Valnaos
IT Training & Consulting

ALTRAN
.ALTRAN EDUCATION SERVICES

Python 3 Beginner

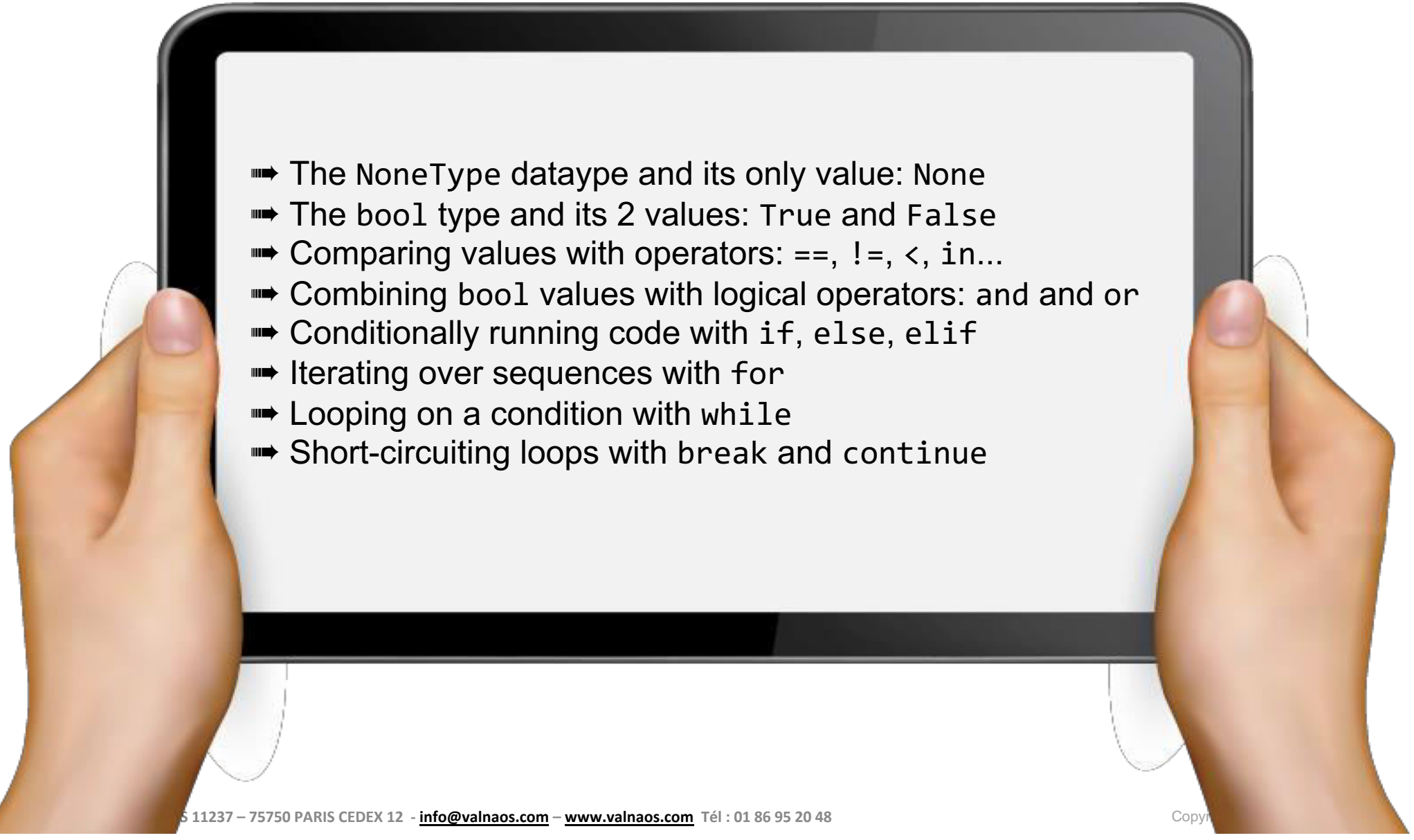
Chapter **00**

Previously, on Python 3 Beginner…

release 1.0.0

37/39 Avenue Ledru Rollin – CS 11237 – 75750 PARIS CEDEX 12 - info@valnaos.com – www.valnaos.com Tél : 01 86 95 20 48

What we saw last time



Q&A

Where? Who?

Class Material

➠ GitHub: https://github.com/cstar-industries/python-3-beginner

Instructor

➠ Charles Francoise <charles@cstar.io>

Session Objectives

At the end of this session, you will be able to:

- Master the `list` type
- Use `str` to its full potential
- Use and recognize the `tuple` type for immutable ordered lists
- Use the `set` type to perform efficient inclusion tests and set arithmetic
- Use and master the `dict` type to associate arbitrary keys and values
- Wield Python superpowers like list comprehensions and more...

Session Syllabus

Chapter	Subject	Start	End	Total Time (in hours)
00	Previously on Python 3 Beginner…	14:00	14:30	00:30
01	More about `list`	14:30	15:00	00:30
02	Other sequence types: `str` – `tuple` – `set`	15:00	15:45	00:45
	Coffee Break	*15:45*	*16:00*	*00:15*
03	Associative container: `dict`	16:00	16:30	00:30
04	Mastering container types	16:30	17:00	00:30
	Coffee Break	*17:00*	*17:15*	*00:15*
	Workshop	17:15	18:00	00:45
	Total			**04:00**

Valnaos
IT Training & Consulting

ALTRAN
.ALTRAN EDUCATION SERVICES

Python 3 Beginner

Chapter **01**

More about `list`

release 1.0.0

`list`: what we already know

➠ Test inclusion with `in` and `not in`

```
'toto' in [0, 3.33, False, 'toto', []]
```

```
True
```

➠ Extend with + and *

```
[1, 2] + [3]
```

```
[1, 2, 3]
```

```
3 * [1, 2]
```

```
[1, 2, 1, 2, 1, 2]
```

`list`: what we already know

➠ Get list length with `len()`

```
len(['Hello', 'World', '!'])
```

```
3
```

➠ Extract items with `[]`

```
l = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
print(l[2])
print(l[:2])
print(l[1:8:2])
```

```
2
[0, 1]
[1, 3, 5, 7]
```

`list`: methods and built-in functions

➠ Find the first occurrence of an item: `l.index`

```
l = ['H', 'e', 'l', 'l', 'o']
l.index('l')
```

```
2
```

➠ Return the number of occurrences of an item: `l.count`

```
print(l.count('l'))
print(l.count('J'))
```

```
2
0
```

`list`: methods and built-in functions

➠ Get the largest and smallest items: `max` and `min`

```
l = [9, 2, 8, 5, 0, 1, 4, 7, 6, 3]
print(min(l), max(l))
```

```
0 9
```

➠ Add all items together: `sum`

```
sum([1, 2, 5, 10])
```

```
18
```

Let's write some code!

```
from random import shuffle

l = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
shuffle(l)

print(l)
print(f'max value: {max(l)}, min value: {min(l)}')
```

```
[3, 6, 0, 1, 5, 7, 8, 9, 2, 4]
max value: 9, min value: 0
```

`list` is a **mutable** object

➠ Replace items at indexes or ranges

```
l = [0, 1, 2, 3, 4]
l[1] = 'toto'
print(l)
```

```
[0, 'toto', 2, 3, 4]
```

```
l[2:4] = [8, '8', 'eight']
print(l)
```

```
[0, 'toto', 8, '8', 'eight', 4]
```

```
l[1:5] = []
print(l)
```

```
[0, 4]
```

`list` is a **mutable** object

➠ Delete items at indexes or ranges

```
l = [0, 1, 2, 3, 4]
del l[1]
print(l)
```

```
[0, 2, 3, 4]
```

```
del l[:2]
print(l)
```

```
[3, 4]
```

`list` is a **mutable** object

➠ Add and remove items at the end of the list

```
l = [0, 1, 2, 3, 4]
l.append(5)
print(l)
```

```
[0, 1, 2, 3, 4, 5]
```

```
a = l.pop()
print(l)
print(a)
```

```
[0, 1, 2, 3, 4]
5
```

`list` is a **mutable** object

➠ Add and remove items at an arbitrary position

```
l = [0, 1, 2, 3, 4]
l.insert(1, 5)
print(l)
```

```
[0, 5, 1, 2, 3, 4]
```

```
a = l.pop(3)
print(l)
print(a)
```

```
[0, 5, 1, 3, 4]
2
```

`list` is a **mutable** object

➠ Remove the first occurrence of an item

```
l = ['H', 'e', 'l', 'l', 'o']
l.remove('l')
print(l)
```

```
['H', 'e', 'l', 'o']
```

➠ Copy a list

```
a = [0, 1, 2, 3, 4]
b = a.copy()
print(b)
print(a is b)
```

```
[0, 1, 2, 3, 4]
False
```

`list` is a **mutable** object

➠ Remove all elements from a list

```
l = ['H', 'e', 'l', 'l', 'o']
print(l)

l.clear()
print(l)
```

```
['H', 'e', 'l', 'l', 'o']
[]
```

