

Python From Scratch

Python While Loops & For Loops

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Python While Loops

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
```

Note: remember to increment i, or else the loop will continue forever.

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
```

The continue Statement

With the **continue** statement we can stop the current iteration, and continue with the next:

Example

Continue to the next iteration if i is 3:

```
i = 0
while i < 6:
    i += 1
    if i == 3:
        continue
    print(i)
```

The else Statement

With the else statement we can run a block of code once when the condition no longer is true:

Example

Print a message once the condition is false:

```
i = 1
while i < 6:
    print(i)
    i += 1
else:
    print("i is no longer less than 6")
```

Test Yourself With Exercises

Exercise:

Print **i** as long as **i** is less than 6.

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

Python For Loops

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
```

Example

Exit the loop when **x** is "banana", but this time the break comes before the print:

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

The continue Statement

With the **continue** statement we can stop the current iteration of the loop, and continue with the next:

Example

Do not print banana:

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

The range() Function

To loop through a set of code a specified number of times, we can use the `range()` function,

The `range()` function returns a sequence of numbers, starting from 0 by default, and increments by 1 (by default), and ends at a specified number.

Example

Using the `range()` function:

```
for x in range(6):  
    print(x)
```

Note that `range(6)` is not the values of 0 to 6, but the values 0 to 5.

The `range()` function defaults to 0 as a starting value, however it is possible to specify the starting value by adding a parameter: `range(2, 6)`, which means values from 2 to 6 (but not including 6):

Example

Using the start parameter:

```
for x in range(2, 6):  
    print(x)
```

The `range()` function defaults to increment the sequence by 1, however it is possible to specify the increment value by adding a third parameter: `range(2, 30, 3)`:

Example

Increment the sequence with 3 (default is 1):

```
for x in range(2, 30, 3):  
    print(x)
```

Else in For Loop

The `else` keyword in a `for` loop specifies a block of code to be executed when the loop is finished:

Example

Print all numbers from 0 to 5, and print a message when the loop has ended:

```
for x in range(6):  
    print(x)  
else:  
    print("Finally finished!")
```

Note: The `else` block will NOT be executed if the loop is stopped by a `break` statement.

Example

Break the loop when `x` is 3, and see what happens with the `else` block:

```
for x in range(6):  
    if x == 3: break  
    print(x)  
else:  
    print("Finally finished!")
```

Nested Loops

A nested loop is a loop inside a loop.

The "inner loop" will be executed one time for each iteration of the "outer loop":

Example

Print each adjective for every fruit:

```
adj = ["red", "big", "tasty"]
fruits = ["apple", "banana", "cherry"]

for x in adj:
    for y in fruits:
        print(x, y)
```

The pass Statement

for loops cannot be empty, but if you for some reason have a for loop with no content, put in the pass statement to avoid getting an error.

Example

```
for x in [0, 1, 2]:
    pass
```

Test Yourself With Exercises

Exercise:

Loop through the items in the fruits list.

```
fruits = ["apple", "banana", "cherry"]

 x  fruits

    print(x)
```

Python From Scratch

Python Dictionaries

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Python Dictionaries

Dictionary Items

Dictionaries are used to store data values in key:value pairs.

A dictionary is a collection which is ordered*, changeable and do not allow duplicates.

As of Python version 3.7, dictionaries are *ordered*. In Python 3.6 and earlier, dictionaries are *unordered*.

Dictionaries are written with curly brackets, and have keys and values:

Example

Create and print a dictionary:

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

Dictionary Items

Dictionary items are ordered, changeable, and does not allow duplicates.

Dictionary items are presented in key:value pairs, and can be referred to by using the key name.

Example

Print the "brand" value of the dictionary:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
print(thisdict["brand"])
```

Ordered or Unordered?

As of Python version 3.7, dictionaries are *ordered*. In Python 3.6 and earlier, dictionaries are *unordered*.

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

Unordered means that the items does not have a defined order, you cannot refer to an item by using an index.

Changeable

Dictionaries are changeable, meaning that we can change, add or remove items after the dictionary has been created.

Duplicates Not Allowed

Dictionaries cannot have two items with the same key:

Example

Duplicate values will overwrite existing values:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964,  
    "year": 2020  
}  
print(thisdict)
```

Python - Access Dictionary Items

Accessing Items

You can access the items of a dictionary by referring to its key name, inside square brackets:

Example

Get the value of the "model" key:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964,  
    "year": 2020  
}  
x = thisdict["model"]
```

There is also a method called `get()` that will give you the same result:

Example

Get the value of the "model" key:

```
x = thisdict.get("model")
```

Get Keys

The `keys()` method will return a list of all the keys in the dictionary.

