எங்கள் வாழ்வும் எங்கள் வளமும்
மங்காத தமிழ் என்று சங்கே முழங்கு ... *புரட்சிக்கவி*

NOTICE

- We support open-source products to spread Technology to the mass.
- This is completely a FREE training course to provide introduction to Python language
- All materials / contents / images/ examples and logo used in this document are owned by the respective companies / websites. We use those contents for FREE teaching purposes only.

- We take utmost care to provide credits when ever we use materials from external source/s. If we missed to acknowledge any content that we had used here, please feel free to inform us at info@DataScienceInTamil.com.
- All the programing examples in this document are for teaching purposes only.

Thanks to all the open-source community and to the below websites from where we take references / content /code example. definitions, please use these websites for further reading:

Python Notes For Professionals.pdf – this is the book we follow

https://docs.python.org

Today’s class

006 TOPIC: PYTHON LOOPS

What to cover today

1. Infinite loop
2. “Nested” loops
3. Nested Loops – how to use “break’
4. Loop with increment
5. 'Break' in Loops
6. 'Continue' in Loops
7. For loops
8. For loops in list
9. For loop with 'range'
10. For loop with "enumerate'
11. Loops with an "else" clause
12. The Pass Statement

TOPIC : LOOPS

As one of the most basic functions in programming, loops are an important piece to nearly every programming language. Loops enable developers **to set certain portions of their code to repeat through a number of loops** which are referred to as iterations. This topic covers using multiple types of loops and applications of loops in Python.

Infinite loop

```
i = 0
while i < 7:
    print(i)
```

output

infinite

Loop with increment

(increment the initial value for every iteration of loop)

```
marks = 0
while marks < 35:
    print(marks)
    # marks = marks + 1
    # marks = marks + 5
    # # marks = marks + 10
output
--------------------------
```

Break and Continue in Loops

When a **break** statement executes inside a loop, control flow "breaks" out of the loop immediately:

```
i = 0
while i < 7:
    print(i)
    if i == 4:
        break
    i+=1
```

output

```
0

1

2

3

4
```

=========

Note: it prints all as the condition never met

It process the order in which seq of the tuple

```
for i in (3,5,7,9, 6):
    print(i)
    if i == 1:
        break
```

output

```
3

5
```

```
7

9

6

===============

for i in (3,5,7,9, 6, "Linda", "Aswathy",False, "Sudha"):
    print((i))
    if i == " ":
        break


============


marks =  35
for name in ("Lavender", "Muthu", "TamilSelvan", "Muthu", "Siva", ): # list, set, tuple, dict
    print(name)
    if name == "TamilSelvan" and marks >= 35:
        print(name,  " mark is : ", marks)
        break
---------------
a=0
b=1
while a<7 and b>8 : # since b becomes FALSE, this while loop resturns FALSE, so the
execution does not  go the next line
    print("a Value" , a ," b Value ",b)
    a=a+1
    b=b+2
```

