Python for intermediate:

Python Tuples:

Tuple

Tuples are used to store multiple items in a single variable.

Tuple is one of 4 built-in data types in Python used to store collections of data, the other 3 are List, Set, and Dictionary, all with different qualities and usage.

A tuple is a collection which is ordered and **unchangeable**.

Tuples are written with round brackets.

Example

Create a Tuple:

```
thistuple = ("apple", "banana", "cherry")
print(thistuple)
```

Tuple Items

Tuple items are ordered, unchangeable, and allow duplicate values.

Tuple items are indexed, the first item has index `[0]`, the second item has index `[1]` etc.

Ordered

When we say that tuples are ordered, it means that the items have a defined order, and that order will not change.

Unchangeable

Tuples are unchangeable, meaning that we cannot change, add or remove items after the tuple has been created.

Allow Duplicates

Since tuples are indexed, they can have items with the same value:

Example

Tuples allow duplicate values:

```
thistuple = ("apple", "banana", "cherry", "apple", "cherry")
print(thistuple)
```

Access Tuple Items

You can access tuple items by referring to the index number, inside square brackets:

Example

Print the second item in the tuple:

```
thistuple = ("apple", "banana", "cherry")
print(thistuple[1])
```

Change Tuple Values

Once a tuple is created, you cannot change its values. Tuples are **unchangeable**, or **immutable** as it also is called.

But there is a workaround. You can convert the tuple into a list, change the list, and convert the list back into a tuple.

Example

Convert the tuple into a list to be able to change it:

```
x = ("apple", "banana", "cherry")
y = list(x)
y[1] = "kiwi"
x = tuple(y)

print(x)
```

Loop Through a Tuple

You can loop through the tuple items by using a `for` loop.

Example

Iterate through the items and print the values:

```
thistuple = ("apple", "banana", "cherry")
for x in thistuple:
  print(x)
```

Join Two Tuples

To join two or more tuples you can use the `+` operator:

Example

Join two tuples:

```
tuple1 = ("a", "b" , "c")
tuple2 = (1, 2, 3)

tuple3 = tuple1 + tuple2
print(tuple3)
```

Multiply Tuples

If you want to multiply the content of a tuple a given number of times, you can use the * operator:

Example

Multiply the fruits tuple by 2:

```
fruits = ("apple", "banana", "cherry")
mytuple = fruits * 2

print(mytuple)
```

Python Conditions and If statements

Python supports the usual logical conditions from mathematics:

- Equals: `a == b`
- Not Equals: `a != b`
- Less than: `a < b`
- Less than or equal to: `a <= b`
- Greater than: `a > b`
- Greater than or equal to: `a >= b`

These conditions can be used in several ways, most commonly in "if statements" and loops.

An "if statement" is written by using the `if` keyword.

Example

If statement:

```
a = 33
b = 200
if b > a:
  print("b is greater than a")
```

In this example we use two variables, `a` and `b`, which are used as part of the if statement to test whether `b` is greater than `a`. As `a` is `33`, and `b` is `200`, we know that 200 is greater than 33, and so we print to screen that "b is greater than a".

Python Loops

Python has two primitive loop commands:

- `while` loops
- `for` loops

The while Loop

With the `while` loop we can execute a set of statements as long as a condition is true.

Example

Print i as long as i is less than 6:

```
i = 1
while i < 6:
  print(i)
  i += 1
```

The `while` loop requires relevant variables to be ready, in this example we need to define an indexing variable, `i`, which we set to 1.

The break Statement

With the `break` statement we can stop the loop even if the while condition is true:

Example

Exit the loop when i is 3:

```
i = 1
while i < 6:
  print(i)
  if i == 3:
```

```
    break
  i += 1
```

Python For Loops

A `for` loop is used for iterating over a sequence (that is either a list, a tuple, a dictionary, a set, or a string).

This is less like the `for` keyword in other programming languages, and works more like an iterator method as found in other object-orientated programming languages.

With the `for` loop we can execute a set of statements, once for each item in a list, tuple, set etc.

Example

Print each fruit in a fruit list:

```
fruits = ["apple", "banana", "cherry"]
for x in fruits:
  print(x)
```

The `for` loop does not require an indexing variable to set beforehand.