Example

Get a list of the keys:

```
x = thisdict.keys()
```

The list of the keys is a view of the dictionary, meaning that any changes done to the dictionary will be reflected in the keys list.

Example

Add a new item to the original dictionary, and see that the keys list gets updated as well:

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
x = car.keys()  
print(x) #before the change  
car["color"] = "white"  
print(x) #after the change
```

Get Values

The `values()` method will return a list of all the values in the dictionary.

Example

Get a list of the values:

```
x = thisdict.values()
```

The list of the values is a *view* of the dictionary, meaning that any changes done to the dictionary will be reflected in the values list.

Example

Make a change in the original dictionary, and see that the values list gets updated as well:

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
x = car.values()  
print(x) #before the change  
car["year"] = 2020  
print(x) #after the change
```

Example

Add a new item to the original dictionary, and see that the values list gets updated as well:

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
x = car.values()  
print(x) #before the change  
car["color"] = "red"  
print(x) #after the change
```


Get Items

The `items()` method will return each item in a dictionary, as tuples in a list.

Example

Get a list of the key:value pairs

```
x = thisdict.items()
```

The returned list is a view of the items of the dictionary, meaning that any changes done to the dictionary will be reflected in the items list.

Example

Make a change in the original dictionary, and see that the items list gets updated as well:

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
x = car.items()  
print(x) #before the change  
car["year"] = 2020  
print(x) #after the change
```

Example

Add a new item to the original dictionary, and see that the items list gets updated as well:

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
x = car.items()  
print(x) #before the change  
car["color"] = "red"  
print(x) #after the change
```

Check if Key Exists

To determine if a specified key is present in a dictionary use the `in` keyword:

Example

Check if "model" is present in the dictionary:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
if "model" in thisdict:  
    print("Yes, 'model' is one of the keys in the thisdict dictionary")
```

Python - Change Dictionary Items

Change Values

You can change the value of a specific item by referring to its key name:

Example

Change the "year" to 2018:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict["year"] = 2018
```

Update Dictionary

The `update()` method will update the dictionary with the items from the given argument.

The argument must be a dictionary, or an iterable object with key:value pairs.

Example

Update the "year" of the car by using the `update()` method:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict.update({"year": 2020})
```

Python - Add Dictionary Items

Adding Items

Adding an item to the dictionary is done by using a new index key and assigning a value to it:

Example

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict["color"] = "red"  
print(thisdict)
```

Update Dictionary

The `update()` method will update the dictionary with the items from a given argument. If the item does not exist, the item will be added.

The argument must be a dictionary, or an iterable object with key:value pairs.

Example

Add a color item to the dictionary by using the `update()` method:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict.update({"color": "red"})
```

Python - Remove Dictionary Items

Removing Items

There are several methods to remove items from a dictionary:

Example

The `pop()` method removes the item with the specified key name:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict.pop("model")  
print(thisdict)
```

Example

The `popitem()` method removes the last inserted item (in versions before 3.7, a random item is removed instead):

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict.popitem()  
print(thisdict)
```

Example

The `del` keyword removes the item with the specified key name:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
del thisdict["model"]  
print(thisdict)
```

Example

The `del` keyword can also delete the dictionary completely:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
del thisdict  
print(thisdict) #this will cause an error because "thisdict" no longer exists.
```

Example

The `clear()` method empties the dictionary:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
thisdict.clear()  
print(thisdict)
```

Python - Loop Dictionaries

Loop Through a Dictionary

You can loop through a dictionary by using a **for** loop.

When looping through a dictionary, the return value are the keys of the dictionary, but there are methods to return the values as well.

Example

Print all key names in the dictionary, one by one:

```
for x in thisdict:  
    print(x)
```

Example

You can also use the **values()** method to return values of a dictionary:

```
for x in thisdict.values():  
    print(x)
```

Example

You can use the **keys()** method to return the keys of a dictionary:

```
for x in thisdict.keys():  
    print(x)
```

Example

Loop through both keys and values, by using the **items()** method:

```
for x, y in thisdict.items():  
    print(x, y)
```

Example

Print all values in the dictionary, one by one:

```
for x in thisdict:  
    print(thisdict[x])
```

Python - Copy Dictionaries

Copy a Dictionary

You cannot copy a dictionary simply by typing **dict2 = dict1**, because: **dict2** will only be a *reference* to **dict1**, and changes made in **dict1** will automatically also be made in **dict2**.

There are ways to make a copy, one way is to use the built-in Dictionary method **copy()**.

Example

Make a copy of a dictionary with the **copy()** method:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
mydict = thisdict.copy()  
print(mydict)
```

Another way to make a copy is to use the built-in function **dict()**.