Let's write some code!

```
a = [0, 1, 2, 3, 4, 5]
b = a.copy()

print(a)
print(b)
print(a == b)
print(a is b)
```

```
[0, 1, 2, 3, 4, 5]
[0, 1, 2, 3, 4, 5]
True
False
```

⚠ Mutability can be *dangerous* ⚠

➠ If an object is mutable, changing it in one place also changes in in another.

```
a = [0, 1, 2, 3, 4]
b = a

last_item_of_b = b.pop()
print(b)

print(a)
```

```
[0, 1, 2, 3]
[0, 1, 2, 3]
```

⚠ Mutability can be *dangerous* ⚠

➠ Whenever possible, use `copy` to preserve the original object.

```
a = ['Hello', 'hello', 'hi']
b = a.copy()

print(a == b)
print(a is b)

a.pop()
print(b)
```

```
True
False
['Hello', 'hello', 'hi']
```

⚠ Mutability can be *dangerous* ⚠

➠ Beware! `copy` is *shallow*

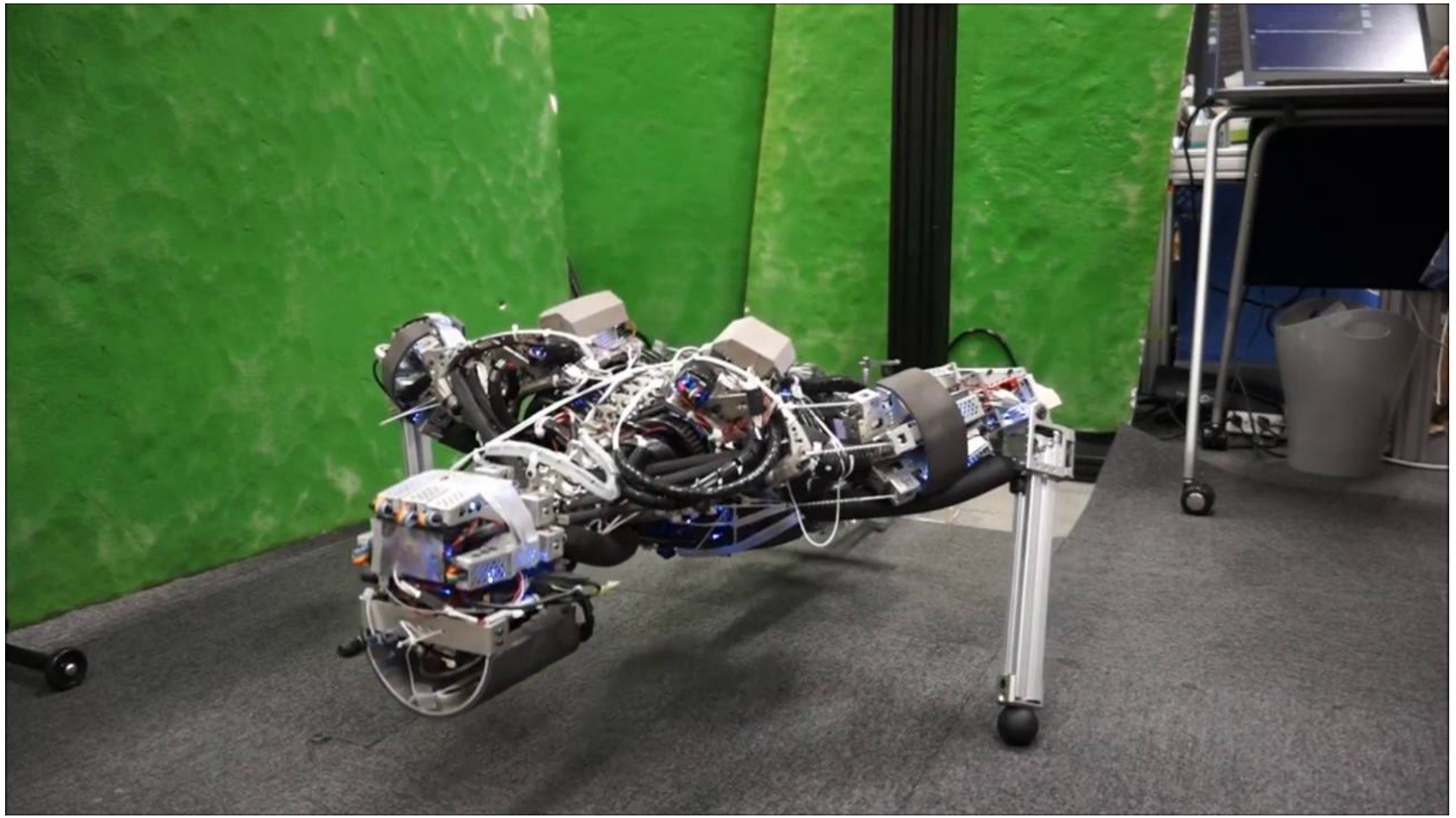
```
a = [['a', 'b'], ['a', 'c'], ['b', 'c']]
b = a.copy()

print(a == b)
print(a is b)
print(a[0] is b[0])

b[0][0] = None
print(a)
```

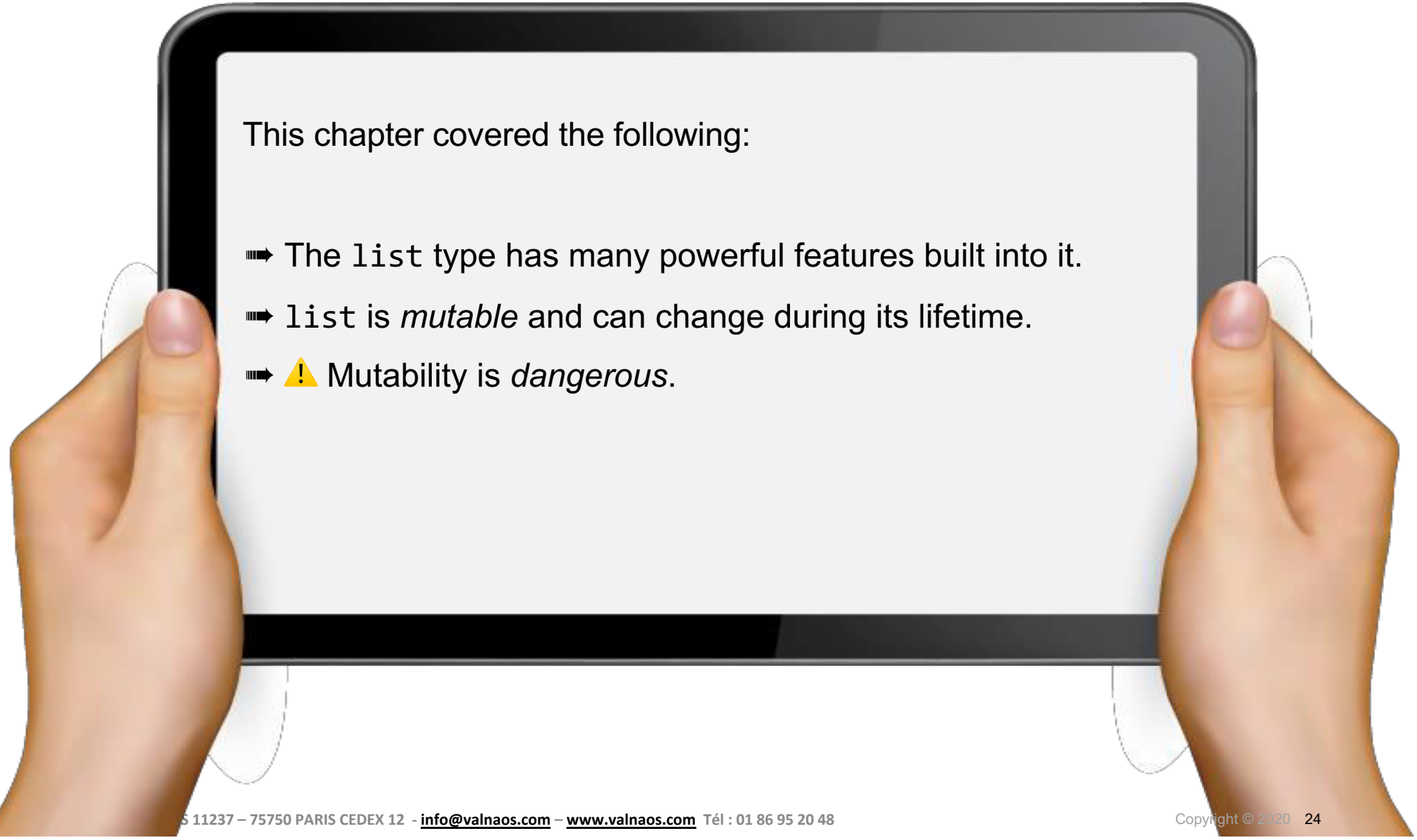
```
True
False
True
[[None, 'b'], ['a', 'c'], ['b', 'c']]
```

Workout Time!



