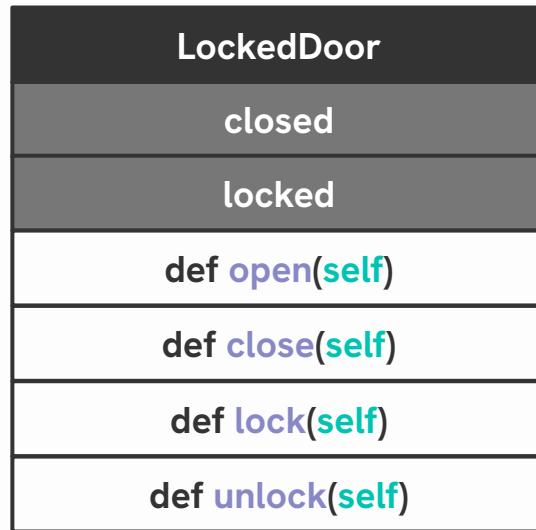
Close the Door

Implement: Door



door.py

Challenge: Locked Door

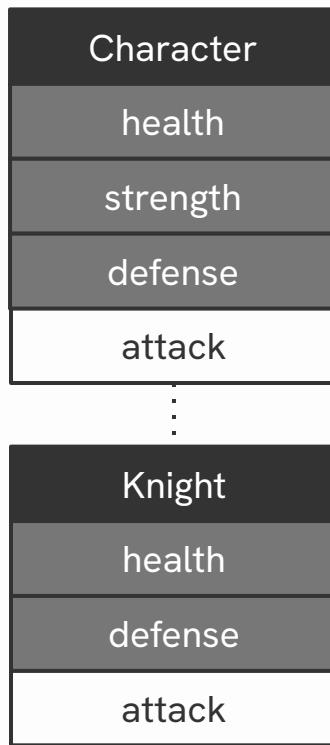


`locked_door.py`

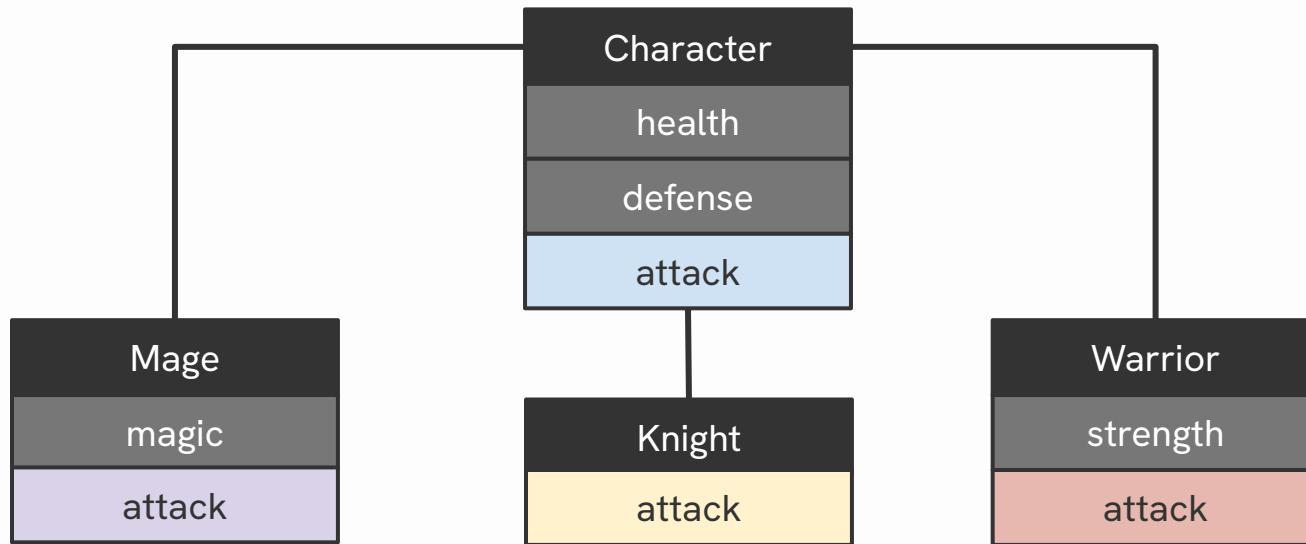
Abstraction

Contractual Implementation

Recall: Game Character



Character Scheme



Initial Implementation

rpg.py

```
1 class Character:
2     def __init__(self, health=10, defense=10):
3         self._health = health
4         self._defense = defense
5     def attack(self, other):
6         raise NotImplementedError()
7
8 class Knight(Character):
9     pass
10
11 enemy = Character()
12 knight = Knight()
13 knight.attack(enemy)
```

Formal Polymorphism

rpg.py

```
1 from abc import ABC, abstractmethod
2
3 class Character(ABC):
4     def __init__(self, health=10, defense=10):
5         self._health = health
6         self._defense = defense
7     @abstractmethod
8     def attack(self, other):
9         raise NotImplementedError()
10
11 class Knight(Character):
12     def attack(self, other):
13         damage = self._defense - other._defense
14         other._health -= damage
```