Example

Make a copy of a dictionary with the **dict()** function:

```
thisdict = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
mydict = dict(thisdict)  
print(mydict)
```

Python - Nested Dictionaries

Nested Dictionaries

A dictionary can contain dictionaries, this is called nested dictionaries.

Example

Create a dictionary that contain three dictionaries:

```
myfamily = {  
    "child1" : {  
        "name" : "Emil",  
        "year" : 2004  
    },  
    "child2" : {  
        "name" : "Tobias",  
        "year" : 2007  
    },  
    "child3" : {  
        "name" : "Linus",  
        "year" : 2011  
    }  
}
```

Or, if you want to add three dictionaries into a new dictionary:

Example

Create three dictionaries, then create one dictionary that will contain the other three dictionaries:

```
child1 = {  
    "name" : "Emil",  
    "year" : 2004  
}  
child2 = {  
    "name" : "Tobias",  
    "year" : 2007  
}  
child3 = {  
    "name" : "Linus",  
    "year" : 2011  
}  
  
myfamily = {  
    "child1" : child1,  
    "child2" : child2,  
    "child3" : child3  
}
```

Python Dictionary Methods

Dictionary Methods

Python has a set of built-in methods that you can use on dictionaries.

Method	Description
<u>clear()</u>	Removes all the elements from the dictionary
<u>copy()</u>	Returns a copy of the dictionary
<u>fromkeys()</u>	Returns a dictionary with the specified keys and value
<u>get()</u>	Returns the value of the specified key
<u>items()</u>	Returns a list containing a tuple for each key value pair
<u>keys()</u>	Returns a list containing the dictionary's keys
<u>pop()</u>	Removes the element with the specified key
<u>popitem()</u>	Removes the last inserted key-value pair
<u>setdefault()</u>	Returns the value of the specified key. If the key does not exist: insert the key, with the specified value
<u>update()</u>	Updates the dictionary with the specified key-value pairs
<u>values()</u>	Returns a list of all the values in the dictionary

Python Dictionary Exercises

Test Yourself With Exercises

Now you have learned a lot about dictionaries, and how to use them in Python.

Are you ready for a test?

Try to insert the missing part to make the code work as expected:

Exercise:

Use the **get** method to print the value of the "model" key of the car dictionary.

```
car = {  
    "brand": "Ford",  
    "model": "Mustang",  
    "year": 1964  
}  
  
print()
```

Python From Scratch

Python If ... Else

Lesson 10 Content

- Python Conditions and If statements
- Indentation
- Elif
- Else
- Short Hand If
- Short Hand If ... Else
- And
- Or
- Not
- Nested If
- The pass Statement
- Python - If ... Else Exercises

Python If ... Else

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".

Indentation

Python relies on indentation (whitespace at the beginning of a line) to define scope in the code. Other programming languages often use curly-brackets for this purpose.

Example

If statement, without indentation (will raise an error):

```
a = 33
b = 200
if b > a:
    print("b is greater than a") # you will get an error
```

Elif

The `elif` keyword is Python's way of saying "if the previous conditions were not true, then try this condition".

Example

```
a = 33
b = 33
if b > a:
    print("b is greater than a")
elif a == b:
    print("a and b are equal")
```

In this example `a` is equal to `b`, so the first condition is not true, but the `elif` condition is true, so we print to screen that "a and b are equal".

Else

The **else** keyword catches anything which isn't caught by the preceding conditions.

Example

```
a = 200
b = 33
if b > a:
    print("b is greater than a")
elif a == b:
    print("a and b are equal")
else:
    print("a is greater than b")
```

In this example **a** is greater than **b**, so the first condition is not true, also the **elif** condition is not true, so we go to the **else** condition and print to screen that "a is greater than b".