Chapter 1 Exercises link

Chapter Summary



This chapter covered the following:

- The `list` type has many powerful features built into it.
- `list` is *mutable* and can change during its lifetime.
- ⚠ Mutability is *dangerous*.

Python 3 Beginner

Chapter **02**

More sequence datatypes

release 1.0.0

An immutable sequence type: `tuple`

- A `tuple` is very `similar` to a list, but it is *immutable*
- It is most often written as a comma-separated series of values between parentheses

```
t = (0, 1, 2)
print(t)
print(type(t))
```

```
(0, 1, 2)
tuple
```

An immutable sequence type: `tuple`

➠ Parentheses are optional

```
t = 0, 1, 2
print(t)
print(type(t))
```

```
(0, 1, 2)
tuple
```

An immutable sequence type: `tuple`

➠ Use a comma for a single-item `tuple`

```
t = (0,)
print(t)
```

```
(0,)
```

➠ Use empty parentheses for an empty `tuple`

```
t = ()
print(t)
```

```
()
```

An immutable sequence type: `tuple`

➠ `tuples` can be used to destructure other sequences at assignment

```
(a, b, c) = range(3)
print(a)
print(b)
print(c)
```

```
0
1
2
```

➠ You've already met `tuple` before...

```
for i, x in enumerate(l):
    ...
```

`tuple` is like `list`

➠ Iteration with `for`

```
for x in t:
    ...
```

➠ Indexation with `[]`

```
t[0]
t[-2:]
```

➠ Inclusion with `in`

```
0 in (0, 1, 2)
1138 not in (3,)
```

`tuple` is *un*like `list`

➠ `tuple` is immutable

```
t = (0, 1, 2)
t[0] = 'toto'
```

```
TypeError: 'tuple' object does not support item assignment
```

```
t.pop()
```

```
AttributeError: 'tuple' object has no attribute 'pop'
```

Let's write some code!

```
t = (0, 1, 2)
print(t)
print(type(t))
```

```
(0, 1, 2)
<class 'tuple'>
```

More about `str`

➠ Match prefix and suffix

```
filename = 'sensor_data.csv'
print(filename.startswith('Sens'))
print(filename.endswith('.csv'))
```

```
True
False
```

➠ Find occurrence of a substring inside a string

```
print(filename.find('data'))
print(filename.find('hello'))
```

```
7
-1
```

More about `str`

- Quickly validate the content of a string
  - `isalpha`: checks if all characters are letters
  - `isnumeric`, `isdigit`, `isdecimal`: checks if all characters are numeric, digits, decimal digits, respectively
  - `isalnum`: checks if all characters are either letter or numeric
  - `isupper`, `islower`: checks if all character are upper or lowercase
  - `isspace`: checks if all characters are whitespace

More about `str`

```
s = 'hello'
print(s.isalpha())
print(s.isnumeric())
print(s.isalnum())
print(s.isupper())
print(s.islower())
```

```
True
False
True
False
True
```

More about `str`

➠ Split strings into a list of strings, separated by a delimiter

```
languages = 'C,C++,Java,Python,Go'
data.split(',')
```

```
['C', 'C++', 'Java', 'Python', 'Go']
```

➠ Join a list of strings using a delimiter

```
languages = '\n'.join(languages)
print(languages)
```

```
C
C++
Java
Python
Go
```

More about `str`

➠ Replace all occurrences of a substring in a string by another

```
languages = 'C,C++,Java,Python,Go'
languages.replace(',', '\n')
print(languages)
```

```
C
C++
Java
Python
Go
```

Let's write some code!

```
filename = 'toto.txt'
print(filename.startswith('hello'))
print(filename.endswith('.txt'))
```

```
False
True
```

set

➠ An **unordered** set of **distinct** objects

```
s = set([1, 2, 3])
print(s)
```

```
{1, 2, 3}
```

```
s1 = {3, 2, 1}
print(s1)
print(s == s1)
```

```
{1, 2, 3}
True
```

```
print({1, 1, 1, 1, 1, 1})
```

```
{1}
```

set

➠ Test inclusion

```
s = {1, 2, 3}
print(1 in s)
print(0 in s)
```

```
True
False
```

➠ No indexing

```
s[0]
```

```
TypeError: 'set' object does not support indexing
```

set

➠ Iteration

```
s = set('Python')
for c in s:
    print(c)
```

```
P
t
o
y
n
h
```

`set` is mutable

➠ add an item to the set

```
s = set()
s.add(1)
print(s)
```

```
{1}
```

```
s = {1, 2, 3}
s.add(1)
print(s)
```

```
{1, 2, 3}
```

`set` is mutable

➠ remove an item from the set

```
s = {1, 2, 3}
s.remove(1)
print(s)
```

```
{2, 3}
```

```
s.remove('a')
```