Warrior

H6



Thief



Monk



Red Mage



White Mage

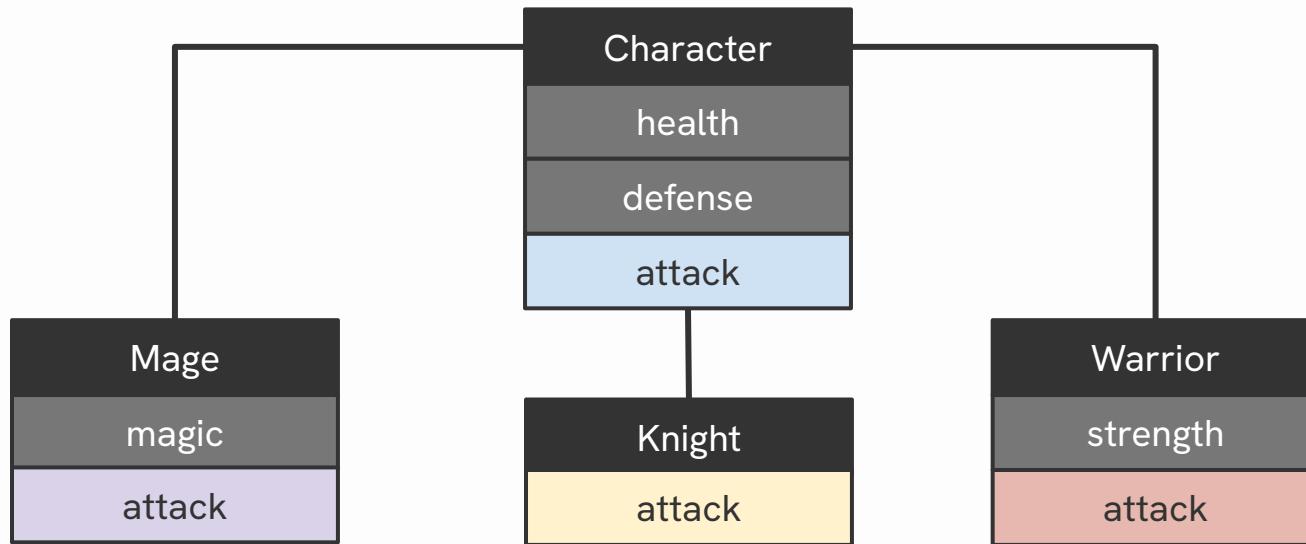


Black Mage



Class Tree

Character Scheme



rpg.py

Custom Exception

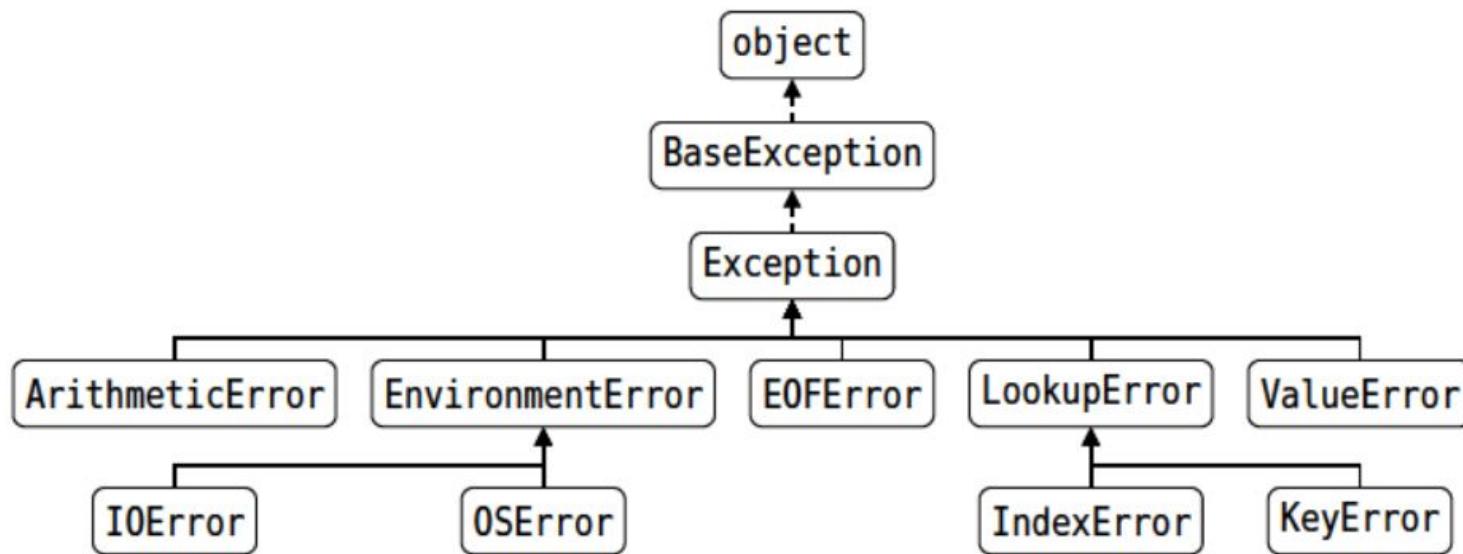
Create your own errors

Custom Error

custom_error.py

```
1 class CustomError(Exception):
2     pass
3
4 raise CustomError("yikes")
```

Exception Hierarchy Excerpt



Custom Error (Specific)

It is best practice to inherit from the closest existing error class

```
1 class InvalidChoiceError(ValueError):
2     pass
3
4 options = ("rock", "paper", "scissors")
5 user_choice = input("Pick move (rock/paper/scissors): ")
6
7 if user_choice not in options:
8     raise InvalidChoiceError()
```

Roughly Equivalent Error

custom_error.py

```
1 class CustomError(Exception):
2     def __init__(self, message):
3         super().__init__(message)
4
5 raise CustomError("yikes")
```

custom_error_complex.py

```
1 class CustomError(Exception):
2     def __init__(self, message, id):
3         message = f"Custom Error [{id}]: {message}"
4         super().__init__(message)
5
6 raise CustomError("yikes", 'a')
```

Quick Exercise: Number Error

number_error.py

```
1 number = input("Enter positive number [1,100]: ")
2
3 # If input not a number, raise a custom error
4 # If input is not positive, raise a custom error
5 # If input is not between 1 and 100, raise a custom error
```

A close-up photograph of a woman with blonde hair and a tattooed arm, wearing a green shirt, holding a large LEGO set. The set features Mickey Mouse dressed as a sorcerer with a blue pointed hat and a red robe, standing on a circular base. The base is filled with various LEGO minifigures, including a wizard, a woman in a red dress, a small yellow lion cub, and a person in a green outfit. There are also small buildings, trees, and a broomstick. The background is blurred, showing shelves with more LEGO sets.

Magic Methods

Magic/Dunder Methods

Dunder methods are special, built-in methods that start and end with dunders (double underscores). Using these methods change or add custom behaviors to classes.

Method Name	Input(s)	Output(s)	Note
<code>__init__</code>	*	None	Sets behavior when creating objects
<code>__str__</code>	None	String	Used in <code>str()</code> and <code>print()</code>
<code>__eq__</code>	Any	Boolean	Sets behavior for <code>==</code> operations
<code>__add__</code>	Any	Any	Sets behavior for <code>+</code> operations
<code>__len__</code>	None	Integer	Sets behavior when used in <code>len()</code>

Implement: Book

```
1 class Book:  
2     def __init__(self, title=None, genre=None, author=None):  
3         self.title = title  
4         self.genre = genre  
5         self.author = author  
6  
7 book1 = Book("The Hobbit", "Fantasy", "Tolkien")  
8 book2 = Book("Dune", "Sci-Fi", "Herbert")  
9 print(book1)
```

```
<__main__.Book object at 0x0000019FE4F27BC0>
```

Magic Method `__repr__`

The `__repr__` dunder method defines what is used if the object is printed

```
1 class Book:  
2     def __init__(self, title=None, genre=None, author=None):  
3         self.title = title  
4         self.genre = genre  
5         self.author = author  
6  
7     def __repr__(self):  
8         return f"{self.title} [{self.genre}] - {self.author}"  
9  
book1 = Book("The Hobbit", "Fantasy", "Tolkien")  
book2 = Book("Dune", "Sci-Fi", "Herbert")  
print(book1)
```

