Abstract Base Classes

In this lesson, we will learn what abstract base classes are in Python and how to use them.

WE'LL COVER THE FOLLOWING

- What are Abstract Base Classes?
- Why use Abstract Base Classes?
 - Syntax
- Example
 - Explanation

What are Abstract Base Classes?

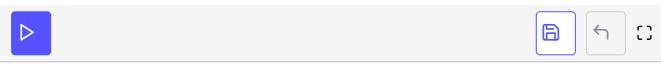
Duck typing is useful as it simplifies the code and the user can implement the functions without worrying about the data type. But this may not be the case all the time. The user might not follow the instructions to implement the necessary steps for duck typing. To cater to this issue, Python introduced the concept of Abstract Base Classes, or **ABC**.

Abstract base classes define a set of methods and properties that a class must implement in order to be considered a duck-type instance of that class.

Why use Abstract Base Classes?

Let's see an example below to understand why we should use abstract base classes:

```
def perimeter(self):
        pass
class Square(Shape):
    def __init__(self, length):
        self.length = length
    def area(self):
        return (self.length * self.length)
    def perimeter(self):
        return (4 * self.length)
shape = Shape()
square = Square(4)
```



In the example above, you can see that an instance of Shape can be created even though an object from this class cannot stand on its own. Square class, which is the child class of Shape, actually implements the methods, area() and perimeter(), of the Shape class. Shape class should provide a blueprint for its child classes to implement methods in it. To prevent the user from making a Shape class object, we use abstract base classes.

Syntax

To define an abstract base class, we use the abc module. The abstract base class is inherited from the built-in ABC class. We have to use the decorator @abstractmethod above the method that we want to declare as an abstract method.

```
from abc import ABC, abstractmethod
class ParentClass(ABC):
   @abstractmethod
    def method(self)
```

Example

Below is a code implementation for abstract base classes:

```
Shape
              Square
from abc import ABC, abstractmethod
                                                                                      n
class Shape(ABC): # Shape is a child class of ABC
    @abstractmethod
    def area(self):
        pass
    @abstractmethod
    def perimeter(self):
       pass
class Square(Shape):
    def __init__(self, length):
       self.length = length
shape = Shape()
# this will code will not compile since Shape has abstract methods without
# method definitions in it
```

As you can see above, the code does not compile since we have not defined the abstract methods, area and perimeter, inside the parent class, Shape, or the child class, Square. Let's do it and see what happens:



```
def perimeter(self):
    return (4 * self.length)

shape = Shape()
# this will code will not compile since Shape has abstract methods without
# method definitions in it
```







[]

Explanation

- Now when we define the methods, area and perimeter in the child class Square, an object of Shape cannot be instantiated, but an object of Square can be.
- We allow the user to have a free hand over the definition of the methods while also making sure that the methods are defined.

Note: Methods with <code>@abstractmethod</code> decorators **must** be defined either in the parent class or the child class.

By using abstract base classes, we can control the classes whose objects can or cannot be created.

Abstract methods must be defined in child classes for proper implementation of inheritance.

That is all for polymorphism in Python. Let's test your knowledge with a quick quiz!