====================

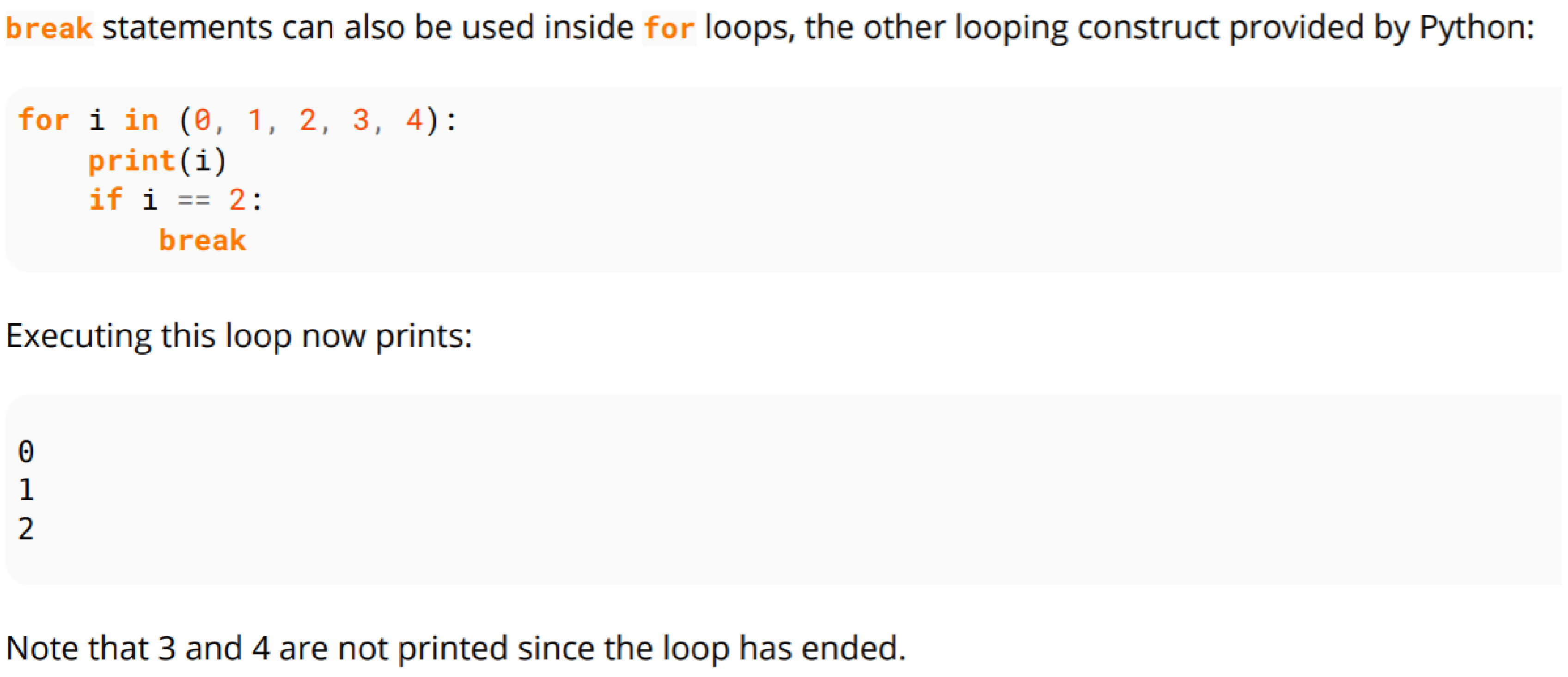
The loop conditional will not be evaluated after the **break** statement is executed. Note that **break** statements are only allowed inside loops, syntactically.

A break statement inside a function cannot be used to terminate loops that called that function.

Phycharm itself does not allow the "break" statement in side the fn – see below the example

```
def test():
    print("Canada")
    break # break can not be used inside the fn to stop the fn execution, it is an error
for i in range (5):
    test() # ie we call the fn in side the loop, so the fn can not be broken using break statement
-----------------
```

break statements can also be used inside for loops, the other looping construct provided by Python:



break statements can also be used inside for loops, the other looping construct provided by Python:

```
for i in (0, 1, 2, 3, 4):
    print(i)
    if i == 2:
        break
```

Executing this loop now prints:

```
0
1
2
```

Note that 3 and 4 are not printed since the loop has ended.

If a loop has an else clause, it does not execute when the loop is terminated through a break statement.

```
for val in range(5):
    print(val)
    if val == 3:
        break
    else:
        print("This Else Statement will bot be executed
after the 3rd execution")
```

output

```
0

This Else Statement will bot be executed after the 3rd execution

1

This Else Statement will bot be executed after the 3rd execution

2

This Else Statement will bot be executed after the 3rd execution

3

========
```

Continue statement

It skips the current iteration but never comes out / terminate the loop

A continue statement will skip to the next iteration of the loop bypassing the rest of the current block but continuing the loop. As with break, continue can only appear inside loops:

```
lst = [2,4,6,8,10]
for item in lst:
    if item == 6:
        continue
    print(item)
```

output

```
2
4
8
10
```

========

```
lst = [2,4,6,8,10]
for item in lst:
    if item ==2:
        break
    print(item)
```

no output ..why ? discuss and find the reason

==============

```
for i in (0,1,2,3,4):
    if i == 2 or i == 4:
        continue
    print(i)
```

output

```
0
1
3
```

Note that 2 and 4 aren't printed, this is because continue goes to the next iteration instead of continuing on to print(i) when i == 2 or i == 4.

```
lst = [2,4,6,8,10]
for item in lst:
    if item ==2 and item ==4:
        continue
    print(item)
```

output

run the pgm to see the result and discuss

```
--------- lst = [2,4,6,8,10]
for item in lst:
```

```
if item ==2 or item ==4:
    continue
print(item)
```

Output

```
6

8

10
```

Note: why 2 and 4 are not displayed? discuss

=========

Nested Loops – how to use “break’

break and continue only **operate on a single level of loop**. The following example will only break out of the inner for loop, not the outer while loop:

```
while True:
    for i in range(1,5):
        print(i)
        if i == 2:
            break   # Will only break the inner loop!
```