Looping Through a String

Even strings are iterable objects, they contain a sequence of characters:

Example

Loop through the letters in the word "banana":

```
for x in "banana":
  print(x)
```

The break Statement

With the `break` statement we can stop the loop before it has looped through all the items:

Example

Exit the loop when `x` is "banana":

```
fruits = ["apple", "banana", "cherry"]
for x in fruits:
  print(x)
  if x == "banana":
    break
```

Python Functions

A function is a block of code which only runs when it is called.

You can pass data, known as parameters, into a function.

A function can return data as a result.

Creating a Function

In Python a function is defined using the `def` keyword:

Example

```
def my_function():
  print("Hello from a function")
```

Calling a Function

To call a function, use the function name followed by parenthesis:

Example

```
def my_function():
  print("Hello from a function")

my_function()
```

Arguments

Information can be passed into functions as arguments.

Arguments are specified after the function name, inside the parentheses. You can add as many arguments as you want, just separate them with a comma.

The following example has a function with one argument (fname). When the function is called, we pass along a first name, which is used inside the function to print the full name:

Example

```
def my_function(fname):
  print(fname + " Refsnes")

my_function("Emil")
my_function("Tobias")
my_function("Linus")
```

What is an Array?

An array is a special variable, which can hold more than one value at a time.

If you have a list of items (a list of car names, for example), storing the cars in single variables could look like this:

```
car1 = "Ford"
car2 = "Volvo"
car3 = "BMW"
```

However, what if you want to loop through the cars and find a specific one? And what if you had not 3 cars, but 300?

The solution is an array!

An array can hold many values under a single name, and you can access the values by referring to an index number.

Access the Elements of an Array

You refer to an array element by referring to the *index number*.

Example

Get the value of the first array item:

```
x = cars[0]
```

Example

Modify the value of the first array item:

```
cars[0] = "Toyota"
```

The Length of an Array

Use the `len()` method to return the length of an array (the number of elements in an array).

Example

Return the number of elements in the `cars` array:

```
x = len(cars)
```

Python Classes/Objects

Python is an object oriented programming language.

Almost everything in Python is an object, with its properties and methods.

A Class is like an object constructor, or a "blueprint" for creating objects.

Create a Class

To create a class, use the keyword `class`:

Example

Create a class named MyClass, with a property named x:

```
class MyClass:
  x = 5
```

Create Object

Now we can use the class named MyClass to create objects:

Example

Create an object named p1, and print the value of x:

```
p1 = MyClass()
print(p1.x)
```

The __init__() Function

The examples above are classes and objects in their simplest form, and are not really useful in real life applications.

To understand the meaning of classes we have to understand the built-in __init__() function.

All classes have a function called __init__(), which is always executed when the class is being initiated.

Use the __init__() function to assign values to object properties, or other operations that are necessary to do when the object is being created:

Example

Create a class named Person, use the __init__() function to assign values for name and age:

```
class Person:
  def __init__(self, name, age):
    self.name = name
    self.age = age

p1 = Person("John", 36)

print(p1.name)
print(p1.age)
```

Python Inheritance

Inheritance allows us to define a class that inherits all the methods and properties from another class.

Parent class is the class being inherited from, also called base class.

Child class is the class that inherits from another class, also called derived class.

Create a Parent Class

Any class can be a parent class, so the syntax is the same as creating any other class:

Example

Create a class named `Person`, with `firstname` and `lastname` properties, and a `printname` method:

```
class Person:
  def __init__(self, fname, lname):
    self.firstname = fname
    self.lastname = lname

  def printname(self):
```

```
    print(self.firstname, self.lastname)

#Use the Person class to create an object, and then execute the printname
method:

x = Person("John", "Doe")
x.printname()
```

Create a Child Class

To create a class that inherits the functionality from another class, send the parent class as a parameter when creating the child class:

Example

Create a class named `Student`, which will inherit the properties and methods from the `Person` class:

```
class Student(Person):
  pass
```

Python Polymorphism

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The word "polymorphism" means "many forms", and in programming it refers to methods/functions/operators with the same name that can be executed on many objects or classes.

Function Polymorphism

An example of a Python function that can be used on different objects is the `len()` function.

String

For strings `len()` returns the number of characters:

Example

```
x = "Hello World!"

print(len(x))
```

Tuple

For tuples `len()` returns the number of items in the tuple:

Example

```
mytuple = ("apple", "banana", "cherry")

print(len(mytuple))
```

Dictionary

For dictionaries `len()` returns the number of key/value pairs in the dictionary:

Example

```
thisdict = {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}

print(len(thisdict))
```

Python Scope

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A variable is only available from inside the region it is created. This is called **scope**.

