07_advanced

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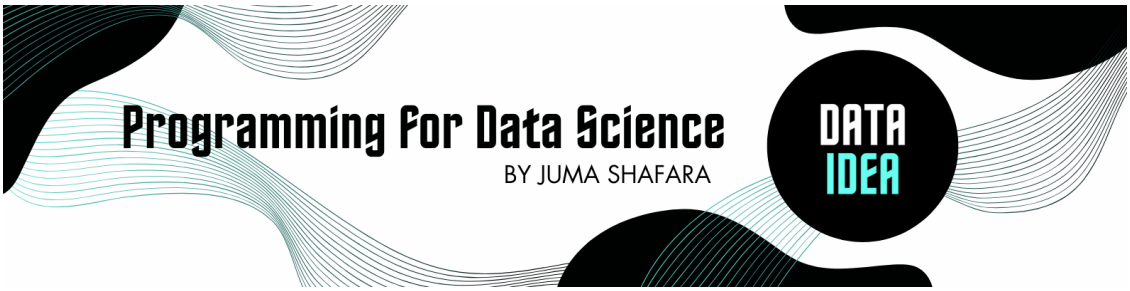

0.1 Advanced

In this notebook, we'll introduce and discuss the following concepts in Python

- Classes and Objects
- Formatted Strings
- Handling Errors
- Variable Scopes

0.2 Classes and Objects

In Python, everything is an object. A class helps us create objects.

0.2.1 Creating a Class

Use the `class` keyword to create a class

[ ]:
```
class Person:
    first_name = "Betty"
    last_name = "Kawala"
    age = 30
```

0.2.2 Instantiating a class

Now we can ceate an object from the class by instantiating it.

To instantiate a class, add round brackets to the class name.

[ ]:
```
person_obj1 = Person()

type(person_obj1)
```

[ ]:
```
__main__.Person
```

After instantiating a class, we can now access the object's properties.

[ ]:
```
# print attributes
print(person_obj1.first_name)
print(person_obj1.last_name)
print(person_obj1.age)
```

```
Betty
Kawala
30
```

0.3 Class Attributes

A class can have attributes. Forexample the Person Class can have attributes like the `name`, `height` and `feet`

[ ]:
```
class Person:
    def __init__(self, name, height, feet):
        self.name = name
        self.height = height
        self.feet = feet
```

Note!

For now, focus on the syntax. Later we will explain the **init**() function and the self parameter.

Now that our class is ready, we can now instantiate it and provide values to it's attributes.

This process can also be called "creating an instance of a class".

An instance is simply the object created from a class

In this example, `person_obj1` is a unique instance of the person class.

[ ]:
```
# create a class instance
person_obj1 = Person(
    name='Betty Kawala',
    height=1.57,
    feet=4
    )

# accessing the properties
print('Name:', person_obj1.name)
print('Height:', person_obj1.height)
print('Feet:', person_obj1.feet)
```

```
Name: Betty Kawala
Height: 1.57
Feet: 4
```

The `self` parameter allows us to access the attributes and methods of a class

The `__init__()` functino allows us to provide values for the attributes of a class

0.3.1 Instances are unique

Let's say you have 500 people and you need to manage their data.

It is inefficient to create a variable for each of them, instead, you can create unique instances of a class.

In this example, the student1 and student2 instances are different from each other

[ ]:
```
class Student:
  def __init__(self, id_number, name, age):
    self.id_number = id_number
    self.name = name
    self.age = age

student1 = Student(5243, "Mary Doe", 18)
student2 = Student(3221, "John Doe", 18)

print("Student 1 ID:", student1.id_number)
print("Student 1 Name:", student1.name)
print("Student 1 Age:", student1.age)

print("----------------------")

print("Student 2 ID:", student2.id_number)
print("Student 2 Name:", student2.name)
print("Student 2 Age:", student2.age)
```

```
Student 1 ID: 5243
Student 1 Name: Mary Doe
Student 1 Age: 18
----------------------
Student 2 ID: 3221
Student 2 Name: John Doe
Student 2 Age: 18
```

0.4 Methods

Methods are functions that can access the class attributes. These methods should be defined (created) inside the class

[ ]:
```
class Person:
    def __init__(self, name, height, feet):
        self.name = name
        self.height = height
        self.feet = feet
```

```
    def jump(self):
        return "I'm jumping " + str(self.feet) + " Feet"
```

[ ]:
```
person_obj1 = Person(name='Juma', height=1.59, feet=5)

print(person_obj1.jump())
```

```
I'm jumping 5 Feet
```

As you may notice, we used the `self` parameter to access the `feet` attribute

0.5 Python Inheritance

Inheritance is a feature that allows us to create a class that inherits the attributes or properties and methods of another class

0.5.1 Example

The `Animal` class below can be used to tell that an animal can eat

[ ]:
```
class Animal:
    def __init__(self, name, age):
        self.name = name
        self.age = age

    def eat(self):
        print(f"{self.name} is eating.")
```

Let's say we need to create another class called Dog.

Since a dog is also an animal, it's more efficient to have access to all the properties and methods of the `Animal` class than to create another

This example creates a class named `Dog` and inherits from the `Animal` class

[ ]:
```
class Dog(Animal):
    def __init__(self, name, age, color):
        super().__init__(name, age)
        self.color = color

    def sound(self):
        print(self.name, "barks")
```

Note!