=================

```python
while True:
    for i in range(1,5):
        print(i)
        if i == 2:
            break
        break
```

output

```
1
1
1
1
```

….. why? Discuss

==========

```python
while True:
    for i in range(1,5):
        print(i)
        if i == 2:
            break # it breaks the for loop
    break # # it breaks the while
```

output

```
1
2
```

Below print 5 times the 1 and 2 (Home work)

```python
a = 0
while a < 5:
   for i in range(1,5):
      print(i, a)
      if i == 2:
         break   # Will only break out of the inner loop!
   a = a+1
```

ouput

```
1  0
2  0
1  1
2  1
1  2
2  2
1  3
2  3
1  4
2  4
```

Doubt: how the result arrived ? discuss

```
while True:
    for i in range(1,5):
        if i == 2:
            continue    # # continue skip that particular iteration
        print(i)
NOTE: it prints 134 continuously
```

Note: execute the pgm to see the result

In the above pg, it is a nested loops. Break and continue will breaks=>only one level of loop. ie…the inner ‘for’ loop will be broken.

But the outer While loop will keep execute

To break all the loop together , use the below nested in inside a fn with ‘return’ – see below

----

```
def m():
    while True:
        for i in range(1,5):
            print(i)
            if i == 2:
                return
```

```
m()
```

output

```
1

2
```

```
def m():
    while True:
        for i in range(1,5):
            if i == 2:
                return
            print(i)

m()
```

Note: **because of ‘return’ , the above will come out from inner ‘for’ loop and outer’while’ loop**

=================

Another way of break the outerloop// do some more research

```
while True:
    for i in range(1,5):
        print(i)
        if i ==2:
           break
    break
```

Any time the pgm sees return, it GETS OUT of the fn

```
def m():
    while True:
        for i in range(1,5):
            if i == 2:
                print(i)
            print(i)
        return

m()
```

output

```
1

2

2

3
```

4

=======

Python doesn't have the ability to break out of multiple levels of loop at once -- if this behavior is desired, refactoring one or more loops into a function and replacing **break** with **return** may be the way to go.

==========

Use return from within a function as a break

The return statement exits from a function, without executing the code that comes after it.

If you have a loop inside a function, using return from inside that loop is equivalent to having a break as the rest of the code of the loop is not executed (note that any code after the loop is not executed either):

=====

```
def breakLoop():
    for i in range(1,5):
        if i == 2:
            return (i) #this returns 2
        print(i)
    return “”
```

```
a = breakLoop()
print(a,  "it comes from  return")
```

```
output

1

2
```

Note: # if we don’t assign this fn to a variable and print, the output 2 will not be available

---

```
def breakLoop():
    for i in range(1,5):
        if i == 2:
            return
        print(i)
    return (5)

a = breakLoop()
print(a)
```

```
Output:
```

```
1

None

========

Above pgm can be redefined as below
```

```
def breakLoop():
    for i in range(1,5):
        if i == 3:
            return (i) # this ‘return’ works only if the i
becomes 3
        print(i)# only 1 and 2 will print here
    return ()

a = breakLoop()
print(a)
output
1
2
3 # this 3 comes from return statement
========
```

If you have nested loops, the return statement will break all loops:

```
def break_all():
    for j in range(1,5):
        for i in range(1,4):
            if i * j == 6:
                return (i)
            print(i * j)

a = break_all()
print(a)
output
1  (1x1# 1 from outer loop, 1 from inner loop
2 # (1x2)1 from outer loop, 2 from inner loop
3 # (1 x3) 1 from inner loop 3 from inner loop
2 (2x1) 2 from outer loop, 1 from inner loop
4 # (2x2) 2 from outer loop, 2 from inner loop

3 # 3 comes from return statement
-----
1 # 1*1
```