Local Scope

A variable created inside a function belongs to the *local scope* of that function, and can only be used inside that function.

Example

A variable created inside a function is available inside that function:

```
def myfunc():
  x = 300
  print(x)

myfunc()
```

Function Inside Function

As explained in the example above, the variable `x` is not available outside the function, but it is available for any function inside the function:

Example

The local variable can be accessed from a function within the function:

```
def myfunc():
  x = 300
  def myinnerfunc():
    print(x)
  myinnerfunc()

myfunc()
```

Global Scope

A variable created in the main body of the Python code is a global variable and belongs to the global scope.

Global variables are available from within any scope, global and local.

Example

A variable created outside of a function is global and can be used by anyone:

```
x = 300

def myfunc():
  print(x)

myfunc()

print(x)
```

Naming Variables

If you operate with the same variable name inside and outside of a function, Python will treat them as two separate variables, one available in the global scope (outside the function) and one available in the local scope (inside the function):

Example

The function will print the local `x`, and then the code will print the global `x`:

```
x = 300

def myfunc():
  x = 200
  print(x)

myfunc()

print(x)
```

Global Keyword

If you need to create a global variable, but are stuck in the local scope, you can use the `global` keyword.

The `global` keyword makes the variable global.

Example

If you use the `global` keyword, the variable belongs to the global scope:

```
def myfunc():
  global x
  x = 300

myfunc()

print(x)
```

Also, use the `global` keyword if you want to make a change to a global variable inside a function.

Example

To change the value of a global variable inside a function, refer to the variable by using the `global` keyword:

```
x = 300

def myfunc():
  global x
  x = 200

myfunc()

print(x)
```

Python Datetime

Python Dates

A date in Python is not a data type of its own, but we can import a module named `datetime` to work with dates as date objects.

Example Get your own Python Server

Import the datetime module and display the current date:

```
import datetime
```

```
x = datetime.datetime.now()
print(x)
```

Date Output

When we execute the code from the example above the result will be:

```
2024-03-26 07:52:32.669053
```

The date contains year, month, day, hour, minute, second, and microsecond.

The `datetime` module has many methods to return information about the date object.

Here are a few examples, you will learn more about them later in this chapter:

Example

Return the year and name of weekday:

```
import datetime

x = datetime.datetime.now()

print(x.year)
print(x.strftime("%A"))
```

Creating Date Objects

To create a date, we can use the `datetime()` class (constructor) of the `datetime` module.

The `datetime()` class requires three parameters to create a date: year, month, day.

Example

Create a date object:

```
import datetime

x = datetime.datetime(2020, 5, 17)

print(x)
```

The `datetime()` class also takes parameters for time and timezone (hour, minute, second, microsecond, tzone), but they are optional, and has a default value of `0`, (`None` for timezone).

The strftime() Method

The `datetime` object has a method for formatting date objects into readable strings.

The method is called `strftime()`, and takes one parameter, `format`, to specify the format of the returned string:

Example

Display the name of the month:

```
import datetime

x = datetime.datetime(2018, 6, 1)

print(x.strftime("%B"))
```

A reference of all the legal format codes:

Directive	Description	Example
%a	Weekday, short version	Wed
%A	Weekday, full version	Wednesday

%w	Weekday as a number 0-6, 0 is Sunday	3
%d	Day of month 01-31	31
%b	Month name, short version	Dec
%B	Month name, full version	December
%m	Month as a number 01-12	12
%y	Year, short version, without century	18
%Y	Year, full version	2018
%H	Hour 00-23	17
%I	Hour 00-12	05
%p	AM/PM	PM
%M	Minute 00-59	41

%S	Second 00-59	08
%f	Microsecond 000000-999999	548513
%z	UTC offset	+0100
%Z	Timezone	CST
%j	Day number of year 001-366	365
%U	Week number of year, Sunday as the first day of week, 00-53	52
%W	Week number of year, Monday as the first day of week, 00-53	52
%c	Local version of date and time	Mon Dec 31 17:41 2018
%C	Century	20
%x	Local version of date	12/31/18

%X	Local version of time	17:41:00
%%	A % character	%
%G	ISO 8601 year	2018
%u	ISO 8601 weekday (1-7)	1
%V	ISO 8601 weeknumber (01-53)	01