The Hobbit [Fantasy] - Tolkien

Magic Method `__add__`

The `__add__` dunder method defines the result when an `+` operation is used with the object

```
1 class Wallet:  
2     def __init__(self, initial_amount=0):  
3         self.amount = initial_amount  
4  
5     def __add__(self, other):  
6         new_amount = self.amount + other.amount  
7         return Wallet(new_amount)  
8  
9 food_wallet = Wallet(250)  
10 transport_wallet = Wallet(1000)  
11 total_wallet = food_wallet + transport_wallet  
12  
13 print("Food Budget: ", food_wallet.amount)  
14 print("Transport Budget: ", transport_wallet.amount)  
15 print("Total Budget: ", total_wallet.amount)
```

Object Identity

Python uses the memory location of an object to check for equality

```
1 class Candy:  
2     def __init__(self, flavor):  
3         self.flavor = flavor  
4  
5     choco1 = Candy("chocolate")  
6     choco2 = Candy("chocolate")  
7     milk = Candy("milk")  
8  
9     print(choco1 == milk)  
10    print(choco1 == choco2)
```

Magic Method `__eq__`

The `__eq__` dunder method defines whether two objects are equal (or not)

```
1 class Candy:  
2     def __init__(self, flavor):  
3         self.flavor = flavor  
4  
5     def __eq__(self, other):  
6         return self.flavor == other.flavor  
7  
8 choco1 = Candy("chocolate")  
9 choco2 = Candy("chocolate")  
10 milk = Candy("milk")  
11  
12 print(choco1 == milk)  
13 print(choco1 == choco2)
```

05

GUI

Graphical User Interface

Benefits of Graphical User Interfaces



User Experience

Easier to understand and provides appeal and interactivity



Separation

Clearly Separate Frontend (Design, UI/UX) and Backend (Logic)



Limitations

Limit the possible edge cases and directly get needed data type

Python GUI Libraries



Tkinter

Standard GUI toolkit available in (almost) all Python distributions immediately.
Easy to understand and great for building simple applications quickly.



PyQt

Python bindings or implementations for the Qt application framework. It has a lot of flexible components and great for building complex applications.



Kivy

Library built specifically for multi-touch platforms (mobile) but can be used in Desktops as well. Good for complex, cross-platform applications.

Window

01_hello_world.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 root.mainloop()
```

Window (with Title)

01_hello_world.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 root.title("Sample GUI Application")  
5  
6 root.mainloop()
```

Window (with Size)

01_hello_world.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 root.title("Sample GUI Application")  
5 root.geometry("1200x400")  
6  
7 root.mainloop()
```

Label

Adding text to the window

Label

01_hello_world.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 root.title("Sample GUI Application")  
5 root.geometry("1200x400")  
6  
7 label = tkinter.Label(root, text="Hello")  
8 label.pack()  
9  
10 root.mainloop()
```

Multiple Labels

01_hello_world.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 root.title("Sample GUI Application")  
5 root.geometry("1200x400")  
6  
7 label = tkinter.Label(root, text="Hello")  
8 label.pack()  
9  
10 next_label = tkinter.Label(root, text="World")  
11 next_label.pack()  
12  
13 root.mainloop()
```

Multiline Label

02_multiline.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 message = """  
6 Hello  
7 World  
8 """  
9  
10 label = tkinter.Label(root, text=message)  
11 label.pack()  
12  
13 root.mainloop()
```

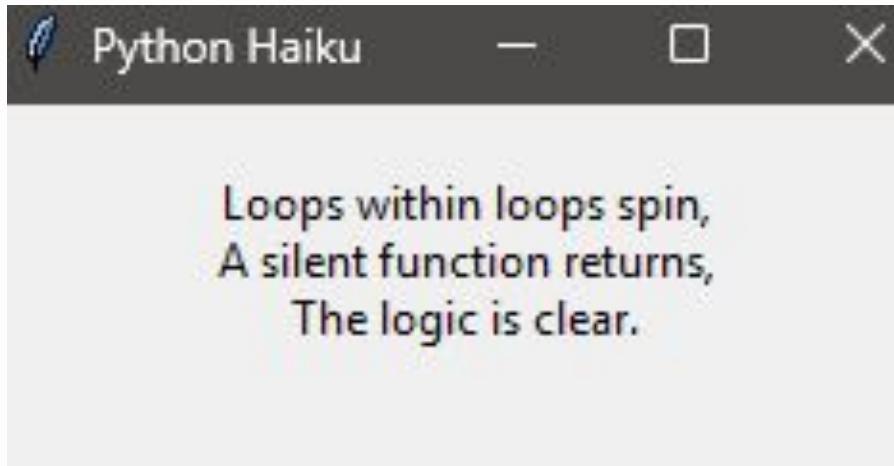
Message

03_message.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 text = "Sentence 1 Sentence 2 Sentence 3"  
6 message = tkinter.Message(root, text=text)  
7 message.pack()  
8  
9 root.mainloop()
```

Quick Exercise: Haiku

Recreate the following window using label(s)



04_haiku.py

Properties

Adding styling and layout to components

Component Font Style

05_font_style.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 label = tkinter.Label(  
6     root,  
7     text="Hello",  
8     font=("Arial", 14, "bold italic"))  
9  
10 label.pack()  
11  
12 root.mainloop()
```

Find Other Fonts Available

06_font_families.py

```
1 import tkinter  
2 from tkinter import font  
3  
4 root = tkinter.Tk()  
5  
6 all_fonts = font.families()  
7 print(all_fonts)
```

Component Color

07_colors.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 label = tkinter.Label(  
6     root,  
7     text="Hello",  
8     fg="red",  
9     bg="yellow"  
10 )  
11 label.pack()  
12  
13 root.mainloop()
```

Component Size

08_size.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 label = tkinter.Label(  
6     root,  
7     text="Hello",  
8     width=100,  
9     height=20  
10 )  
11 label.pack()  
12  
13 root.mainloop()
```

Component Pad

09_pads.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 label = tkinter.Label(  
6     root,  
7     text="Hello",  
8     padx=10,  
9     pady=200  
10 )  
11 label.pack()  
12  
13 root.mainloop()
```

Component Pack Side

10_sides.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 label1 = tkinter.Label(root, text="Left")  
6 label1.pack(side="left")  
7  
8 label2 = tkinter.Label(root, text="Right")  
9 label2.pack(side="right")  
10  
11 root.mainloop()
```

Quick Exercise: Mood Board

Recreate the following window using properties and label(s)