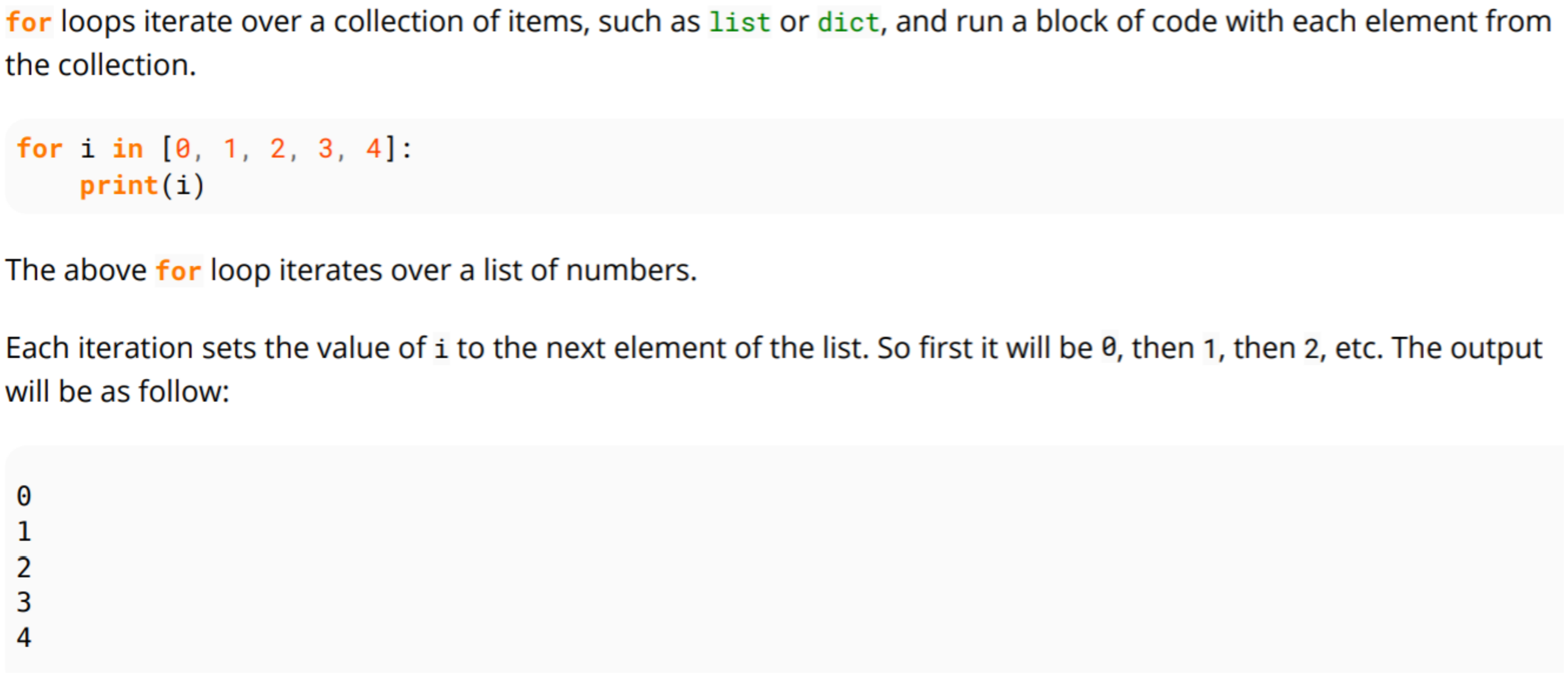
```
2 # 1*2
3 # 1*3
4 # 1*4
2 # 2*1
4 # 2*2
```

# return because 2*3 = 6, the remaining iterations of both loops are not executed

Execute the code bythe use of visual representation from http://www.pythontutor.com/visualize.html#mode=display

======

For loops



for loops iterate over a collection of items, such as list or dict, and run a block of code with each element from the collection.

```
for i in [0, 1, 2, 3, 4]:
    print(i)
```

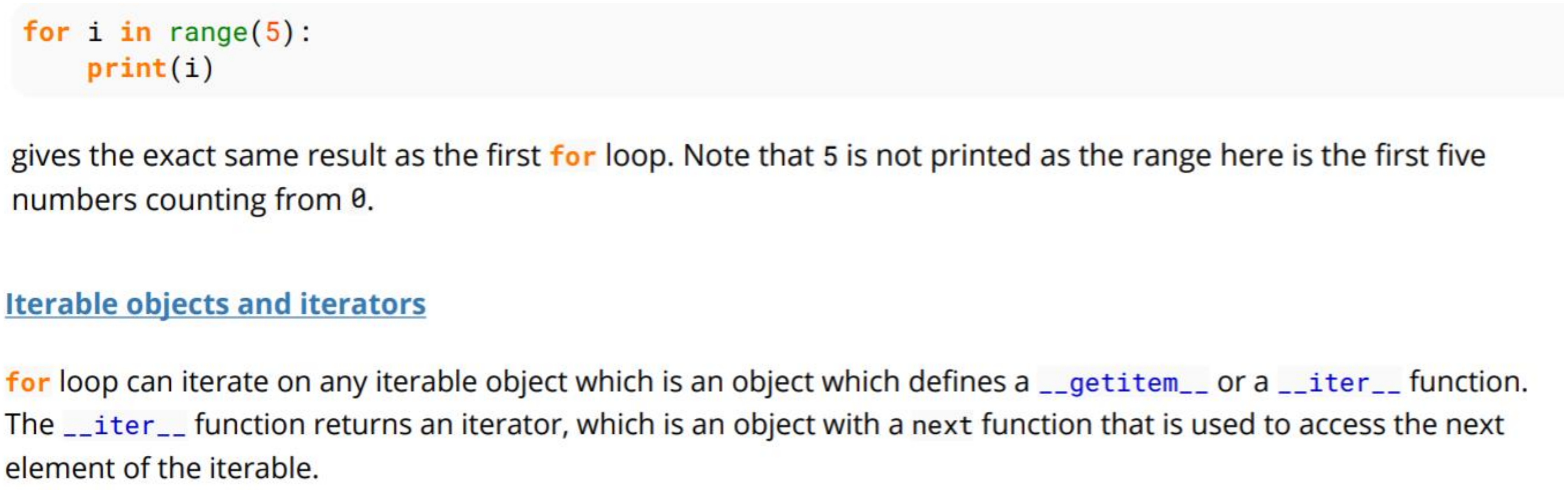
The above for loop iterates over a list of numbers.

