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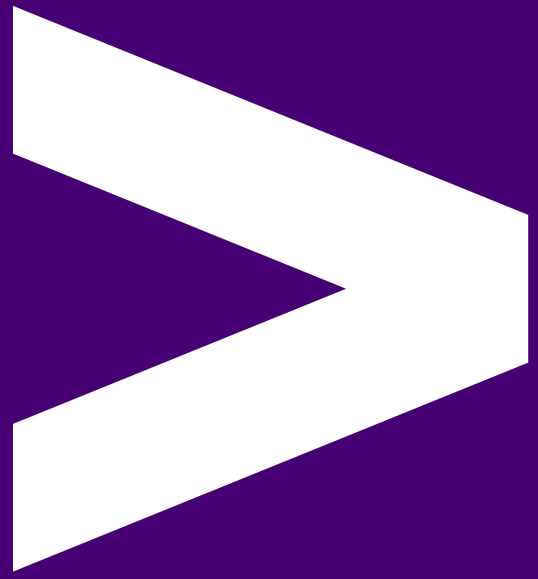
Python 2



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Overview

- Loops
- Dictionaries
- Exceptions
- Functions
- Googling!

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Learning Objectives

- Understand and implement loops
- Understand and implement dictionaries
- Understand what exceptions are and how to handle them
- Understand and implement functions
- Understand good Googling practices

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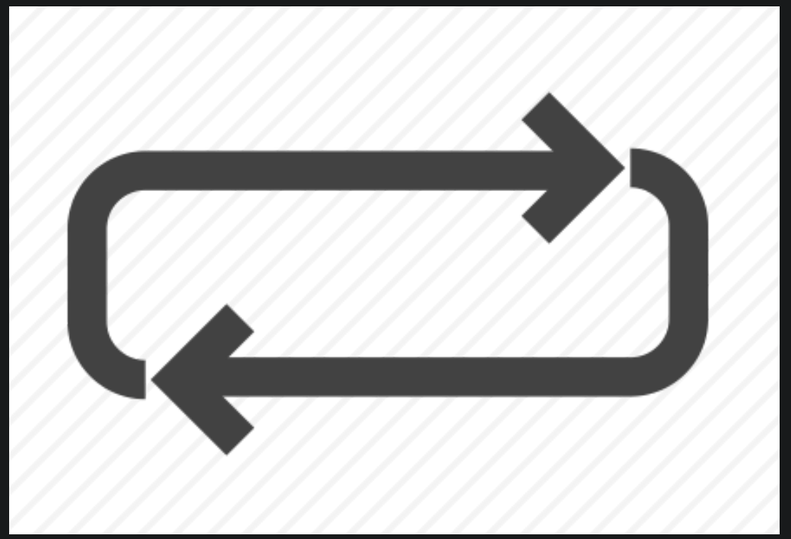
Loops



Loops

- Programming construct that allow us to iterate over a sequence of values
- Execute the same block of code a number of times
- Python has two built-in loop commands: for and while

For Loops

Used when you want to repeat a block of code a fixed number of times:

```
for x in [0,1,2]:
  print(f'current number is {x}')

# Output
# current number is 0
# current number is 1
# current number is 2
```

While Loops

We can execute a block of code as long as a condition is true:

```
i = 0

while i < 5:
  print(i)
  i += 1

# Output will be 0, 1, 2, 3, 4
```

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Emoji Check:

Do you feel you understand Loops? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Range

```
for x in range(0, 3):
  print(f'current number is {x}')
```

Returns a sequence of numbers in the specified range, which increments by 1 each time (by default).

Nested Loops

You can nest as many loops inside one another as you like:

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

for adj in adjectives:
  for fruit in fruits:
    print(adj, fruit)
```

Break Keyword

With the break keyword we can stop the loop before it has looped through all of the items

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

for fruit in fruits:
  print(fruit)
  if fruit == "banana":
    break
```

Continue Keyword

With the continue keyword we can end the current iteration of the loop early and move to the next

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

for fruit in fruits:
  if fruit == "banana":
    continue
  print(fruit)
```

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Emoji Check:

Do you feel you can use Loop keywords now? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

For Else

You can also use the keyword else to execute code after the loop is finished

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

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Quiz Time! 🤓

Given the below code, what are the range of values that will be printed?