You can also have an **else** without the **elif**:

Example

```
a = 200
b = 33
if b > a:
    print("b is greater than a")
else:
    print("b is not greater than a")
```

Short Hand If

If you have only one statement to execute, you can put it on the same line as the if statement.

Example

One line if statement:

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

Short Hand If ... Else

If you have only one statement to execute, one for if, and one for else, you can put it all on the same line:

Example

One line if else statement:

```
a = 2
b = 330
print("A") if a > b else print("B")
```

This technique is known as **Ternary Operators**, or **Conditional Expressions**.

You can also have multiple else statements on the same line:

Example

One line if else statement, with 3 conditions:

```
a = 330
b = 330
print("A") if a > b else print("=") if a == b else print("B")
```

And

The **and** keyword is a logical operator, and is used to combine conditional statements:

Example

Test if **a** is greater than **b**, AND if **c** is greater than **a**:

```
a = 200
b = 33
c = 500
if a > b and c > a:
    print("Both conditions are True")
```

Not

The **not** keyword is a logical operator, and is used to reverse the result of the conditional statement:

Example

Test if **a** is NOT greater than **b**:

```
a = 33
b = 200
if not a > b:
    print("a is NOT greater than b")
```

Nested If

You can have **if** statements inside **if** statements, this is called *nested if* statements.

Example

```
x = 41
if x > 10:
    print("Above ten,")
    if x > 20:
        print("and also above 20!")
    else:
        print("but not above 20.")
```

The pass Statement

if statements cannot be empty, but if you for some reason have an **if** statement with no content, put in the **pass** statement to avoid getting an error.

Example

```
a = 33
b = 200
if b > a:
    pass
```

Test Yourself With Exercises

Exercise:

Print "Hello World" if **a** is greater than **b**.

```
a = 50
b = 10
 a  b 
print("Hello World")
```

Or

The **or** keyword is a logical operator, and is used to combine conditional statements:

Example

Test if **a** is greater than **b**, OR if **a** is greater than **c**:

```
a = 200
b = 33
c = 500
if a > b or a > c:
    print("At least one of the
conditions is True")
```

Python From Scratch

Python Tuples

Lesson 7 Content

- **Python Tuples**

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- **Python - Join Tuples**

- Join Two Tuples
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- **Python - Tuple Methods**

- **Python - Tuple Exercises**

Python Tuples

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

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)
```

Tuple Length

To determine how many items a tuple has, use the **len()** function:

Example

Print the number of items in the tuple:

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

Create Tuple With One Item

To create a tuple with only one item, you have to add a comma after the item, otherwise Python will not recognize it as a tuple.

Example

To create a tuple with only one item, you have to add a comma after the item, otherwise Python will not recognize it as a tuple.

```
thistuple = ("apple",)  
print(type(thistuple))
```

#NOT a tuple

```
thistuple = ("apple")  
print(type(thistuple))
```

Tuple Items - Data Types

Tuple items can be of any data type:

Example

String, int and boolean data types:

```
tuple1 = ("apple", "banana", "cherry")
```

```
tuple2 = (1, 5, 7, 9, 3)
```

```
tuple3 = (True, False, False)
```

A tuple can contain different data types:

Example

A tuple with strings, integers and boolean values:

```
tuple1 = ("abc", 34, True, 40, "male")
```

type()

From Python's perspective, tuples are defined as objects with the data type 'tuple': <class 'tuple'>

Example

What is the data type of a tuple?

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

```
print(type(mytuple))
```

The tuple() Constructor

It is also possible to use the `tuple()` constructor to make a tuple.

Example

Using the tuple() method to make a tuple:

```
thistuple = tuple(("apple", "banana", "cherry")) # note the double round-brackets
```

```
print(thistuple)
```

Python Collections (Arrays)

There are four collection data types in the Python programming language:

- [List](#) is a collection which is ordered and changeable. Allows duplicate members.
- **Tuple** is a collection which is ordered and unchangeable. Allows duplicate members.
- [Set](#) is a collection which is unordered, unchangeable*, and unindexed. No duplicate members.
- [Dictionary](#) is a collection which is ordered** and changeable. No duplicate members.

*Set *items* are unchangeable, but you can remove and/or add items whenever you like.

**As of Python version 3.7, dictionaries are *ordered*. In Python 3.6 and earlier, dictionaries are *unordered*.

When choosing a collection type, it is useful to understand the properties of that type. Choosing the right type for a particular data set could mean retention of meaning, and, it could mean an increase in efficiency or security.

Python - Access Tuple Items

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])
```

Note: The first item has index 0.