Each iteration sets the value of i to the next element of the list. So first it will be 0, then 1, then 2, etc. The output will be as follow:

```
0
1
2
3
4
```

==========

range is a function that returns a series / range of numbers under an iterable form, thus it can be used in for loops:



```
for i in range(5):
    print(i)
```

gives the exact same result as the first `for` loop. Note that `5` is not printed as the range here is the first five numbers counting from `0`.

Iterable objects and iterators

`for` loop can iterate on any iterable object which is an object which defines a `__getitem__` or a `__iter__` function. The `__iter__` function returns an iterator, which is an object with a `next` function that is used to access the next element of the iterable.

```
a = li.__iter__()
for i in a:
    print(i)
print(a)
print(list(a))
```

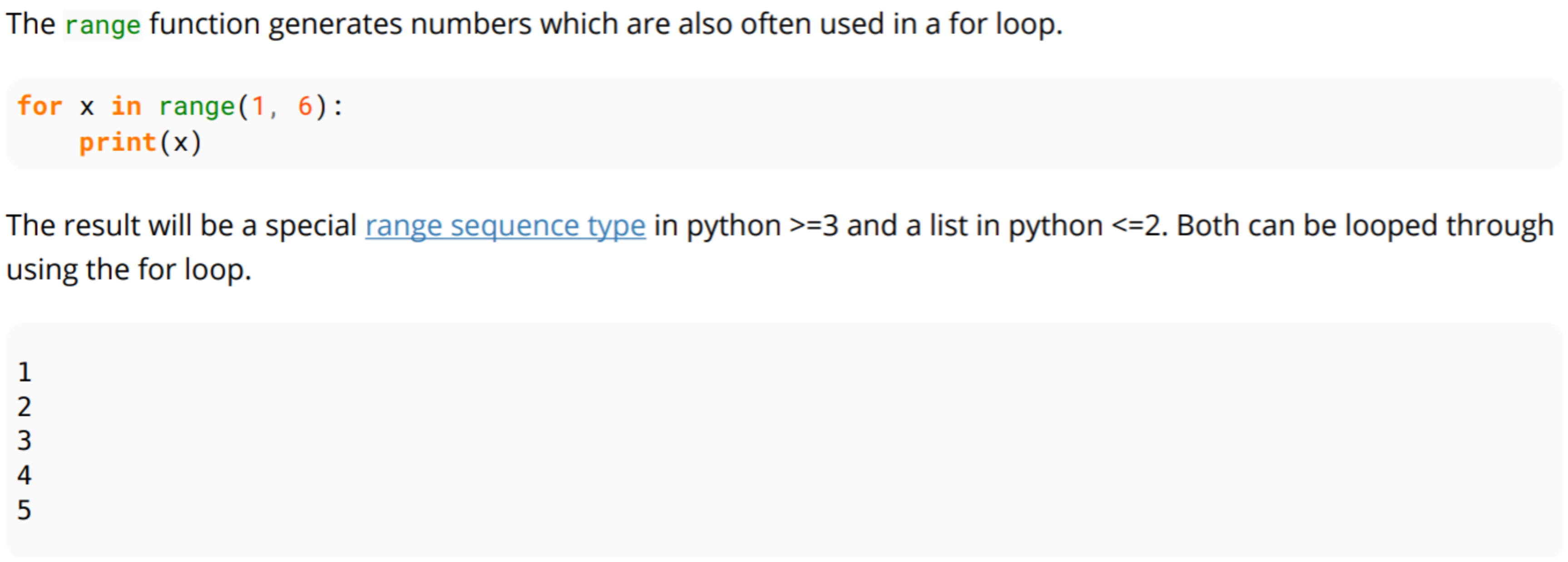
Iterating over lists

To iterate through a list you can use `for`:

```
for x in ['one', 'two', 'three', 'four']:
    print(x)
```

This will print out the elements of the list:

```
one
two
three
four
```



The range function generates numbers which are also often used in a for loop.

```
for x in range(1, 6):
    print(x)
```

The result will be a special range sequence type in python >=3 and a list in python <=2. Both can be looped through using the for loop.

```
1
2
3
4
5
```

Enumerate ()

If you want to loop though both the elements of a list and have an index for the elements as well, you can use Python's enumerate function:

```
lst = ['one', 'two', 'three', 'four']

for item in enumerate(lst):
    # print (index, '::', item)
    print (item)
```

output

```
(0, 'one')
(1, 'two')
(2, 'three')
(3, 'four')
```

Note: enumerate will generate tuples, which are unpacked into index (an integer) and item (the actual value from the list). See the output above

----

Loops with an "else" clause

The for and while compound statements (loops) can optionally have an else clause (in practice, this usage is fairly rare).

