COMP110: Principles of Computing

6: Object oriented programming

Learning outcomes

- **Explain** the key concepts of OOP, including objects, classes, fields, methods, inheritance and polymorphism
- **Use** objects to model systems
- **Write** simple object oriented programs

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Classes and objects

A non-object-oriented program

Clone the `bsc-live-coding` repository to your local machine:

- Open an appropriate folder (e.g. on the `X:` drive) and right-click in empty space
- Select **Git Clone...**
- For the URL, enter `https://github.com/Falmouth-Games-Academy/bsc-live-coding.git`
- Click OK

Once it has finished downloading, open `bsc-live-coding\COMP110\06_OOP` in PyCharm

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- It's inefficient — all that list indexing takes time
- It's error-prone — if we start inserting or removing elements, the lists can easily get out of step with each other

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- We use a class by creating **instances** of it

The constructor

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- Other parameters are optional

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- In Python, **fields** are defined by **assigning** to them
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- Usually define all fields in `__init__`
  - It's possible to define new fields after, but for maintainability it is better to collect them all in the same place

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- If `__init__` takes parameters other than `self`, specify them here
- To access fields, use **dot notation**:

```
ball.pos_x += 10
print ball.pos_x
```

Live coding

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- Use dot notation to call methods

Live coding

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  - Fields can also be called **attributes** or **member variables**
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- The fields and methods available on an object are determined by its **class**, i.e. its **type**
- A class is a "blueprint" for an object; an **instance** is the object itself

Encapsulation

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- Development of modular reusable components
- Decoupling of object behaviour from implementation details

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Inheritance and polymorphism

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- `draw` method has a big `if-elif` block
- Imagine if we also had to do e.g. collision detection – we'd need another `if-elif` block
- If we add a new shape, we have to remember to update all of these blocks

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- We could define multiple classes, e.g. `SquareBall`, `CircleBall`, `TriangleBall`
- But they would have common code (e.g. `update` method) that we would need to copy and paste...

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- The subclass can add new fields and methods
- The subclass can also **override** methods from the base class

Live coding

Inheritance hierarchy

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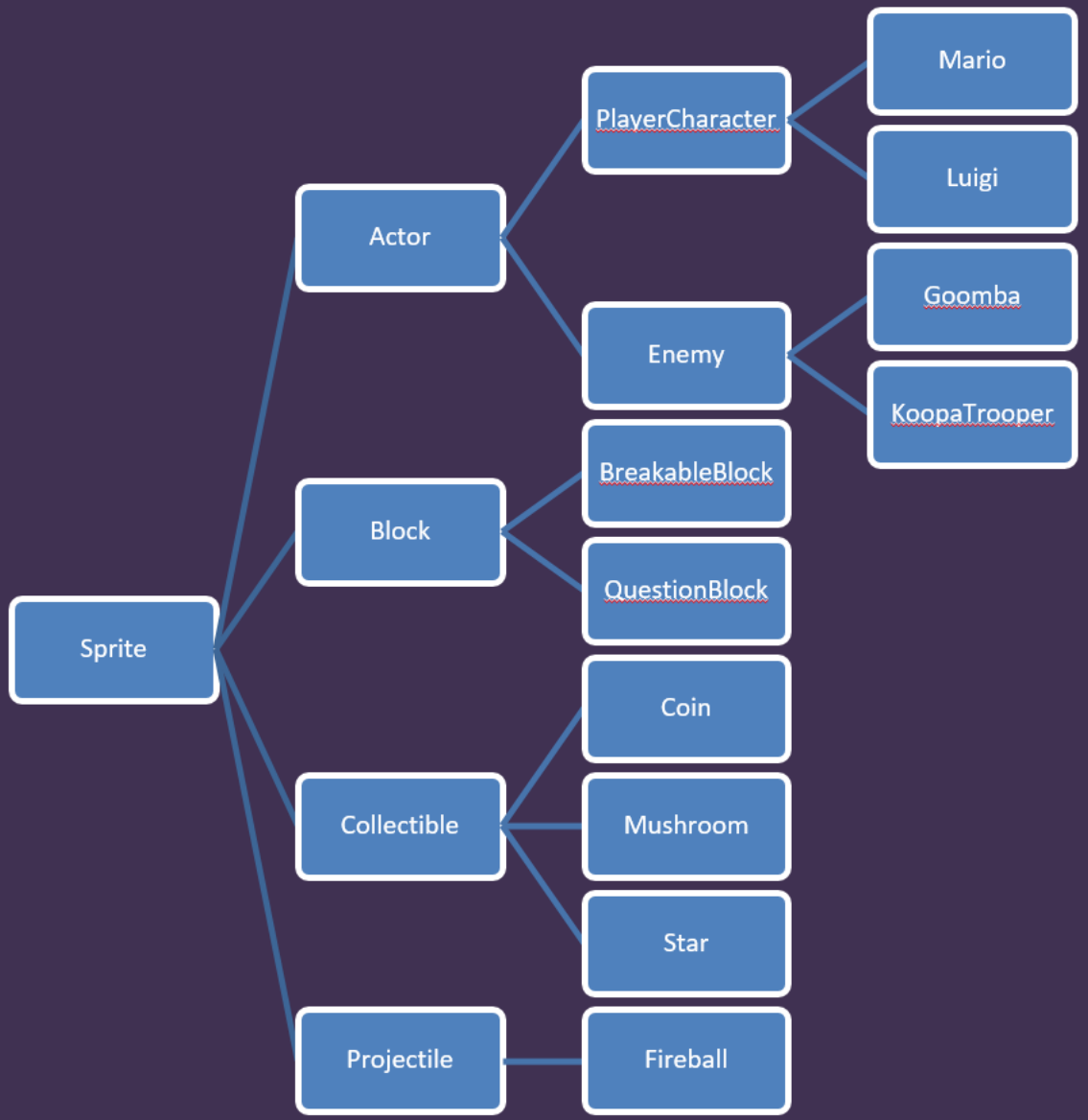

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  - From Greek: "many-shape-ism"

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Worksheet C

Worksheet C

- Upload your work to GitHub **now**!
- If you still have an open pull request for worksheet B, it will be automatically updated — you don't need to create a new one
- (in fact, GitHub won't let you create a new one...)