Range of Indexes

You can specify a range of indexes by specifying where to start and where to end the range. When specifying a range, the return value will be a new tuple with the specified items.

Example

Return the third, fourth, and fifth item:

```
thistuple = ("apple", "banana", "cherry", "orange", "kiwi", "melon", "mango")
print(thistuple[2:5])
```

Note: The search will start at index 2 (included) and end at index 5 (not included). Remember that the first item has index 0.

By leaving out the start value, the range will start at the first item:

Example

This example returns the items from the beginning to, but NOT included, "kiwi":

```
thistuple = ("apple", "banana", "cherry", "orange",
"kiwi", "melon", "mango")
print(thistuple[:4])
```

Range of Negative Indexes

Specify negative indexes if you want to start the search from the end of the tuple:

Example

This example returns the items from index -4 (included) to index -1 (excluded)

```
thistuple = ("apple", "banana", "cherry", "orange", "kiwi", "melon", "mango")
print(thistuple[-4:-1])
```

Check if Item Exists

To determine if a specified item is present in a tuple use the **in** keyword:

Example

Check if "apple" is present in the tuple:

```
thistuple = ("apple", "banana", "cherry")
if "apple" in thistuple:
    print("Yes, 'apple' is in the fruits tuple")
```

Negative Indexing

Negative indexing means start from the end.

-1 refers to the last item, -2 refers to the second last item etc.

Example

Print the last item of the tuple:

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

By leaving out the end value, the range will go on to the end of the list:

Example

This example returns the items from "cherry" and to the end:

```
thistuple = ("apple", "banana", "cherry",
"orange", "kiwi", "melon", "mango")
print(thistuple[2:])
```

Python - Update Tuples

Tuples are unchangeable, meaning that you cannot change, add, or remove items once the tuple is created.

But there are some workarounds.

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)
```

Add Items

Since tuples are immutable, they do not have a build-in **append()** method, but there are other ways to add items to a tuple.

1. **Convert into a list:** Just like the workaround for *changing* a tuple, you can convert it into a list, add your item(s), and convert it back into a tuple.

Example

Convert the tuple into a list, add "orange", and convert it back into a tuple:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.append("orange")
thistuple = tuple(y)
```

2. **Add tuple to a tuple.** You are allowed to add tuples to tuples, so if you want to add one item, (or many), create a new tuple with the item(s), and add it to the existing tuple:

Example

Create a new tuple with the value "orange", and add that tuple:

```
thistuple = ("apple", "banana", "cherry")
y = ("orange",)
thistuple += y
print(thistuple)
```

Note: When creating a tuple with only one item, remember to include a comma after the item, otherwise it will not be identified as a tuple.

Remove Items

Note: You cannot remove items in a tuple.

Tuples are **unchangeable**, so you cannot remove items from it, but you can use the same workaround as we used for changing and adding tuple items:

Example

Convert the tuple into a list, remove "apple", and convert it back into a tuple:

```
thistuple = ("apple", "banana", "cherry")
y = list(thistuple)
y.remove("apple")
thistuple = tuple(y)
```

Or you can delete the tuple completely:

Example

The **del** keyword can delete the tuple completely:

```
thistuple = ("apple", "banana", "cherry")
del thistuple
print(thistuple) #this will raise an error because
the tuple no longer exists
```

Python - Unpack Tuples

Unpacking a Tuple

When we create a tuple, we normally assign values to it. This is called "packing" a tuple:

Example

Packing a tuple:

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

But, in Python, we are also allowed to extract the values back into variables. This is called "unpacking":

Example

Unpacking a tuple:

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

```
(green, yellow, red) = fruits
```

```
print(green)
```

```
print(yellow)
```

```
print(red)
```

Note: The number of variables must match the number of values in the tuple, if not, you must use an asterisk to collect the remaining values as a list.

Using Asterisk*

If the number of variables is less than the number of values, you can add an * to the variable name and the values will be assigned to the variable as a list:

Example

Assign the rest of the values as a list called "red":

```
fruits = ("apple", "banana", "cherry", "strawberry", "raspberry")
```

```
(green, yellow, *red) = fruits
```

```
print(green)
```

```
print(yellow)
```

```
print(red)
```

If the asterisk is added to another variable name than the last, Python will assign values to the variable until the number of values left matches the number of variables left.