11_mood_board.py

Entry

Asking the user for text input

Blank Entry

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
6 entry.pack()  
7  
8 root.mainloop()
```

Entry Bind

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
entry.pack()  
6  
7  
8 def show_input(event):  
9     print("Enter pressed")  
10  
11 root.bind("<Return>", show_input)  
12 root.mainloop()
```

Entry Echo

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
entry.pack()  
6  
7  
8 def show_input(event):  
9     given_text= entry.get()  
10    print(given_text)  
11  
12 root.bind("<Return>", show_input)  
13 root.mainloop()
```

Entry Echo

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
entry.pack()  
6  
7  
8 def show_input(event):  
9     given_text= entry.get()  
10    print(given_text)  
11  
12 root.bind("<Return>", show_input)  
root.bind("<space>", show_input)  
13  
14 root.mainloop()
```

Available Bindings

Type of Key	Behavior
Numbers	<0>, <1>, <2>, <3>, <4>, <5>, <6>, <7>, <8>, <9>
Lowercase Letters	<a>, , <c>, ...
Uppercase Letters	<A>, , <C>, ...
Space	<space>
Special Keys	<Return>, <Tab>, <Shift>, <Alt_L>, <Escape>, ...
Function Keys	<F1>, <F2>, <F3>, ...
Navigation Keys	<Left>, <Right>, <Up>, <Down>
Multiple Keys	<Control-Shift-s>

Entry Marker

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
entry.pack()  
6  
7  
8 def show_input(event):  
9     given_text = entry.get()  
10    label = tkinter.Label(root, text=given_text)  
label.pack()  
11  
12  
13 root.bind("<Return>", show_input)  
root.bind("<space>", show_input)  
14  
15 root.mainloop()
```

String Variable

Dynamic text for components

String Variable

13_string_var.py

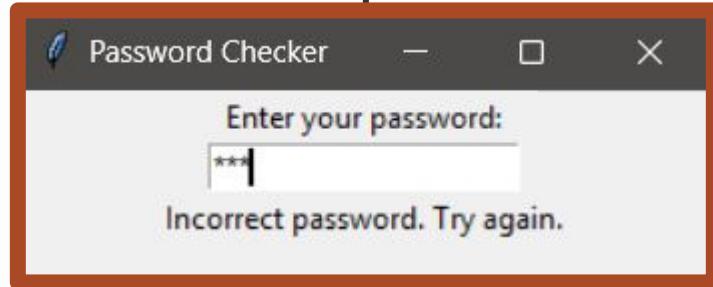
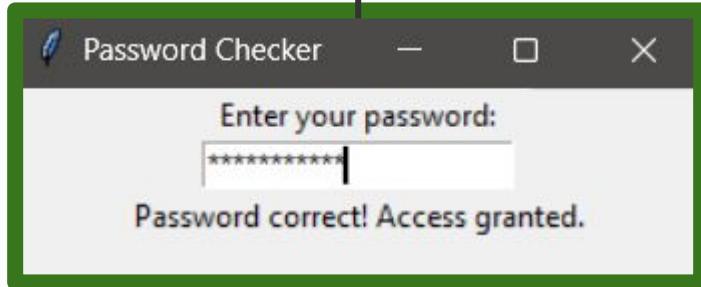
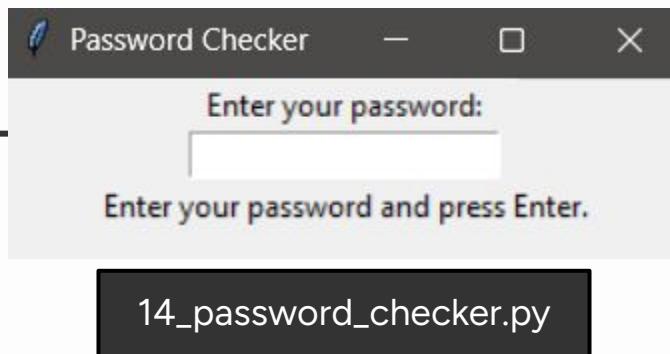
```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 text = tkinter.StringVar(root, value="Hello")  
6 label = tkinter.Label(root, textvariable=text)  
7 label.pack()  
8  
9 root.mainloop()
```

Dynamic Label

12_entry_bind.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 entry = tkinter.Entry(root)  
entry.pack()  
6  
7  
8 user_input = tkinter.StringVar(root, value="Enter any text")  
9 label = tkinter.Label(root, textvariable=user_input)  
label.pack()  
10  
11  
12 def show_input(event):  
13     given_text = entry.get()  
14     user_input.set(given_text)  
15 ...
```

Quick Exercise: Password Checker



Buttons

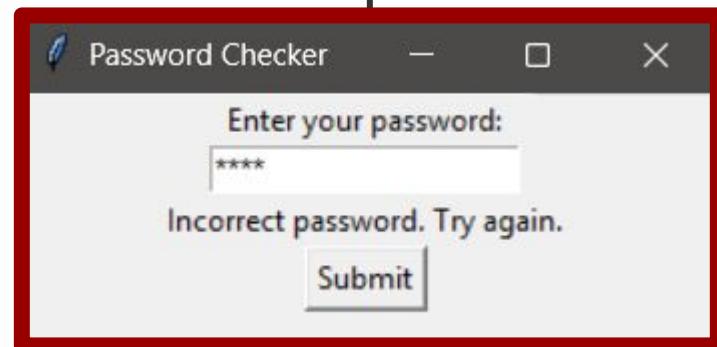
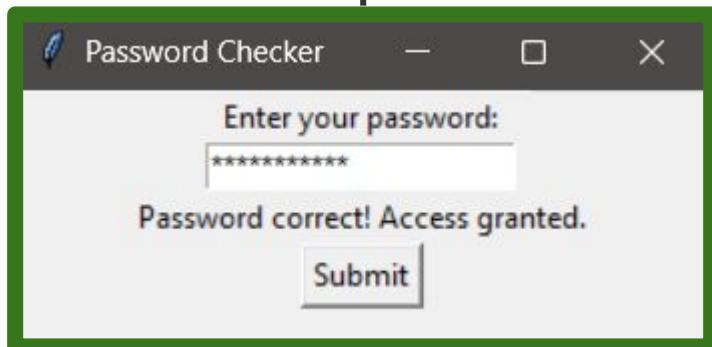
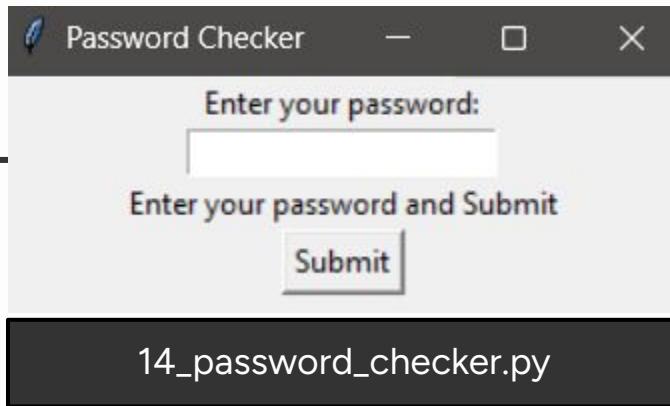
Trigger functions on command