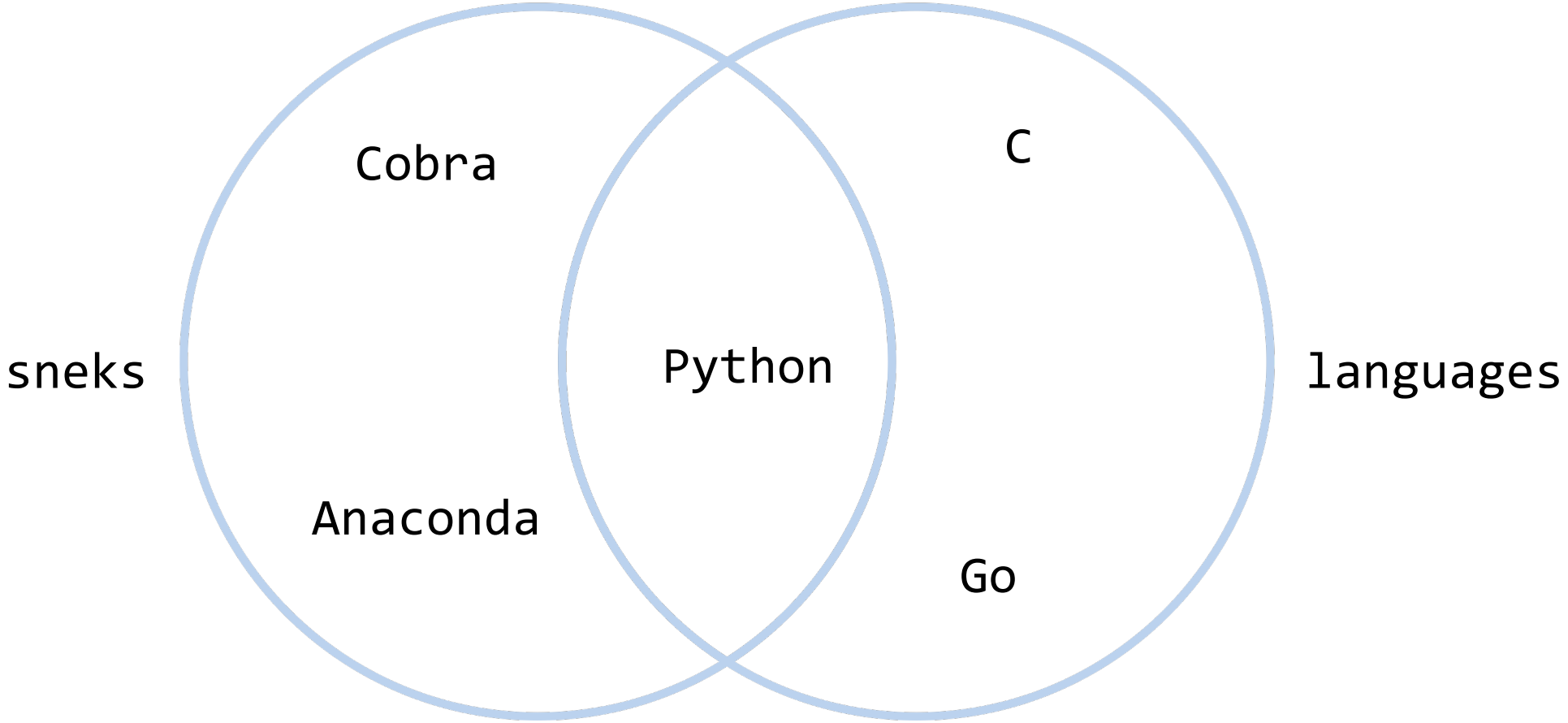
```
KeyError: 'a'
```

➠ remove all items from the set

```
s.clear()
print(s)
```

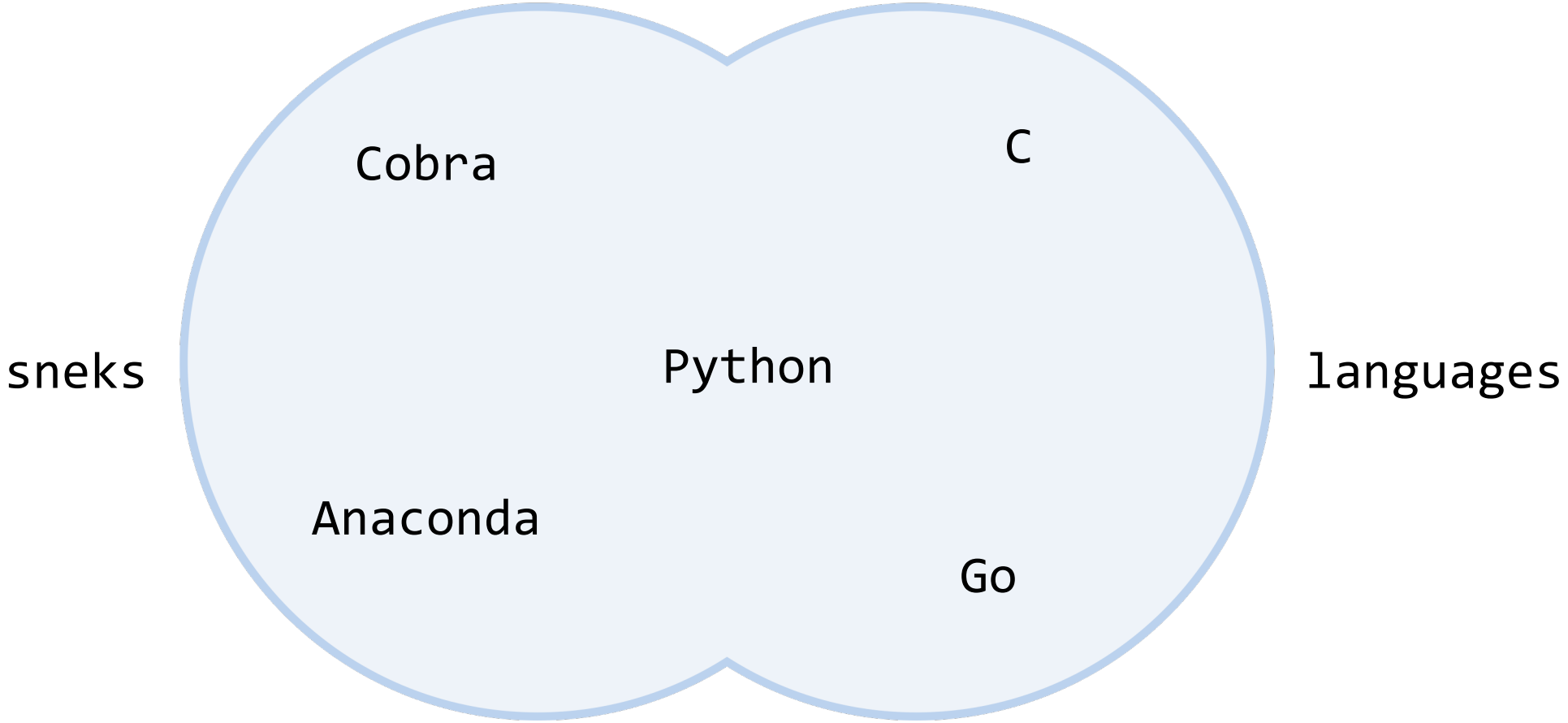
```
set()
```

Set arithmetic




```
sneks = {'Python', 'Cobra', 'Anaconda'}
languages = {'Python', 'C', 'Go'}
```

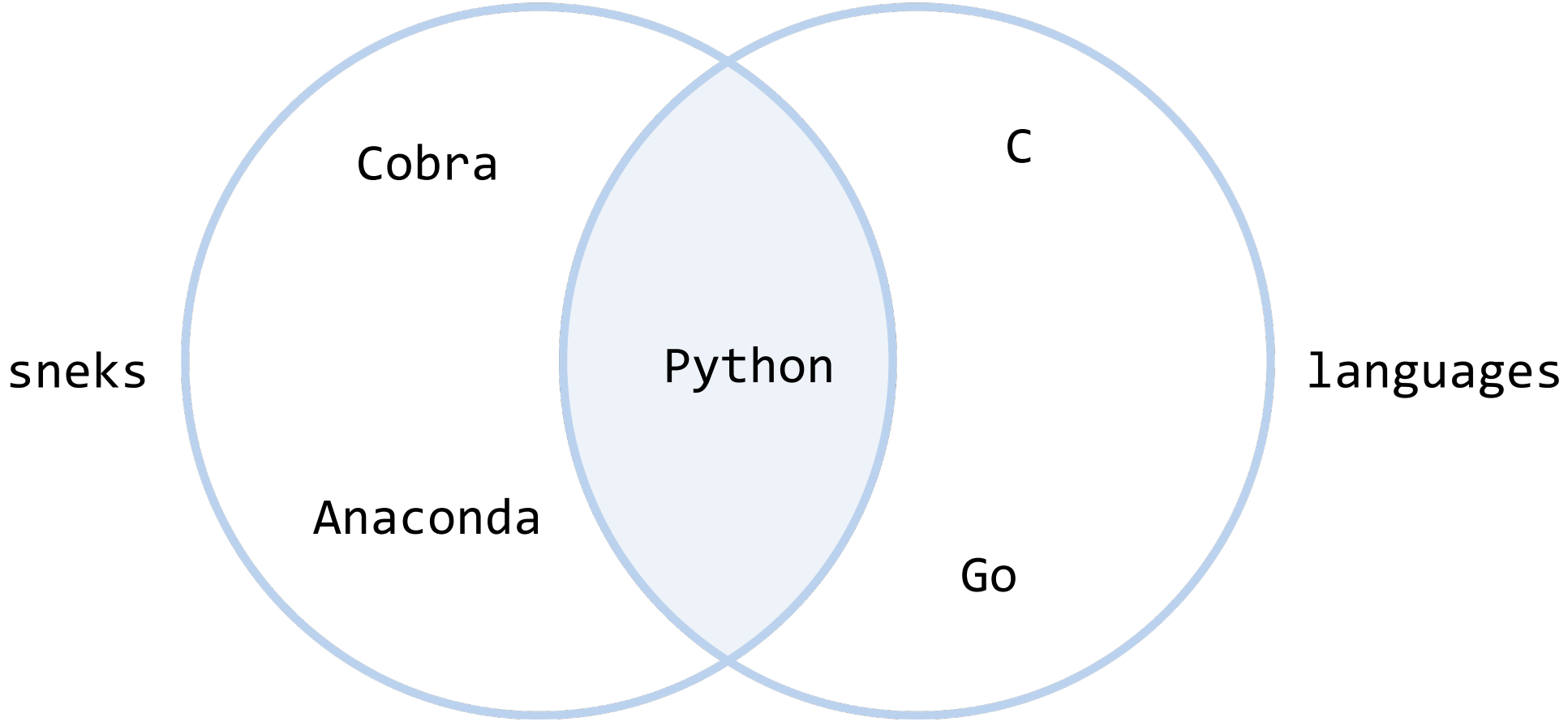
Union "OR"




```
sneks | languages
```

```
{'Cobra', 'Anaconda', 'Go', 'C', 'Python'}
```

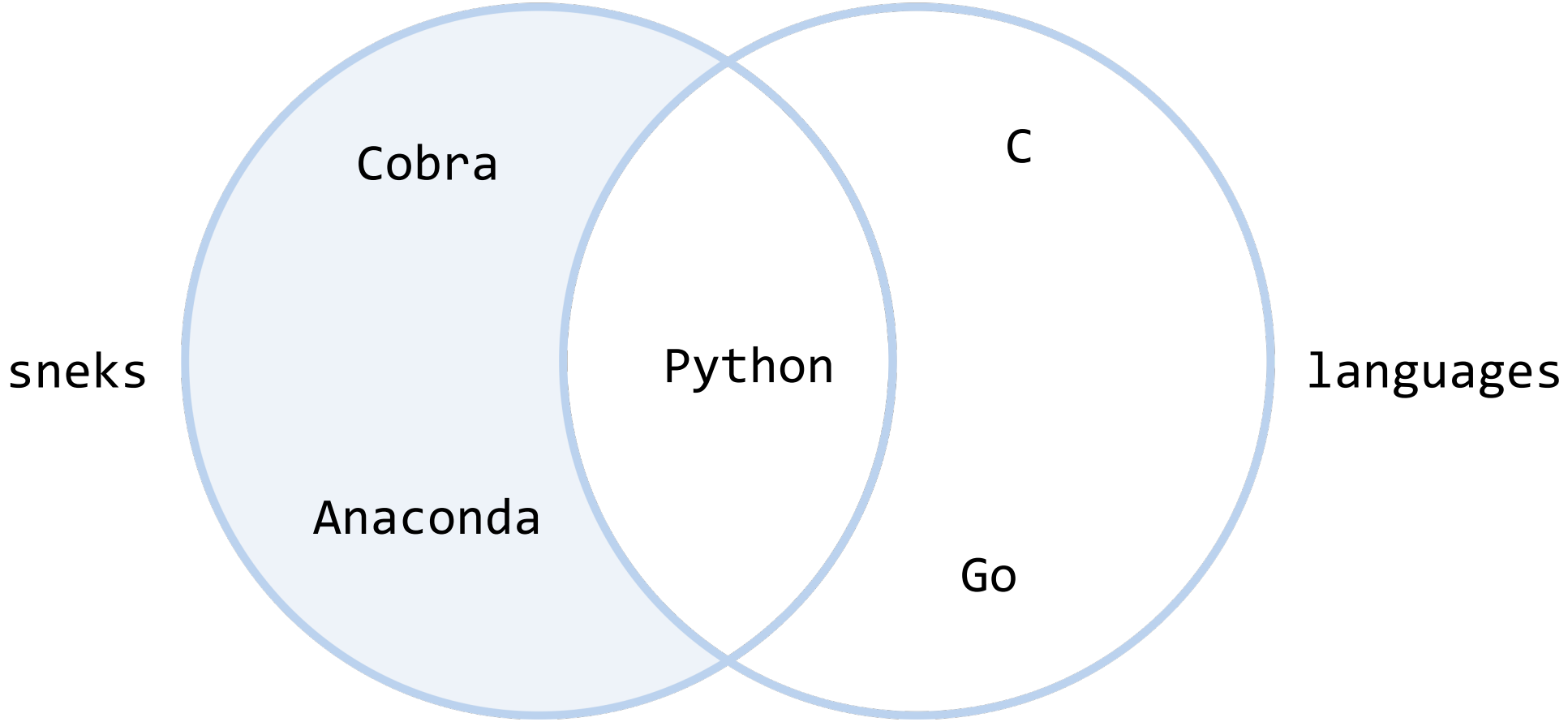
Intersection "AND"




```
sneks & languages
```

```
{'Python'}
```