1. The else clause only executes after a for loop terminates by iterating to completion, (ie all the iteration must complete with out any interruption)
2. after a while loop terminates by its loop conditional expression becoming false

```
for i in range(3):
    print (i)
else:
    print("After the completion of the for loop")
```

output

```
0
1
2
After the completion of the for loop
```

Now the for loop has some interruption (ie break) , so the else
Class will not execute- see below

```
for i in range(5):
    print (i)
    if i== 3:
          print(“Hi”)
        break
else:
    print("After the completion of the for loop")
```

output

```
0
1
2
3
```

=====

What happens if give else and continue inside the for loop

```
for i in range(5):
    print (i)
    if i== 3:
        print("Hi")
        continue
else:
    print("After the completion of the for loop")
```

output

```
0
1
2
3
Hi
4
After the completion of the for loop
```

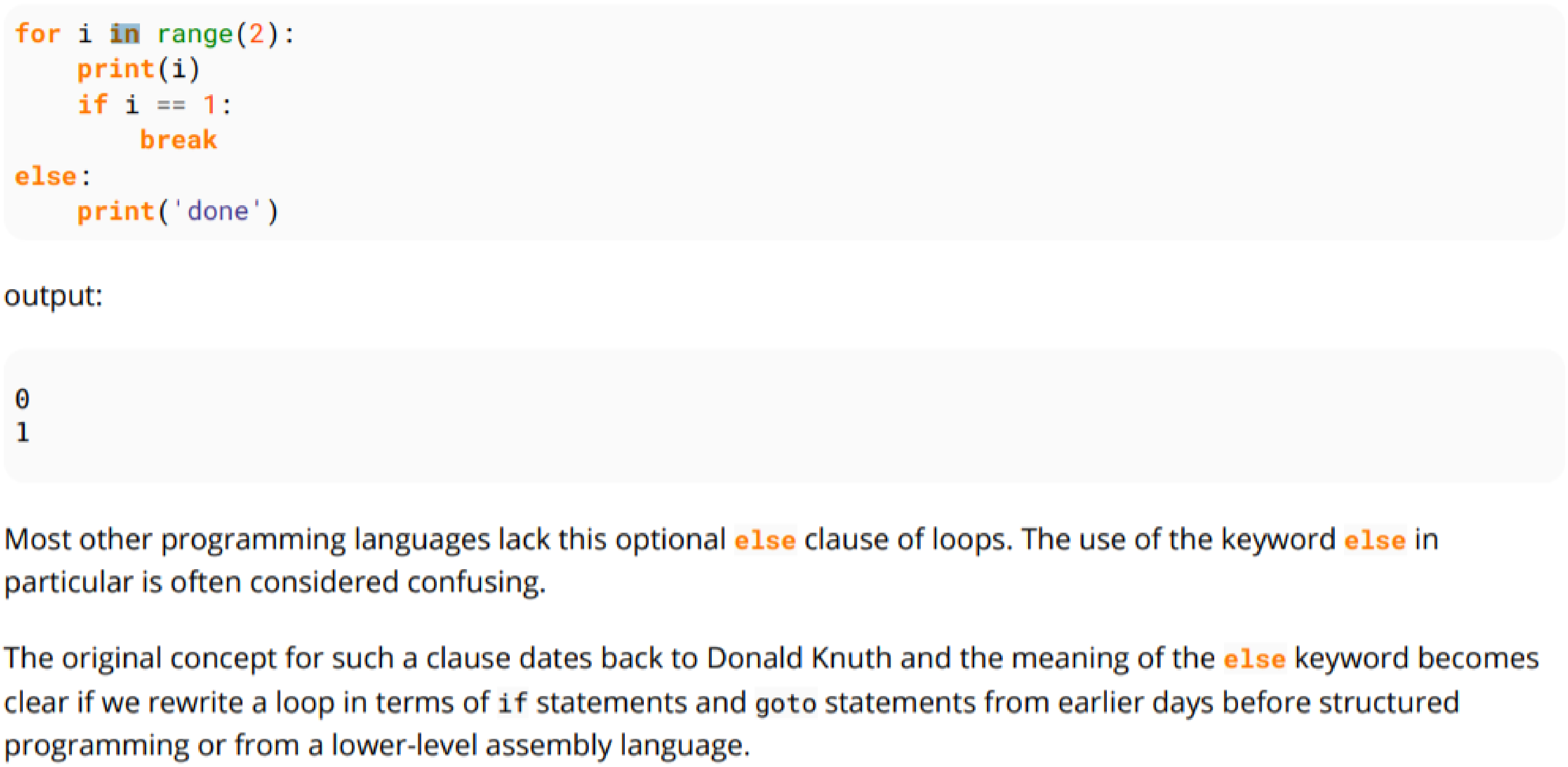
from Sean (from DSIT)

```
i = 0
while i < 5:
     print(i)
     i+=1
else:
    print("after LOOP the conditional expression becomes false, this will print")
```