Dynamic Label (Submit)

15_entry_button.py

```
...
12 def show_input():
13     given_text = entry.get()
14     user_input.set(given_text)
15
16 button = tkinter.Button(root, text="Submit", command=show_input)
17 button.pack()
18 root.mainloop()
```

Quick Exercise: Password Checker



Counter

16_counter.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 count = tkinter.IntVar(root, value=0)  
5 label = tkinter.Label(root, textvariable=count)  
6 label.pack()  
7  
8 def increment():  
9     new_value = count.get() + 1  
10    count.set(new_value)  
11  
12 button = tkinter.Button(root, text=" + ", command=increment)  
13 button.pack()  
14  
15 root.mainloop()
```

Quick Exercise: Full Counter



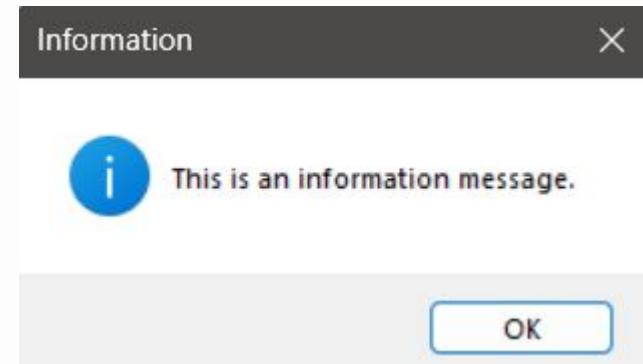
17_full_counter.py

Message Boxes

Sudden message displays for the user

Information Box

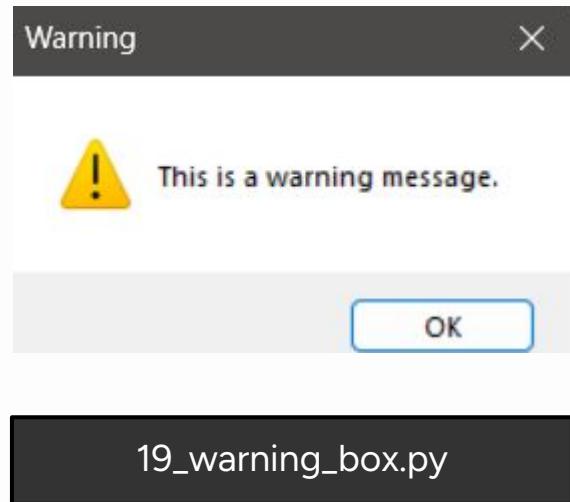
```
1 import tkinter  
2 from tkinter import messagebox  
3  
4 root = tkinter.Tk()  
5  
6 messagebox.showinfo(  
7     "Information",  
8     "This is an information message."  
9 )  
10  
11 root.mainloop()  
12  
13  
14  
15
```



18_information_box.py

Warning Box

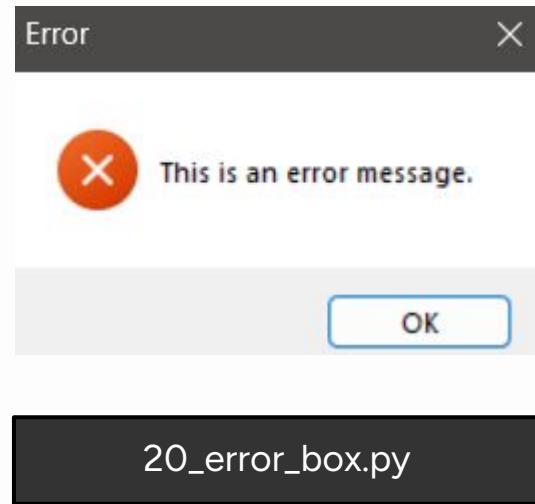
```
1 import tkinter  
2 from tkinter import messagebox  
3  
4 root = tkinter.Tk()  
5  
6 messagebox.showwarning(  
7     "Warning",  
8     "This is a warning message."  
9 )  
10  
11 root.mainloop()  
12  
13  
14  
15
```



19_warning_box.py

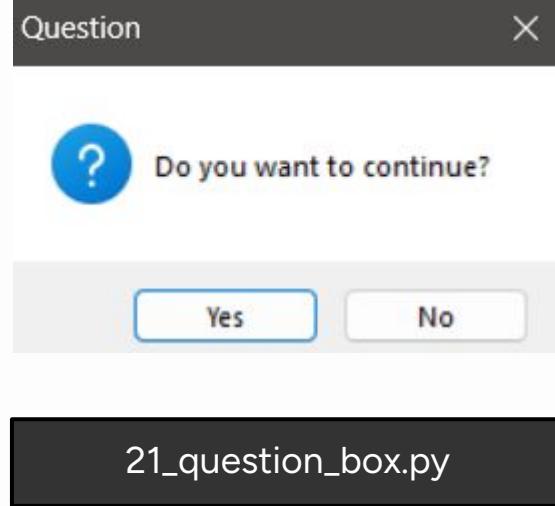
Error Message Box

```
1 import tkinter  
2 from tkinter import messagebox  
3  
4 root = tkinter.Tk()  
5  
6 messagebox.showerror(  
7     "Error",  
8     "This is an error message."  
9 )  
10  
11 root.mainloop()  
12  
13  
14  
15
```



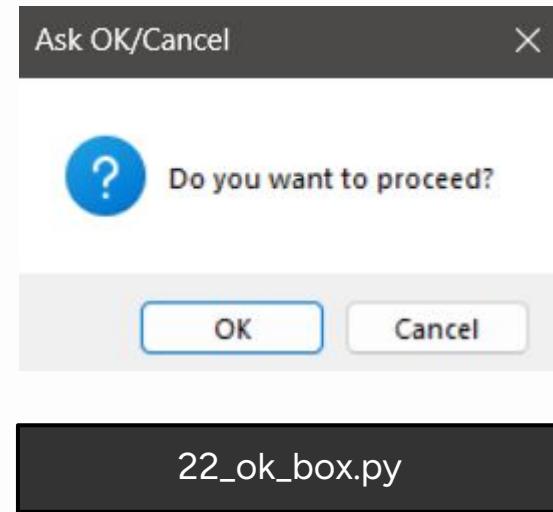
Question Message Box