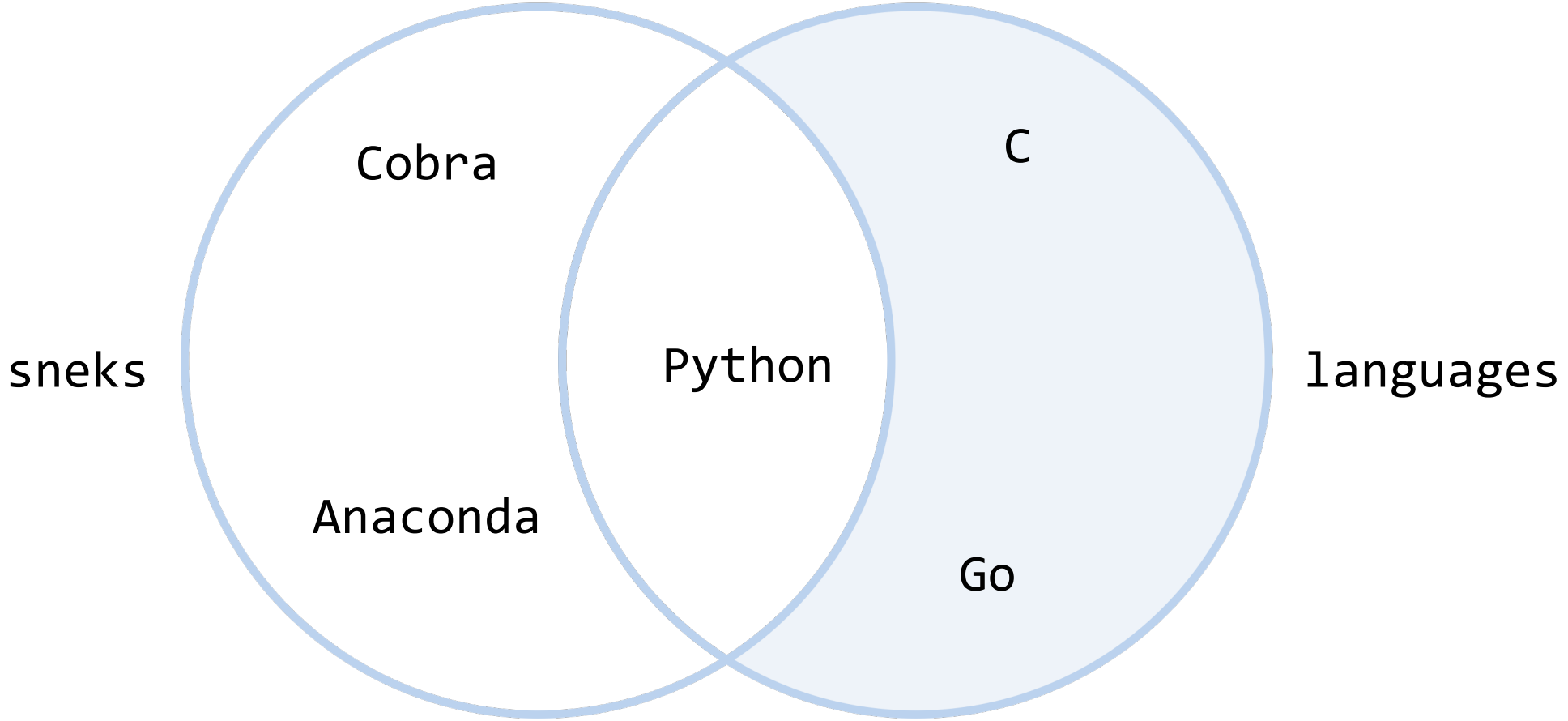
Difference




```
sneks - languages
```

```
{'Anaconda', 'Cobra'}
```

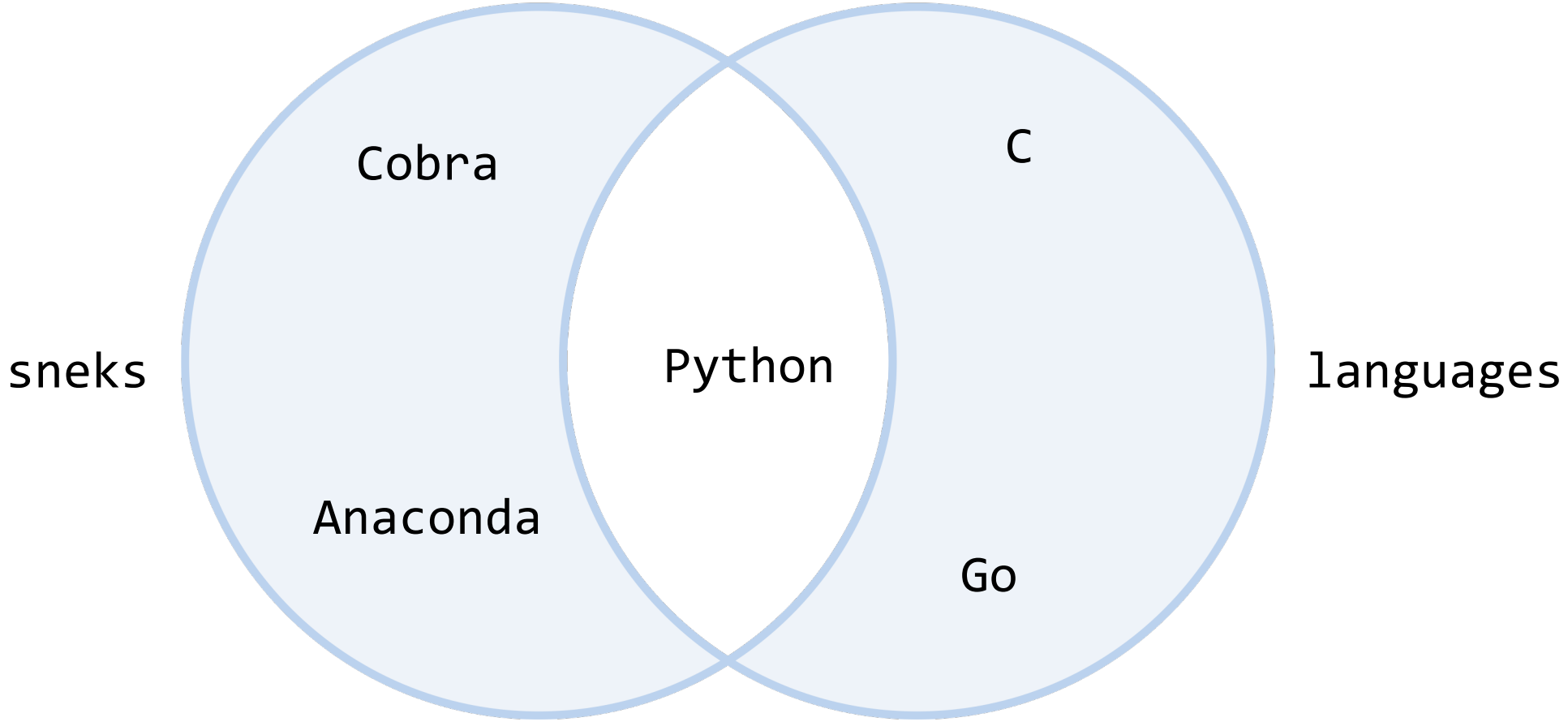
Difference




```
languages - sneks
```

```
{'C', 'Go'}
```