As you may notice, to inherit from a parent, we simply pass the name of that class as a parameter of the child class.

Now we can use the properties and methods of both the `Animal` and the `Dog` classes using just one instance

[ ]:
```
dog1 = Dog(name='Brian', age=8, color='White')
dog1.eat()
dog1.sound()
```

```
Brian is eating.
Brian barks
```

The `super()` and `__init__` functions found in the `Dog` class allow us to inherit the properties and methods of the `Animal` class.

0.5.2 Parent and Child Class

The parent class is the class from whick the other class inherits from.

The child class is the the class that inherits from another class

In our example above, the `Animal` is the parent class while the `Dog` class is the child class

0.6 Formatted Strings

In Python, we can format a string by adding substring/s within it.

The `format()` function allows us to format strings.

0.6.1 Placeholders {}

Placeholders help us control which part of the string should be formated.

They are defined using curly braces `{}`.

0.6.2 Multiple placeholders

If you want to format multiple parts of a string, use multiple placeholders.

In this example, we will concatenate (add) a substring to where the curly braces are placed

[ ]:
```
statement = '{} loves to code in {}'

formatted = statement.format('Juma', 'JavaScript')

print(formatted)
```

```
Juma loves to code in JavaScript
```

0.6.3 Literal String Interpolation

Literal string interpolation allows you to use expression inside your strings.

Simply add `f` before you opening quote, then surround your expressions with curly braces `{}`.

[ ]:
```
name = 'Juma';
language = 'JavaScript'
```

```
statement = f'{name} loves to code in {language}'

print(statement)
```

```
Juma loves to code in JavaScript
```

Here's another example

[ ]:
```
answer = f'The summation of 5 and 7 is {5 + 7}'

print(answer)
```

```
The summation of 5 and 7 is 12
```

0.6.4 Using indexes

We can use index numbers to specify exactly where the values should be placed.

The index numbers should be inside the curly braces: `{index_number}`

[ ]:
```
statement = '{0} loves to code in {1}'

modified = statement.format('Juma', 'JavaScript')

print(modified)
```

```
Juma loves to code in JavaScript
```

Note!

0 represents the first value, 1 represents the second value and so on.

0.6.5 Using named indexes

We can also use named indexes to specify exactly where the values should be placed

The arguments of the `format()` functino should be in `key/value` pairs ie `key=value`

The `key/value` pairs should be separated by commas.

[ ]:
```
statement = '{name} loves to code in {language}'

modified = statement.format(language='JavaScript', name='Juma')

print(modified)
```

```
Juma loves to code in JavaScript
```

0.7 Errors in Python

When coding in Python, you will encounter errors.

When errors occur, the program crashes or stops executing.

Fortunately, errors can be handled in Python

0.7.1 The `try...except` statment

The `try...except` statement is used to handle exceptions(errors)

The `try` statement takes a block of code to test for errors

The `except` statement handles the exceptions.

[ ]:
```
try:
    # age = input('Enter your age: ')
    age = '32'

    if age >= 18:
        print('Your vote has been cast')
    else:
        print('You are not eligible to vote')
except:
    print('A problem occured while picking your age \n'
          'You did not enter a number')
```

```
A problem occured while picking your age
You did not enter a number
```

0.7.2 Throw Exceptions

We can intentionally throw and exception to stop the execution of a program.

The `raise` keyword throws an excrption.

[ ]:
```
# Creating your own errors
try:
    # age = int(input('Enter your age: '))
    age = ''

    if age < 18:
        raise Exception('Not an adult')
except Exception as error:
    print('A problem occurred \n'
          f'Error: {error}')
```

```
A problem occurred
Error: '<' not supported between instances of 'str' and 'int'
```

0.7.3 Kinds of Exceptions

In Python, there are different kinds of exceptions and we can handle them individually with the `try...except` statement.

```
try:
    # statements
except ExceptionKind:
    #statments
```

One of the most common kind of exceptions is the `NameError`. This is thrown when you use a variable that is not defined

[ ]:
```
try:
    print(rand_var)
except NameError:
    print('You used a variable that is not defined!')
```

```
You used a variable that is not defined!
```

0.8 Variable Scope

0.9 Python Variable Scopes

The accessibility of variable depends on its scope. In Python, there are two variable scopes:

- Global Scope
- Local Scope

0.9.1 Global Scope

A variable that is defined (created) outside a function has a global scope

A global variable can be accessed anywhere in a program

[ ]:
```
name = 'Viola'
# name can be accessed here
print(name)

def greet():
    # name can be accessed here
    print('Hello ' + name)

greet()
```

```
Viola
Hello Viola
```

0.10 Local Scope

A variable that is defined (created) inside a function has a local scope. A local scope variable can only be accessed and used inside the function.

[ ]:
```
def greet():
    local_name = 'Viola'
    print('Hello ' + local_name)
```

```
greet()

try:
    # local_name cannot be accessed here
    print(local_name)
except Exception as e:
    print(e)
```

```
Hello Viola
name 'local_name' is not defined
```

0.10.1 The `global` Keyword

We can force a local variable to be a global variable by using the `global` keyword.

[ ]:
```
# Global Keyword

def add():
    global summ
    number1 = 5
    number2 = 7
    summ = number1 + number2
    return summ

add()

# summ is accessible even outside the function
print(summ)
```

```
12
```

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