```
1 import tkinter  
2 from tkinter import messagebox  
3  
4 root = tkinter.Tk()  
5  
6 # yes or no  
7 response = messagebox.askquestion(  
8     "Question",  
9     "Do you want to continue?  
10 )  
11  
12 root.mainloop()  
13  
14  
15
```

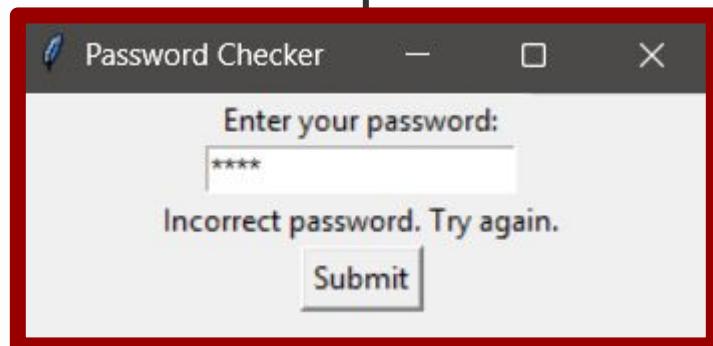
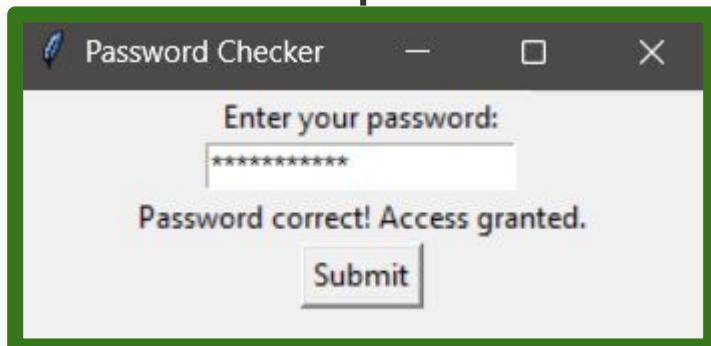


Ask OK Message Box

```
1 import tkinter  
2 from tkinter import messagebox  
3  
4 root = tkinter.Tk()  
5  
6 # true or false  
7 response = messagebox.askokcancel(  
8     "Ask OK/Cancel",  
9     "Do you want to proceed?"  
10 )  
11  
12 root.mainloop()  
13  
14  
15
```



Quick Exercise: Password Checker



Input Components

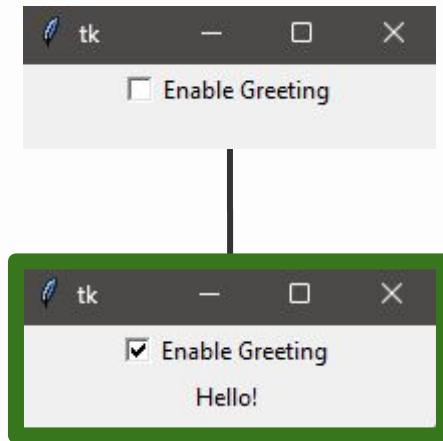
Other basic components for getting user data

Checkbox

23_checkbox.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 check_value = tkinter.BooleanVar()  
6 checkbox = tkinter.Checkbutton(  
7     root,  
8     text="Enable",  
9     variable=check_value  
10 )  
11 checkbox.pack()  
12  
13 root.mainloop()  
14  
15
```

Quick Exercise: First Greeting



24_first_greeting.py

Radio Buttons

25_radio.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 radio_var = tkinter.StringVar(value="Option A")  
6 radio1 = tkinter.Radiobutton(  
7     root, text="Option A", variable=radio_var, value="Option A")  
8 radio1.pack()  
9  
10 radio2 = tkinter.Radiobutton(  
11     root, text="Option B", variable=radio_var, value="Option B")  
12 radio2.pack()  
13  
14 root.mainloop()
```

Quick Exercise: Store Select



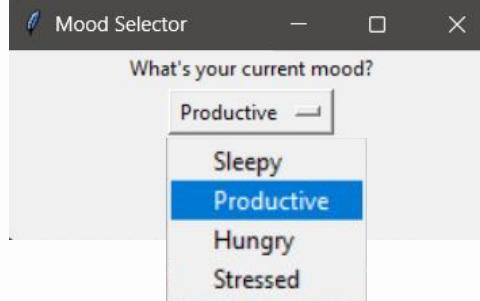
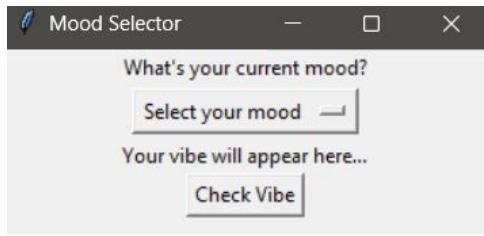
26_store select_.py

Dropdown

27_dropdown.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 dropdown_var = tkinter.StringVar(value="Choice 1")  
6 dropdown_menu = tkinter.OptionMenu(  
7     root, dropdown_var,  
8     "Choice 1",  
9     "Choice 2",  
10    "Choice 3"  
11 )  
12 dropdown_menu.pack()  
13  
14 root.mainloop()
```

Quick Exercise: Check Vibe



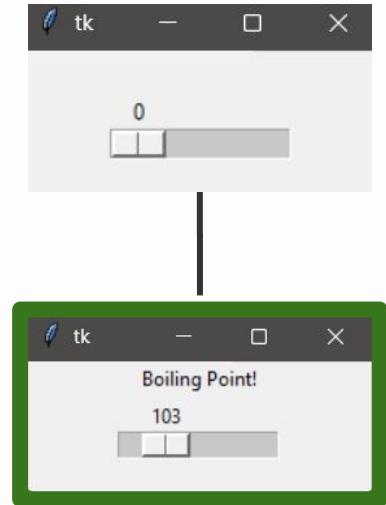
28_check_vibe.py

Slider

29_slider.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 slider_value = tkinter.IntVar(value=0)  
6 slider = tkinter.Scale(  
7     root,  
8     from_=0,  
9     to=100,  
10    orient="horizontal",  
11    variable=slider_value  
12 )  
13 slider.pack()  
14  
15 root.mainloop()
```

Quick Exercise: Thermostat



30_thermostat.py

SimpleDialog

31_simple_dialog.py