output

```
0
1
2
3
4
after the conditional expression becomes false, this will print
```

The else clause does not execute if the loop terminates some other way (through a break statement or by raising an exception):



```
for i in range(2):
    print(i)
    if i == 1:
        break
else:
    print('done')
```

output:

```
0
1
```

Most other programming languages lack this optional `else` clause of loops. The use of the keyword `else` in particular is often considered confusing.

The original concept for such a clause dates back to Donald Knuth and the meaning of the `else` keyword becomes clear if we rewrite a loop in terms of `if` statements and `goto` statements from earlier days before structured programming or from a lower-level assembly language.

Note: in the for loop, if “break” executes, the “else” will not execute, it comes out of the pgm.

If the break statement DOES not execute, it WILL go the else statement

“Else” in generally at the last statement

Melcose note: Teach the below code on isinstance(), once the ‘class’ and object are taught

```
li = [  "Muthu", "Nathan" , "Melcose"]
for item in li:
    if isinstance(item, int):
        print("This is number", item)
        break
    else:
        print("This is string,", item)
else:
    print("Only if list contains all string")
```

output

```
This is string, Muthu
This is string, Nathan
This is string, Melcose
Only if list contains all string
```

```
li = [  "Muthu", "Nathan" , 7, "Melcose"]
for item in li:
    if isinstance(item, int):
        print("This is number", item)
        break
    else:
        print("This is string,", item)
else:
    print("Only if list contains all string")
```

output

```
This is string, Muthu
This is string, Nathan
This is number 7
========
```

For example:

```
while loop_condition():
    ...
    if break_condition():
        break
    ...
```

is equivalent to:

```
# pseudocode

<<start>>:
if loop_condition():
    ...
    if break_condition():
        goto <<end>>
    ...
    goto <<start>>
```

```
<<end>>:
```

These remain equivalent if we attach an `else` clause to each of them.

For example:

These remain equivalent if we attach an `else` clause to each of them.