```
for x in range(0, 5):
  print (x)
```

1. 0-4
2. 0-5
3. 1-4
4. 1-5

Answer: 1

Given the below code, what are the range of values that will be printed?

```
i = 0
while i < 5:
  i += 1
  print(i)
```

1. 0–5
2. 1–5
3. 0–4
4. 1–4

Answer: 2

Exercise prep

> Instructor to give out the zip file of exercises for `python-2`
>
> Everyone please unzip the file

Exercise time

> From the zip, you should have a file `exercises/loop-exercises.md`
>
> Let's all do the exercises included in this file

Emoji Check:

How did the exercises go? Are Loops making more sense now?

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Dictionaries

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Dictionaries

- A collection of values, similar to a list
- Used to store values as key-value pairs

```
car = {
  # key    # value
  'make': 'Jaguar',
  'model': 'XF',
  'year' : 2019,
  'isNew': False
}

print (car['make'], car['year'])
# Jaguar, 2019
```

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Dictionary Keys & Values

Keys

We use keys to unlock values, the most common key types are strings and numbers:

```
d = {
  'a': 'b',
  1: 'c',
  0.75: 'test',
  'd': [ 1, 2, 3 ],
  'e': { 'f': 'g' }
}
```

Values

Values can be pretty much anything! They can even be another dictionary.

Dictionary Exceptions

If you try to access a value with a key that does not exist, an error will be raised

```
d = {'a': 1, 'b': 2}
>>> d['c']

Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
KeyError: 'c'
```

Dictionary Mutations

Add an entry:

```
car['colour'] = 'Red'
```

Update an entry:

```
car['colour'] = 'Blue'
```

Delete an entry:

```
del car['colour']
```

Emoji Check:

Do you feel you understand Dictionaries? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Built-In Functions

Python dictionaries have some built-in functions to help us work with them.

> Can you think of any examples?

Built-In Functions

What might this do?

```
>>> car.get(x)
```

Returns the value for a key if it exists.

How about this code?

```
>>> car.items()
```

Returns a list of the key-value pairs.

And this one?

```
>>> car.clear()
```

Empties a dictionary

Built-In Functions

```
>>> car.keys()
```

Returns a list of keys

```
>>> car.values()
```

Returns a list of values

Other useful things

```
# check if key exists
>>> 'colour' in car
True

# count how many keys there are
>>> len(car)
6
```

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Quiz Time! 🤓

Given the below code, how would you access the value of the fruit's colour?

```
fruit = {
  'type': 'apple',
  'color': 'green'
}
```

1. `fruit['type']`
2. `color['green']`
3. `fruit['color']`
4. `fruit['color']['green']`

Answer: `3`

Dictionary vs List

✅ Both mutable

✅ Both dynamic (can change in size)

✅ Can be nested

❌ List elements are accessed by position in list (indexed), dictionary elements are accessed by their keys

Dictionary vs List

When might you use a dictionary versus a list?

Scenario: You want to store the first name of every student in a class

- List

Scenario: You need to store detailed information about a specific vehicle, including make, model and colour

- Dictionary

Scenario: You need to store information about a number of different vehicles, and be able to look up each of those sets of information using the vehicle's number-plate

- Dictionary of dictionaries

Emoji Check:

Do you feel you understand Dictionaries vs Lists? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Exercise time

> From the same Exercises zip, you should have a file `exercises/dictionary-exercises.md`
>
> Let's all do the exercises included in this file

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Emoji Check:

How did the exercises go? Are Dictionaries making more sense now?

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
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Exceptions

Example

```
>>> numbers = [1,3,5,7,9]
>>> numbers[5]

Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
IndexError: list index out of range
```

What happened?

Exceptions

An exception is an error from which your application cannot recover.

Exceptions are thrown when something unexpected happens in your program.

> Can you think of any examples?

Types of Exceptions

Trying to change the type of some variable when it doesn't make sense, e.g. casting a string to a integer

```
>>> '2' + 2

TypeError: can only concatenate str (not "int") to str
```

Getting the sixth item from a list that only has 5 items