```
1 import tkinter
2 from tkinter import simpledialog
3
4 root = tkinter.Tk()
5
6 def ask_all():
7     name = simpledialog.askstring("String", "Your name?")
8     age = simpledialog.askinteger("Integer", "Your age?")
9     score = simpledialog.askfloat("Float", "Your score?")
10    if name and age and score:
11        message = f"{name} | {age} | {score}"
12        tkinter.Label(root, text=message).pack()
13
14 tkinter.Button(root, text="Start", command=ask_all).pack()
15 root.mainloop()
```

Layout

Setup the layouting for all of the components by group

Frames

32_frames.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 left_frame = tkinter.Frame(root, bg="lightblue")  
6 left_frame.pack(side="left")  
7  
8 left_label = tkinter.Label(left_frame, text="I'm on the left")  
9 left_label.pack()  
10  
11 right_frame = tkinter.Frame(root, bg="lightgreen")  
12 right_frame.pack(side="right")  
13  
14 right_entry = tkinter.Entry(right_frame)  
15 right_entry.pack()  
16 right_button = tkinter.Button(right_frame, text="Click me")  
17 right_button.pack()  
18  
19 root.mainloop()
```

Grids

33_grids.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4  
5 top = tkinter.Label(root, text="Top", bg="blue", width=40, height=2)  
6 top.grid(row=0, column=0, columnspan=3, sticky="nsew")  
7 side = tkinter.Label(root, text="Side", bg="green", width=15, height=4)  
8 side.grid(row=1, column=0, rowspan=2, sticky="nsew")  
9 cell_1_1 = tkinter.Label(root, text="1,1", bg="gray", width=15, height=2)  
10 cell_1_1.grid(row=1, column=1)  
11 cell_1_2 = tkinter.Label(root, text="1,2", bg="gray", width=15, height=2)  
12 cell_1_2.grid(row=1, column=2)  
13 cell_2_1 = tkinter.Label(root, text="2,1", bg="yellow", width=15, height=2)  
14 cell_2_1.grid(row=2, column=1)  
15 cell_2_2 = tkinter.Label(root, text="2,2", bg="yellow", width=15, height=2)  
16 cell_2_2.grid(row=2, column=2)  
17  
18 root.mainloop()
```

Frame and Grids

34_frames_grid.py

```
1 import tkinter  
2  
3 root = tkinter.Tk()  
4 root.title("Login Form")  
5  
6 form_frame = tkinter.Frame(root, padx=20, pady=20)  
7 form_frame.pack()  
8  
9 tkinter.Label(form_frame, text="Username:").grid(row=0, column=0)  
10 username_entry = tkinter.Entry(form_frame)  
11 username_entry.grid(row=0, column=1)  
12  
13 tkinter.Label(form_frame, text="Password:").grid(row=1, column=0)  
14 password_entry = tkinter.Entry(form_frame, show="*")  
15 password_entry.grid(row=1, column=1)  
16  
17 login_button = tkinter.Button(form_frame, text="Login")  
18 login_button.grid(row=2, column=0, columnspan=2, pady=10)  
19 root.mainloop()
```

Class Organization

35_tkinter_class.py

```
1 import tkinter  
2  
3 class Application(tkinter.Tk):  
4     def __init__(self):  
5         super().__init__()  
6         self.title("Tkinter Class Structure")  
7         self.geometry("300x200")  
8         self.create_widgets()  
9  
10    def create_widgets(self):  
11        label = tkinter.Button(self, text="Hello", command=self.hello)  
12        label.pack()  
13  
14    def hello(self):  
15        print("Hello")  
  
app = Application()  
app.mainloop()
```

06

Lab Session

All the Major Features Covered

{