Example

Add a list of values the "tropic" variable:

```
fruits = ("apple", "mango", "papaya", "pineapple", "cherry")
```

```
(green, *tropic, red) = fruits
```

```
print(green)
```

```
print(tropic)
```

```
print(red)
```


Python - Loop Tuples

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)
```

Loop Through the Index Numbers

You can also loop through the tuple items by referring to their index number.

Use the **range()** and **len()** functions to create a suitable iterable.

Example

Print all items by referring to their index number:

```
thistuple = ("apple", "banana", "cherry")
for i in range(len(thistuple)):
    print(thistuple[i])
```

Using a While Loop

You can loop through the tuple items by using a while loop.

Use the **len()** function to determine the length of the tuple, then start at 0 and loop your way through the tuple items by referring to their indexes.

Remember to increase the index by 1 after each iteration.

Example

Print all items, using a **while** loop to go through all the index numbers:

```
thistuple = ("apple", "banana", "cherry")
i = 0
while i < len(thistuple):
    print(thistuple[i])
    i = i + 1
```

Python - Join Tuples

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 - Tuple Methods

Tuple Methods

Python has two built-in methods that you can use on tuples.

Method	Description
<u>count()</u>	Returns the number of times a specified value occurs in a tuple
<u>index()</u>	Searches the tuple for a specified value and returns the position of where it was found

Python - Tuple Exercises

Test Yourself With Exercises

Now you have learned a lot about tuples, and how to use them in Python.

Are you ready for a test?

Try to insert the missing part to make the code work as expected:

Exercise:

Print the first item in the `fruits` tuple.

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

```
print()
```

Python From Scratch

Python Sets

Lesson 8 Content

- Python Sets
- Access Set Items
- Add Set Items
- Remove Set Items
- Loop Sets
- Join Sets
- Python - Set Methods
- Python - Set Exercises

Python Sets

```
myset = {"apple", "banana", "cherry"}
```

Set

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

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

A set is a collection which is unordered, unchangeable*, and unindexed.

*** Note:** Set *items* are unchangeable, but you can remove items and add new items.

Sets are written with curly brackets.

Example

Create a Set:

```
thisset = {"apple", "banana", "cherry"}  
print(thisset)
```

Note: Sets are unordered, so you cannot be sure in which order the items will appear.

Set Items

Set items are unordered, unchangeable, and do not allow duplicate values.

Unordered

Unordered means that the items in a set do not have a defined order.

Set items can appear in a different order every time you use them, and cannot be referred to by index or key.

Unchangeable

Set items are unchangeable, meaning that we cannot change the items after the set has been created.

Once a set is created, you cannot change its items, but you can remove items and add new items.

Duplicates Not Allowed

Sets cannot have two items with the same value.

Example

Duplicate values will be ignored:

```
thisset = {"apple", "banana", "cherry", "apple"}  
  
print(thisset)
```

Python - Access Set Items

Access Items

You cannot access items in a set by referring to an index or a key.

But you can loop through the set items using a **for** loop, or ask if a specified value is present in a set, by using the **in** keyword.

Example

Loop through the set, and print the values:

```
thisset = {"apple", "banana", "cherry"}
```

```
for x in thisset:  
    print(x)
```

Check if "banana" is present in the set:

```
thisset = {"apple", "banana", "cherry"}
```

```
print("banana" in thisset)
```

Python - Add Set Items

Add Items

Once a set is created, you cannot change its items, but you can add new items.

To add one item to a set use the **add()** method.

Example

Add an item to a set, using the **add()** method:

```
thisset = {"apple", "banana", "cherry"}
```

```
thisset.add("orange")
```

```
print(thisset)
```

Add Sets

To add items from another set into the current set, use the **update()** method.

Example

Add elements from **tropical** into **thisset**:

```
thisset = {"apple", "banana", "cherry"}
```

```
tropical = {"pineapple", "mango", "papaya"}
```

```
thisset.update(tropical)
```

```
print(thisset)
```

Add Any Iterable

The object in the **update()** method does not have to be a set, it can be any iterable object (tuples, lists, dictionaries etc.).

Example

Add elements of a list to a set:

```
thisset = {"apple", "banana", "cherry"}
```

```
mylist = ["kiwi", "orange"]
```

```
thisset.update(mylist)
```

```
print(thisset)
```

Python - Remove Set Items

Remove Item

To remove an item in a set, use the `remove()`, or the `discard()` method.

Example

Remove "banana" by using the `remove()` method:

```
thisset = {"apple", "banana", "cherry"}  
thisset.remove("banana")
```

```
print(thisset)
```

Note: If the item to remove does not exist, `remove()` will raise an error.

Example

Remove "banana" by using the `discard()` method:

```
thisset = {"apple", "banana", "cherry"}  
thisset.discard("banana")
```

```
print(thisset)
```

Note: If the item to remove does not exist, `discard()` will **NOT** raise an error.

You can also use the `pop()` method to remove an item, but this method will remove a random item, so you cannot be sure what item that gets removed.

The return value of the `pop()` method is the removed item.

Example

Remove a random item by using the `pop()` method:

```
thisset = {"apple", "banana", "cherry"}  
x = thisset.pop()
```

```
print(x)  
print(thisset)
```

Note: Sets are *unordered*, so when using the `pop()` method, you do not know which item that gets removed.

Example

The `clear()` method empties the set:

```
thisset = {"apple", "banana", "cherry"}  
thisset.clear()
```

```
print(thisset)
```

The `del` keyword will delete the set completely:

```
thisset = {"apple", "banana", "cherry"}  
del thisset
```

```
print(thisset)
```

Python - Loop Sets

Loop Items

You can loop through the set items by using a for loop:

Example

Loop through the set, and print the values:

```
thisset = {"apple", "banana", "cherry" }
```

```
for x in thisset:  
    print(x)
```

Python - Join Sets

Join Two Sets

There are several ways to join two or more sets in Python.

You can use the `union()` method that returns a new set containing all items from both sets, or the `update()` method that inserts all the items from one set into another:

Example

The `union()` method returns a new set with all items from both sets:

```
set1 = {"a", "b" , "c" }
```

```
set2 = {1, 2, 3}
```

```
set3 = set1.union(set2)
```

```
print(set3)
```

Example

The `update()` method inserts the items in set2 into set1:

```
set1 = {"a", "b" , "c" }
```

```
set2 = {1, 2, 3}
```

```
set1.update(set2)
```

```
print(set1)
```

Note: Both `union()` and `update()` will exclude any duplicate items.

Keep ONLY the Duplicates

The `intersection_update()` method will keep only the items that are present in both sets.

Example

Keep the items that exist in both set `x`, and set `y`:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}

x.intersection_update(y)

print(x)
```

The `intersection()` method will return a new set, that only contains the items that are present in both sets.

Example

Return a set that contains the items that exist in both set `x`, and set `y`:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}

z = x.intersection(y)

print(z)
```

Keep All, But NOT the Duplicates

The `symmetric_difference_update()` method will keep only the elements that are NOT present in both sets.

Example

Keep the items that are not present in both sets:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}

x.symmetric_difference_update(y)

print(x)
```

The `symmetric_difference()` method will return a new set, that contains only the elements that are NOT present in both sets.

Example

Return a set that contains all items from both sets, except items that are present in both:

```
x = {"apple", "banana", "cherry"}
y = {"google", "microsoft", "apple"}

z = x.symmetric_difference(y)

print(z)
```


Python - Set Methods

Set Methods

Python has a set of built-in methods that you can use on sets.

Method	Description
add()	Adds an element to the set
clear()	Removes all the elements from the set
copy()	Returns a copy of the set
difference()	Returns a set containing the difference between two or more sets
difference_update()	Removes the items in this set that are also included in another, specified set
discard()	Remove the specified item
intersection()	Returns a set, that is the intersection of two other sets
intersection_update()	Removes the items in this set that are not present in other, specified set(s)
isdisjoint()	Returns whether two sets have a intersection or not
issubset()	Returns whether another set contains this set or not
issuperset()	Returns whether this set contains another set or not
pop()	Removes an element from the set
remove()	Removes the specified element
symmetric_difference()	Returns a set with the symmetric differences of two sets
symmetric_difference_update()	inserts the symmetric differences from this set and another
union()	Return a set containing the union of sets
update()	Update the set with the union of this set and others

Python - Set Exercises

Test Yourself With Exercises

Now you have learned a lot about sets, and how to use them in Python.

Are you ready for a test?

Try to insert the missing part to make the code work as expected:

Exercise:

Check if "apple" is present in the **fruits** set.

```
fruits = {"apple", "banana", "cherry"}
```

```
if "apple"  fruits:
```

```
    print("Yes, apple is a fruit!")
```