```
>>> numbers = [1,3,5,7,9]
>>> numbers[5]

IndexError: list index out of range
```

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Types of Exceptions

Opening a file that doesn't exist

```
>>> f = open('does_not_exist.py')

FileNotFoundError:
  [Errno 2] No such file or directory: 'does_not_exist.py'
```

Dividing by zero:

```
>>> 1 / 0

ZeroDivisionError: division by zero
```

And more!

Handling Exceptions

Python has a built-in construct called `try-except` to handle exceptions.

The code we would normally run is placed inside the `try` block.

If an exception is raised inside the block, it immediately jumped to the `except` block to handle the exception.

```
try:
  x = 1 / 0
except:
  print("You can't do that!")
  print("We can still run the program after this though")

...
# More code carries on
```

Emoji Check:

Do you feel you understand Exceptions? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
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A few pointers about exceptions

1. Minimise the amount of code you put in your exceptions, i.e. no try-except around your entire app, just in case.
2. Exceptions should be used sparingly, as they are no substitute for adequate input handling
3. When handling an exception, print out helpful messages explaining what happened and why in detail

Syntax errors vs Exceptions

Syntax errors occur when Python detects a statement has been written incorrectly:

```
>>> print('hello'))
  File "<stdin>", line 1
    print('hello'))
                  ^
SyntaxError: unmatched ')'
```

These are different to exceptions. Exceptions happen when syntactically correct code fails.

Other types of 'Error' ?

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Quiz Time! 🤓

True or false: this code snippet will raise an exception.

```
stuff = [1, 2, 3, 4, 5, 6, 7, 8, 9]

try:
    for x in stuff:
        print (stuff[x + 1])
except:
    print ('Something went wrong!')
```

Answer: True

Exceptions as Variables

Inside the `except` block, you can contain the details of the exception in a variable:

```
try:
  x = 1 / 0
except Exception as e:
  print(e)
```

```
$ division by zero
```

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Emoji Check:

Do you feel you could use Exceptions? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Exercise

1. Write a small program that will purposefully throw an exception, causing your program to crash
2. Update it to include exception handling with a `try-except` block
3. Update it to print the error generated by the exception
4. Add an additional code path in your application which can generate another exception of of a different type and handle it separately if it occurs
5. Add functionality to print out the stack trace for an exception to see where in code it occurs (Hint: `traceback`)

Emoji Check:

How did the exercises go? Are Exceptions making more sense now?

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
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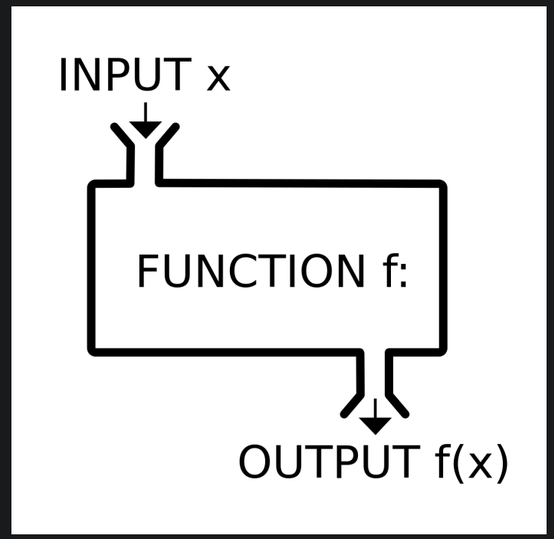
Functions



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Functions

- Allow you to break up your program into a number of reusable chunks
- Functions work on variables that you pass it, which are known as arguments
- A function may take zero or more arguments
- Defined by the def keyword

```
# With arguments
def add_numbers(a, b):
  return a + b

# Without arguments
def get_name():
  return 'Alice'
```

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Return Statement

You may have noticed the return keyword:

```
def get_name():
  return 'Alice'

name = get_name()
print(name) # Alice
```

- A function always has the option to return a value, but it doesn't have to return anything
- You can either use the `return` keyword without a value, or omit entirely

Calling a Function

Simply use the name of the function!