```
"Name": "Peter"  
"Age": 32  
"Theme": "Light"  
"Subscribe": True  
"Rating": 3
```

}

user.json

Name Peter

Age 32

Preferred Theme Light Dark

Subscribe to newsletter

Rate us

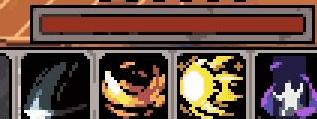
3

Submit

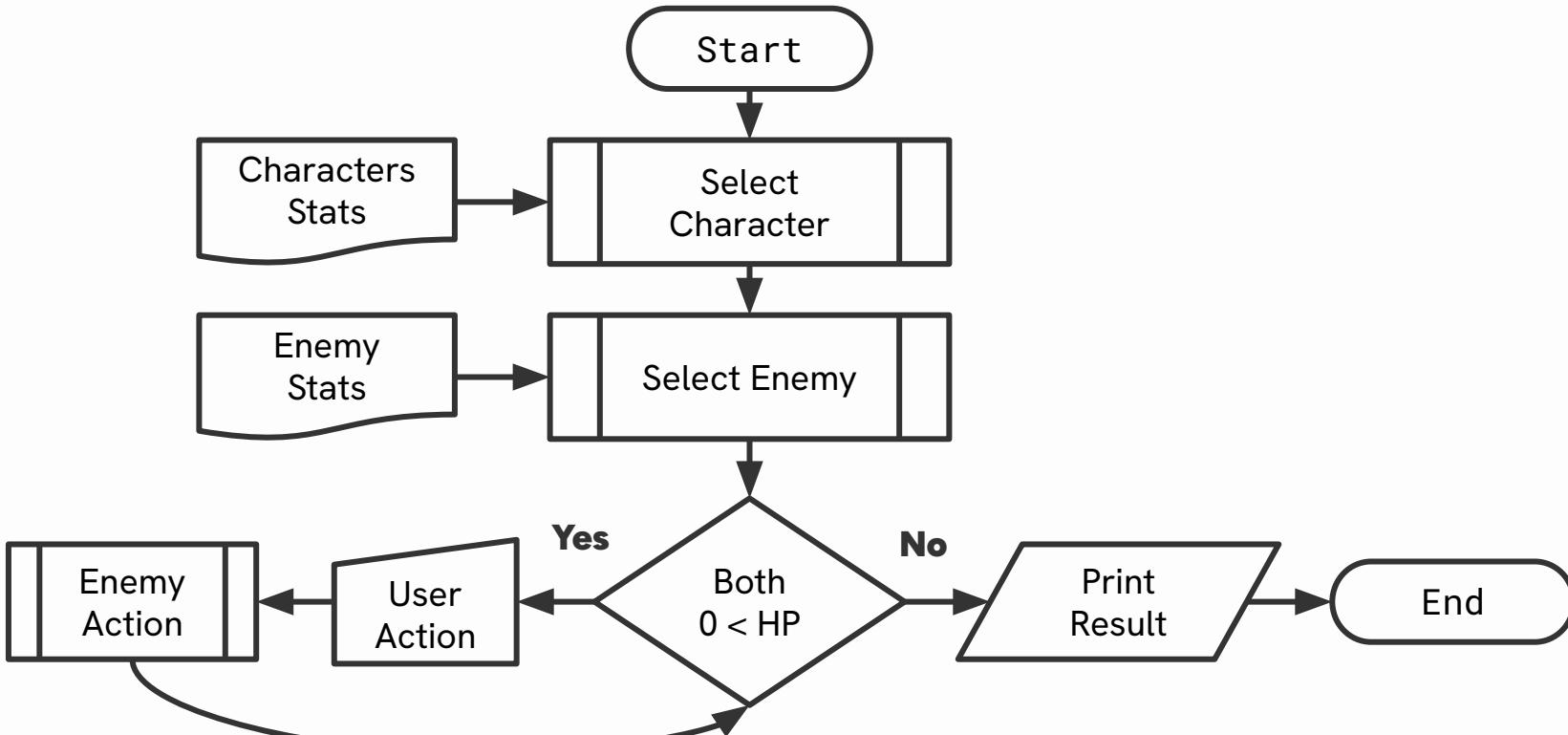
Forms



Battle!



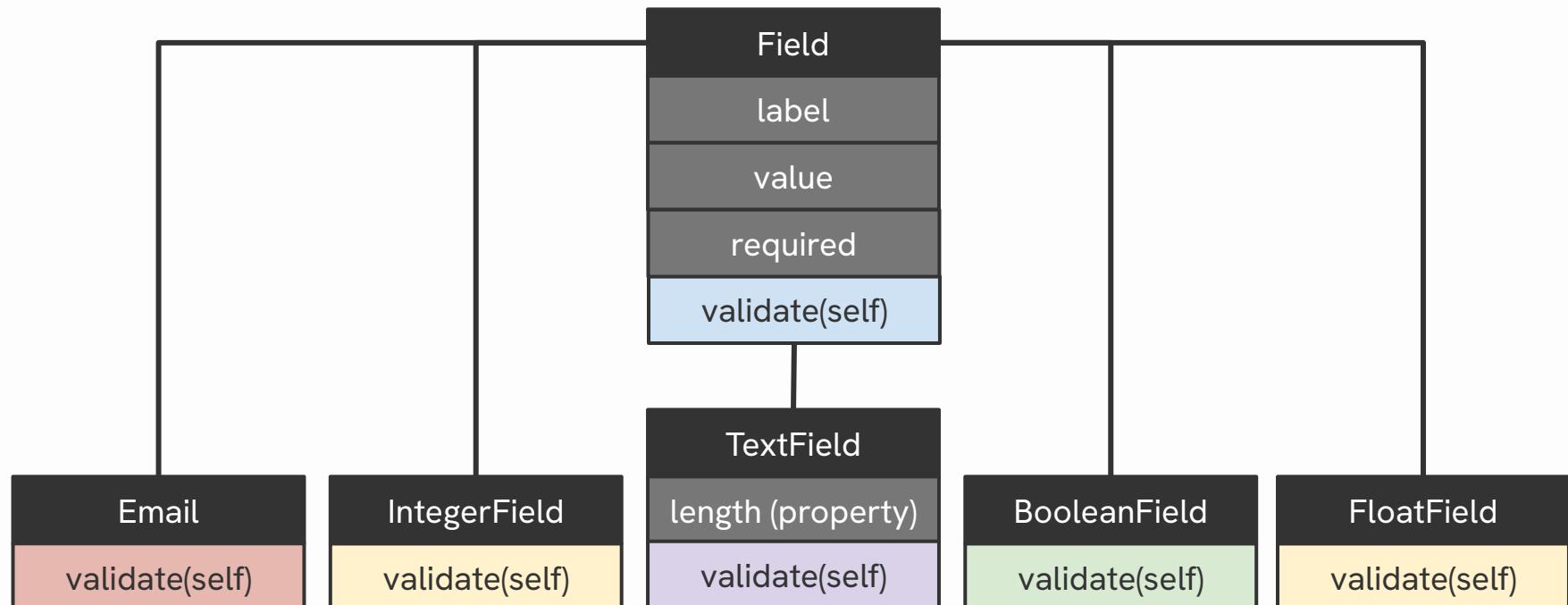
Battle! Game Flow



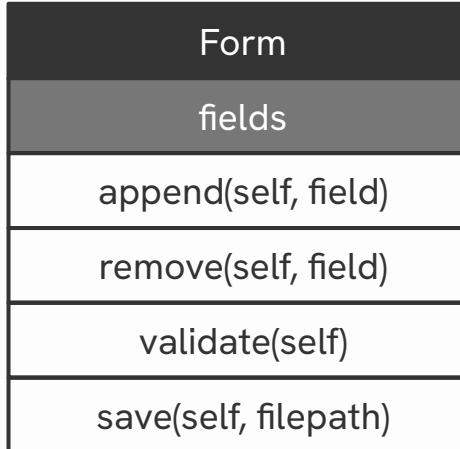
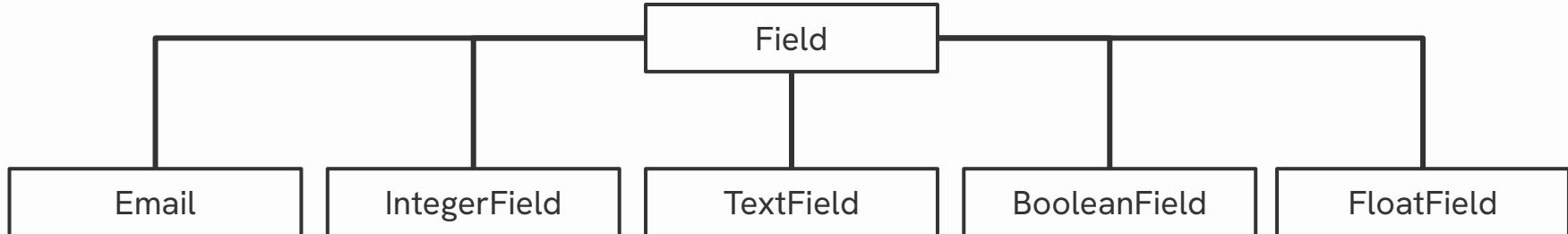
A wide-angle photograph of a vast green field, likely a grassy hillside, stretching towards a horizon under a bright blue sky dotted with wispy white clouds.

Fields

Initial Fields



Forms with Fields



Inbox



Inbox
emails
add(self , email)
show(self , index)
delete(self , index)
search(self , keywords) -> Email
__add__(self)
__repr__(self)
WorkInbox(Inbox)
archived (property)
read (property)
unread(property)

Email
sender
subject
message
date
read_status
archive_status
__repr__(self)
read(self)
unread(self)
archive(self)
unarchive(self)

Sneak Peak

01

Packaging

Handling Python Files

02

Concurrency

Multitasking techniques

03

Best Practices

Writing Pythonic code

04

Testing

Code correctness

05

Web Dev

Introduction to Flask

06

Lab Session

Culminating Exercise

Python: Day 03

Object-Oriented Programming