Exclusive disjunction "XOR"




```
languages ^ sneks
```

```
{'C', 'Cobra', 'Anaconda', 'Go'}
```

`set` is mutable

➠ Use assignment operators to mutate

```
languages |= {'C++', 'Java'}
print(languages)
```

```
{'Go', 'C', 'Python', 'Java', 'C++'}
```

➠ ⚠ Watch out for mutability!

```
s = languages
print(s is languages)
s &= sneks
print(s)
print(languages)
```

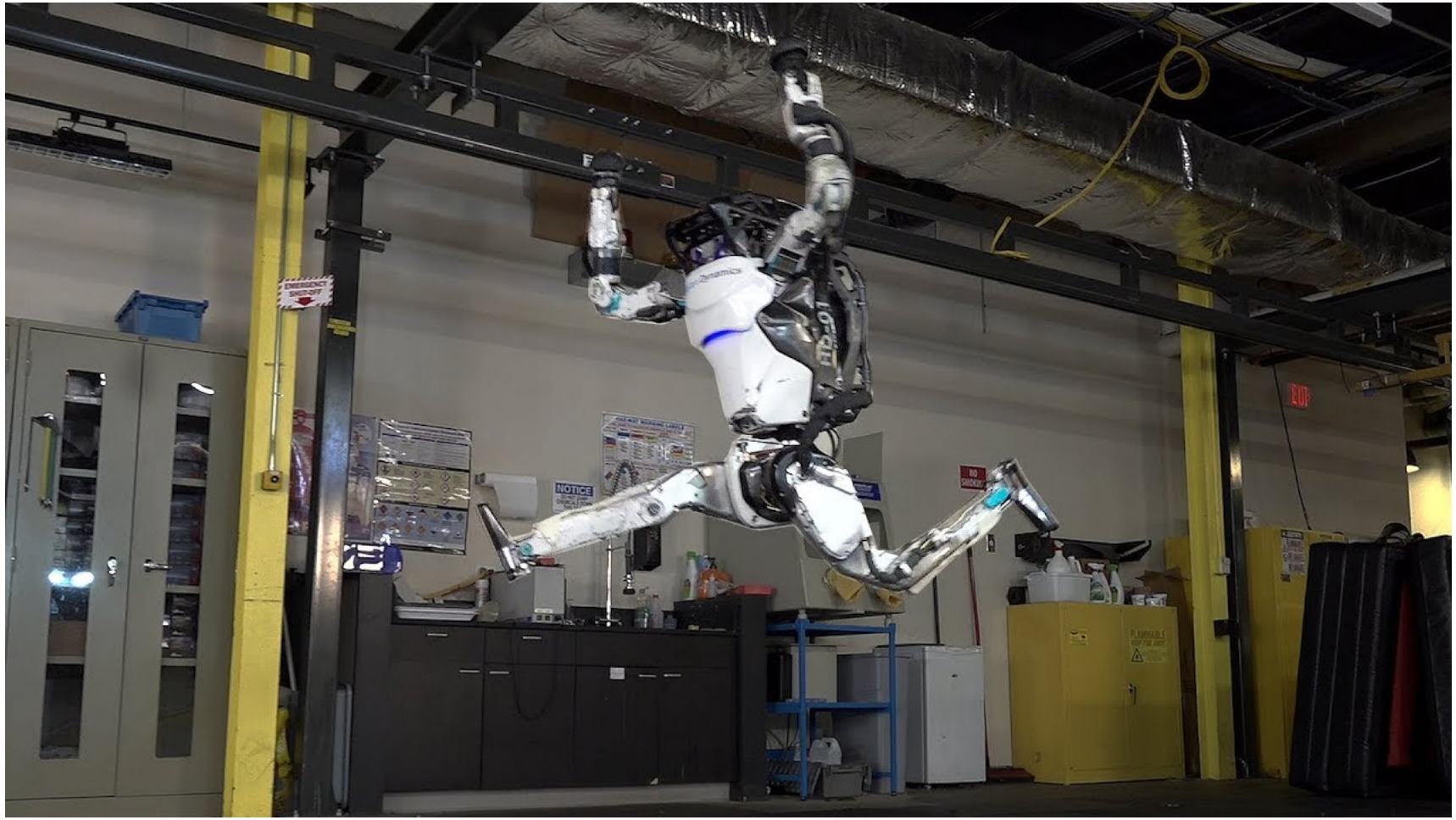
```
True
{'Python'}
{'Python'}
```

Let's write some code!

```
print('Union:', sneks | languages)
print('Intersection:', sneks & languages)
print('Left difference:', sneks - languages)
print('Right difference:', languages - sneks)
print('Exclusion:', languages ^ sneks)
print('Exclusion:', (languages | sneks) - (languages & sneks))
```

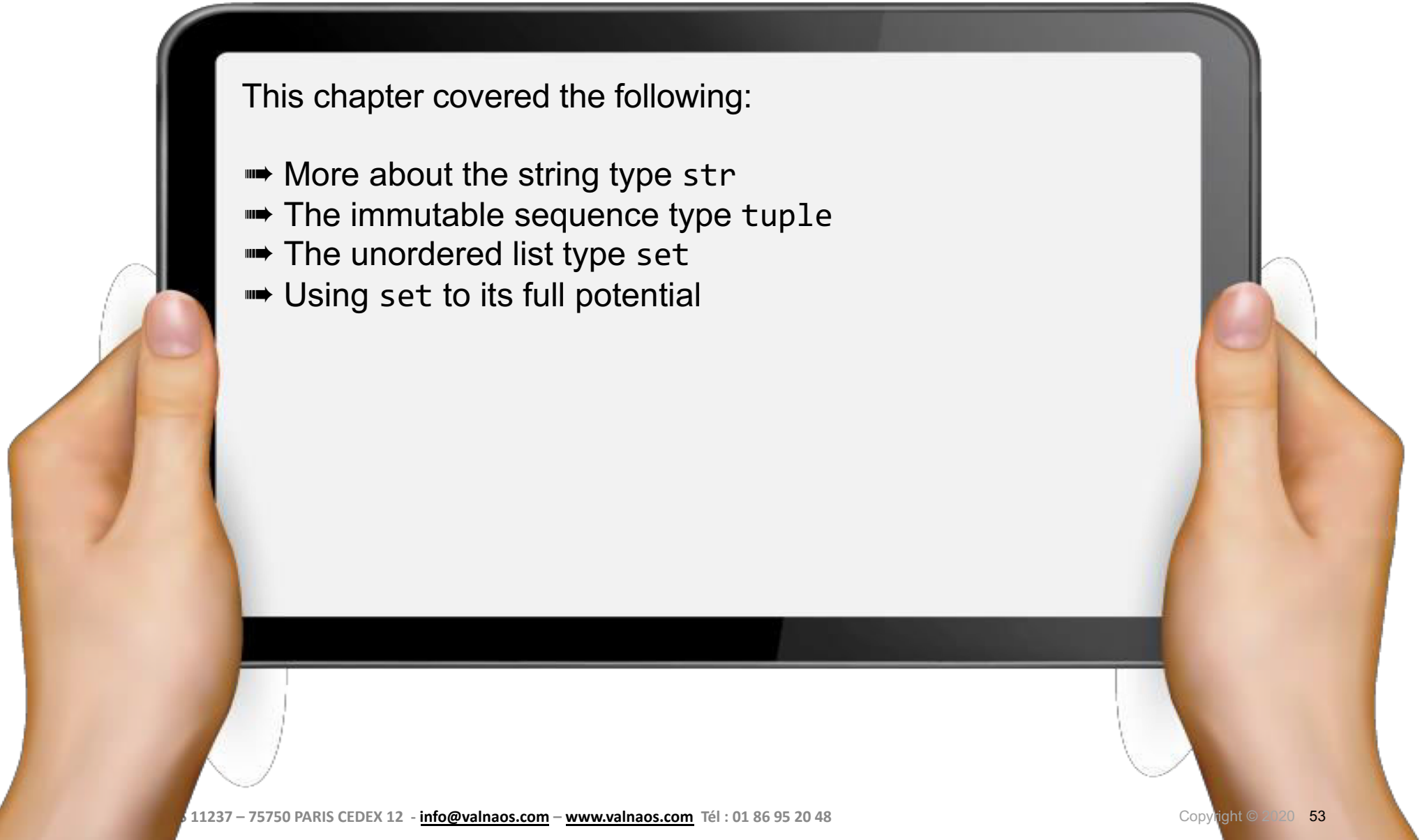
```
Union: {'Cobra', 'Anaconda', 'Go', 'C', 'Python'}
Intersection: {'Python'}
Left difference: {'Anaconda', 'Cobra'}
Right difference: {'C', 'Go'}
Exclusion: {'C', 'Cobra', 'Anaconda', 'Go'}
Exclusion: {'Anaconda', 'Cobra', 'C', 'Go'}
```

Workout Time!