```
def add_numbers(a, b):
  print (a + b)

add_numbers(1, 2)
# 3
```

Function Arguments

- Information can be passed to a function as arguments
- Arguments are the variable names specified after the function name
- You can have as many as you need

```
def my_function(a, b, c):
  print(a, b, c)

my_function('hello', 'world', '!')
# hello world !
```

Emoji Check:

Do you feel you understand Functions? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Default Arguments

- You can provide a default value for an argument to make it optional
- Also known as keyword arguments

```
def my_function(a, b, c='!'):
  print(a, b, c)

my_function('hello', 'world')
# hello world !

my_function('hello', 'world', '?')
# hello world ?
```

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Quiz Time! 🤓

Given the below code, how would you call this function and store the result in a variable?

```
def add_numbers(a, b, c):
    return a + b + c
```

1. `add_numbers()`
2. `add_numbers(1, 2, 3)`
3. `result = add_numbers()`
4. `result = add_numbers(1, 2, 3)`

Answer: `4`

Named Arguments

You can also use the names of arguments when calling a function:

```
def fave_food(person, food):
  print(f"{person}'s favourite food is {food}")

fave_food(food = "Curry", person = "Mark")
```

Note how we can specify these in any order!

Arbitrary Arguments

You can create a function with any number of arguments using `*args`. Effectively, `*args` creates a list of arguments for you inside the function:

```
def my_function(*people):
  for person in people:
    print(person)

my_function("Alice", "Bob", "John")
```

> *args are useful when you don't know how many arguments will be passed.

Arbitrary Named Arguments

There is a similar keyword `**kwargs` which accepts named arguments, It stands for "key Word Arguments".

Inside your function you get a dictionary of key-value arguments:

```
def describe(**kwargs):
  # Iterating over the Python kwargs dictionary
  for key_value_pair in kwargs.items():
    print(key_value_pair)

describe(name="Dora", type="Cat", hungry="Always")
```

Ordering of Arguments

Ordering of arguments is important in Python. The correct order is:

1. Standard arguments
2. `*args` arguments
3. `**kwargs` arguments

```
def my_function(a, b, *args, **kwargs)
```

```
def my_function(a, b, c='default', *args, **kwargs)
```

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Emoji Check:

Do you feel you understand Function Arguments? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Exercise time

> From the same Exercises zip, you should have a file `exercises/function-exercises.md`
>
> Let's all do the exercises included in this file
>
> If you finish early, there's also two bonus exercises at the end of the file

Google-fu (or your search engine of choice)

Learning how to learn and adapt is just as important as remembering everything we're throwing at you here!

The best tool for this is Google, and knowing what to Google and how to interpret results is valuable

Worked example

I, as a developer, want to know how to remove the item `Tractor` from the following list, but I don't know how

```
luxury_cars = ['Ferrari', 'Lamborghini', 'Tractor', 'Porsche']
```

...what search terms might we use to get useful results?

Errors!

Knowing how to Google is especially important for errors! Let's say I've run the following code and got the following error output:

```
func = "ThisIsNotAFunc"
print(func())
```

```
TypeError: 'str' object is not callable
```

...what search terms might we use to get useful results?

Emoji Check:

How did the exercises go? Are Functions making more sense now?

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😄 Yes, enough to start working on it collaboratively

Terms and Definitions - recap

Loop: A programming construct that allow us to iterate over a sequence of values

Dictionary: A collection of key-value pairs, where the keys are usually text, used to access the values

Function: Allow you to break up your program into a number of reusable chunks, with each performing a particular task

Argument: A value that must be provided to the function

Iteration: The repetition of a process in order to generate an outcome; It is used both to mean iterating over a list to do calculations, and iterating our code (doing improvements)

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Further Reading

Loops

Dictionaries

Functions

*args and **kwargs explained

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Overview - recap

- Loops
- Dictionaries
- Exceptions
- Functions
- Googling!

Learning Objectives - recap

- Understand and implement loops
- Understand and implement dictionaries
- Understand what exceptions are and how to handle them
- Understand and implement functions
- Understand good Googling practices

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Emoji Check:

On a high level, do you think you understand the main concepts of this session? Say so if not!

1. 😢 Haven't a clue, please help!
2. 😕 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😀 Yes, enough to start working on it collaboratively