Chapter 2 Exercises link

Chapter Summary



Python 3 Beginner

Chapter **03**

Associative container: `dict`

release 1.0.0

An associative container: `dict`

- Maps *keys* to *values*
- Values can be any object
- Keys can be *almost* any object (must be *hashable*)
- Similar to C++ `std::map`, Java `HashMap`, Ruby hashes, JavaScript objects...
- If you've used JSON, you've used `dicts`

`dict` basics

➠ Creating a dictionary

```
d = {0: 'zero', 2: 'two', 1: 'one'}
type(d)
```

```
dict
```

```
d1 = {'one': 1, 'two': '2', 'three': 3.0, 'four': [4, 4, 4]}
print(d1)
```

```
{'one': 1, 'two': '2', 'three': 3.0, 'four': [4, 4, 4]}
```

`dict` basics

➠ Dictionary creation & equality

```
d1 = {'one': 1, 'two': '2', 'three': 3.0, 'four': [4, 4, 4]}
print(d1)
```

```
{'one': 1, 'two': '2', 'three': 3.0, 'four': [4, 4, 4]}
```

```
d2 = dict(one=1, four=[4, 4, 4], two='2', three=3.0)
print(d2)
print(d1 == d2)
```

```
{'one': 1, 'four': [4, 4, 4], 'two': '2', 'three': 3.0}
True
```

```
d2 = dict([('one', 1), ('four', [4, 4, 4]), ('two', '2'), ('three', 3.0)])
print(d3 == d1)
```

```
True
```

dict basics

➠ Retrieving an item

```
d = {0: 'zero', 2: 'two', 1: 'one'}
d[2]
```

```
'two'
```

```
d['two']
```

```
KeyError: 'two'
```

```
print(d.get('two'))
```

```
None
```

Iterating `dict`

By keys

```
for k in d:
    print(f'{k}=>{d[k]}', end=' ')
```

```
2=>two 1=>one 4=>four
```

By values

```
for v in d.values():
    print(v, end=' ')
```

```
two one four
```

By key-value pairs

```
for k, v in d.items():
    print(f'{k}=>{v}', end=' ')
```

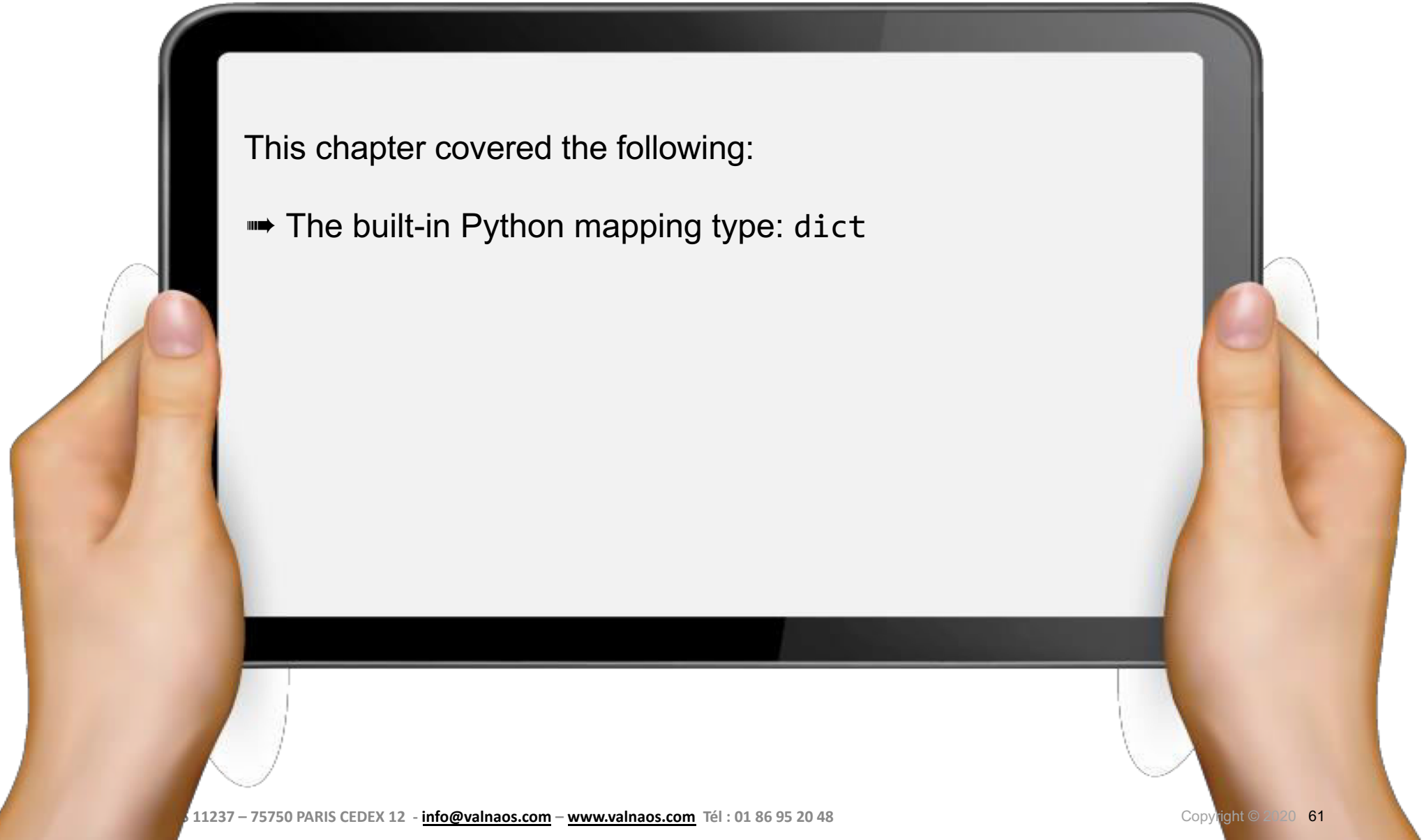
```
2=>two 1=>one 4=>four
```

Let's write some code!

```
for k, v in d.items():
    print(f'{k}=>{v}', end=' ')
```

```
2=>two
1=>one
4=>four
```

Chapter Summary



Valnaos
IT Training & Consulting

ALTRAN
.ALTRAN EDUCATION SERVICES

Python 3 Beginner

Chapter **04**

Container superpowers

release 1.0.0

Converting sequence types

Tuple to list

```
list(('Hello', 'World'))
```

```
['Hello', 'World']
```

List to tuple

```
tuple([0, 1, 2])
```

```
(0, 1, 2)
```

List to set

```
set([0, 1, 0, 1, 2, 0, 1, 3])
```

```
{0, 1, 2, 3}
```

List comprehensions

- Create new lists from concise expressions

```
[x*x for x in range(10)]
```

```
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

```
books = ['1984', 'The Stranger', 'The Pragmatic Programmer']
prices = [9, 12.71, 22.1]
[(b, f'{p:.2f}') for b, p in zip(books, prices)]
```

```
[('1984', '9.00'),
 ('The Stranger', '12.71'),
 ('The Pragmatic Programmer', '22.10')]
```

List comprehensions

➠ Use a condition

```
l = [91, 39, 40, 76, 48, 57, 32, 88, 67, 44]
[x for x in l if (x % 2) == 0]
```

```
[40, 76, 48, 32, 88, 44]
```

➠ Iterate over 2 variables

```
[(x, y) for x in (0, 1, 2) for y in (1, 2, 3)]
```

```
[(0, 1), (0, 2), (0, 3), (1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3)]
```

```
[(x, y) for x in (0, 1, 2) for y in (1, 2, 3) if x != y]
```

```
[(0, 1), (0, 2), (0, 3), (1, 2), (1, 3), (2, 1), (2, 3)]
```

List comprehensions

➠ Use a condition

```
l = [91, 39, 40, 76, 48, 57, 32, 88, 67, 44]
[x for x in l if (x % 2) == 0]
```

```
[40, 76, 48, 32, 88, 44]
```

➠ Iterate over 2 variables

```
[(x, y) for x in (0, 1, 2) for y in (1, 2, 3)]
```

```
[(0, 1), (0, 2), (0, 3), (1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2,
3)]
```

```
[(x, y) for x in (0, 1, 2) for y in (1, 2, 3) if x != y]
```

```
[(0, 1), (0, 2), (0, 3), (1, 2), (1, 3), (2, 1), (2, 3)]
```

More comprehensions

Set comprehension

```
{(-1) ** x for x in range(1000)}
```

```
{-1, 1}
```

Dictionary comprehension

```
s = 'Hello World!'

{c: s.count(c) for c in s}
```

```
{' ': 1, '!': 1, 'H': 1, 'W': 1, 'd': 1, 'e': 1, 'l': 3, 'o': 2, 'r':
1}
```

Starred expressions

➠ Use a * to "unroll" an iterable object into a sequence type

```
[*range(10)]
```

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

```
(*range(10),)
```

```
(0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
```

```
squares = [x*x for x in range(10)]
[*enumerate(squares)]
```

```
[(0, 0), (1, 1), (2, 4), (3, 9), (4, 16), (5, 25), (6, 36), (7, 49),
(8, 64), (9, 81)]
```

any & all

➠ any checks if *at least one* of the items is `True` (or truthful)

```
any([False, False, False, False])
```

```
False
```

```
any([False, False, True, False])
```

```
True
```

```
any([0, 1])
```

```
True
```

any & all

➠ `all` checks if *every* item is `True` (or truthful)

```
all([True, True, True, True])
```

```
True
```

```
all([True, True, True, False])
```

```
False
```

```
all([0, 1])
```

```
False
```

any & all

➠ any and all become powerful with list comprehensions

```
l = [0.938516988270505, 0.9536987969133713, 0.4892805560828089, ...
any([x < 0.1 for x in l])
```

```
True
```

```
all([type(x) == float for x in l])
```

```
True
```

```
any([x == 0.0 for x in l])
```

```
False
```

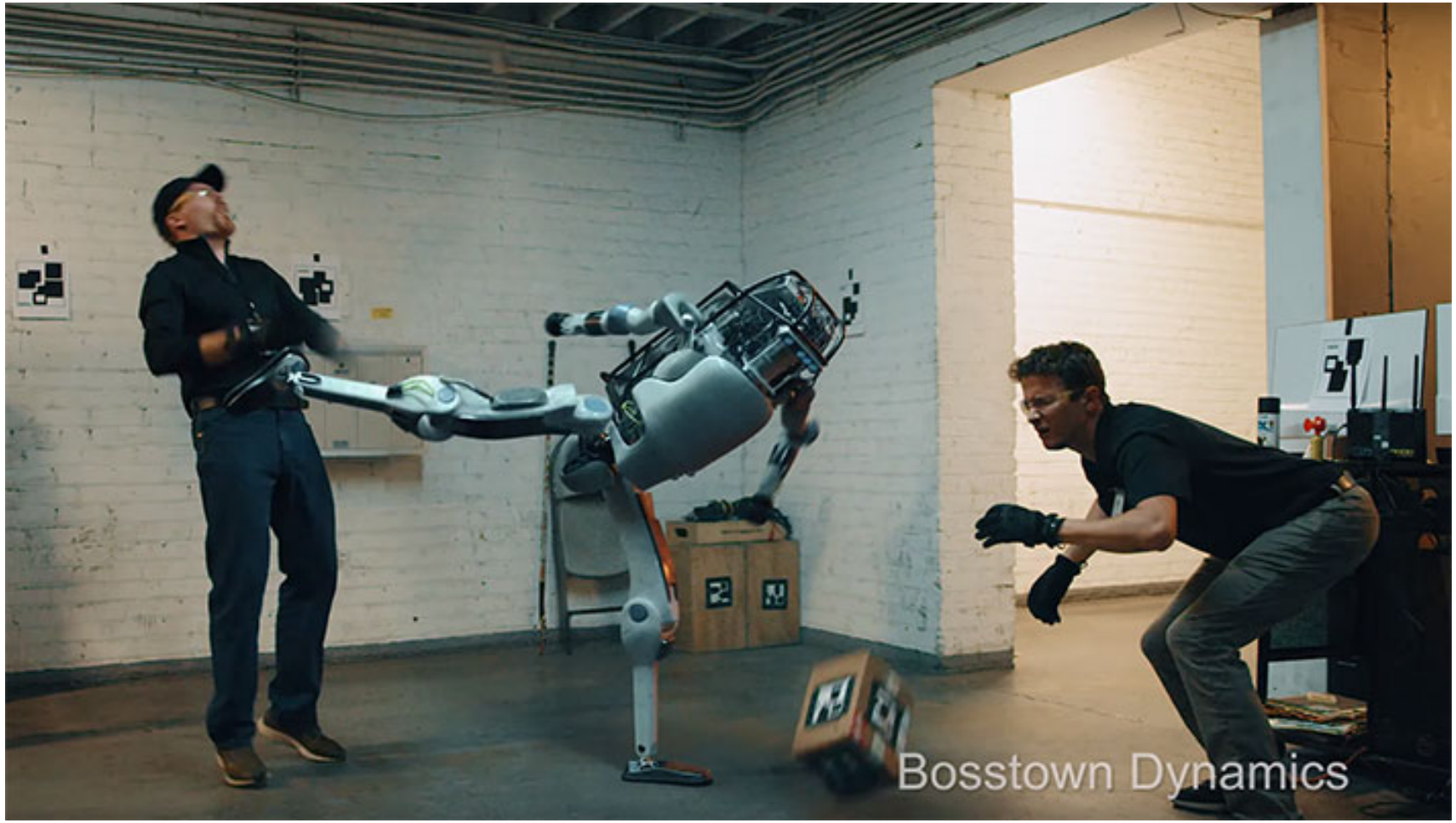
Let's write some code!

```
s = 'Hello World!'

{c: s.count(c) for c in s}
```

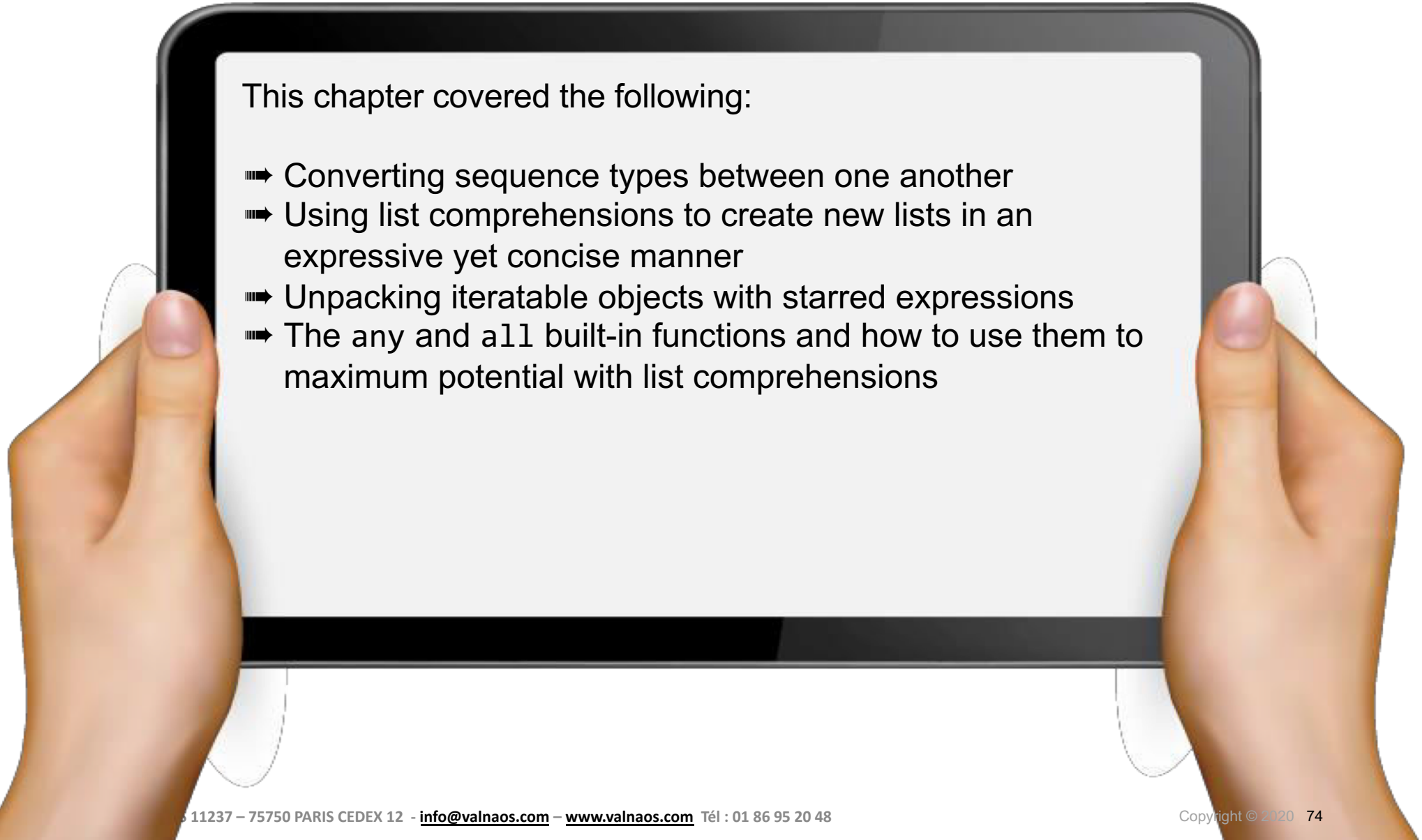
```
{' ': 1, '!': 1, 'H': 1, 'W': 1, 'd': 1, 'e': 1, 'l': 3, 'o': 2, 'r':
1}
```

Workout Time!



Chapter 3 Exercises link

Chapter Summary



Q&A

Workshop

Session 1 Workshop link

Thank you for your attention!