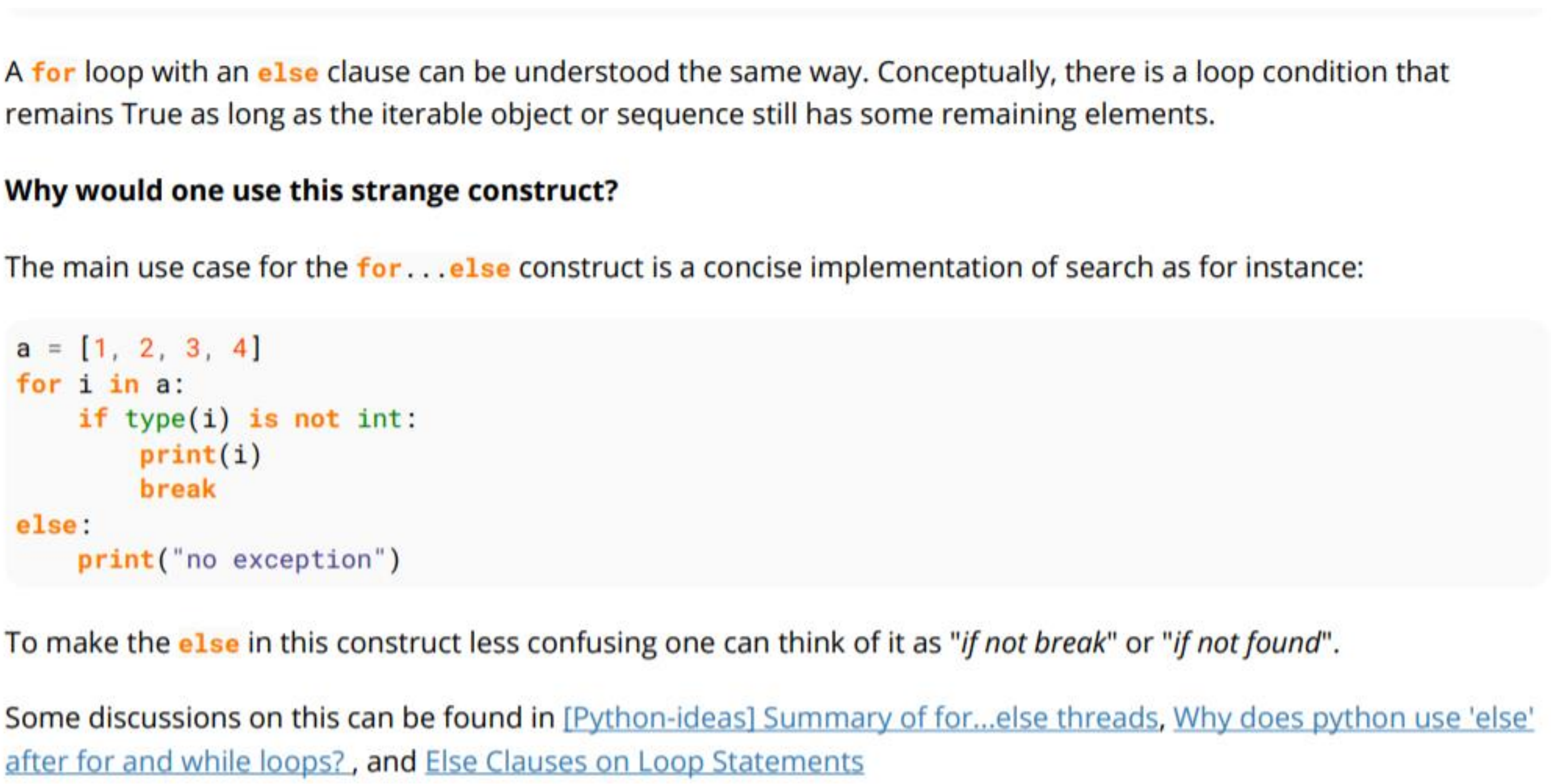
For example:

```
while loop_condition():
    ...
    if break_condition():
        break
    ...
else:
    print('done')
```

is equivalent to:

```
# pseudocode

<<start>>:
if loop_condition():
    ...
    if break_condition():
        goto <<end>>
    ...
    goto <<start>>
else:
    print('done')

<<end>>:
```

A `for` loop with an `else` clause can be understood the same way. Conceptually, there is a loop condition that remains True as long as the iterable object or sequence still has some remaining elements.



A for loop with an else clause can be understood the same way. Conceptually, there is a loop condition that remains True as long as the iterable object or sequence still has some remaining elements.

Why would one use this strange construct?

The main use case for the for...else construct is a concise implementation of search as for instance:

```
a = [1, 2, 3, 4]
for i in a:
    if type(i) is not int:
        print(i)
        break
else:
    print("no exception")
```

To make the else in this construct less confusing one can think of it as "*if not break*" or "*if not found*".

Some discussions on this can be found in [Python-ideas] Summary of for...else threads, Why does python use 'else' after for and while loops? , and Else Clauses on Loop Statements

```
i = 0
if type(i) is not int:
    print("Not int type")
else:
    print("Yes it is int type")
```

output

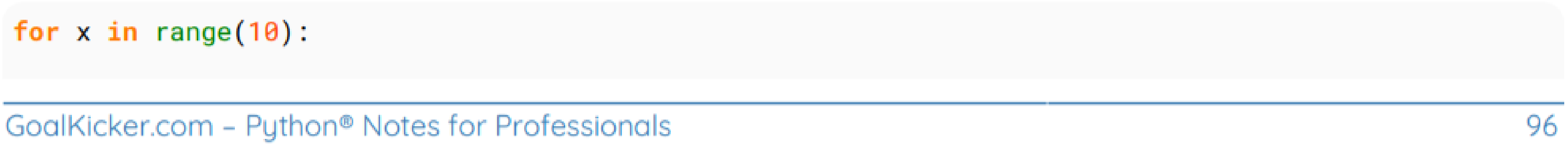
Yes it is int type

```
==========
lst = [3,"DS",5,'A', 89.4, 8,5]
for item in lst:
    if type(item) is not int:
        print(item)
output
DS
A
89.4
===========
lst = [3, 5, 8, 5, 4]
for item in lst:
    if type(item) is not int:
        print(item)
        break
else:
    print("No exception")
output
No exception
```

```
---------
lst = [3, 5, 8, "A", 5, 4]
for item in lst:
    if type(item) is not  int:
        print(item)
        break
    else:
        print(item)
else:
    print("No exception")
output
3
5
8
A
================
```

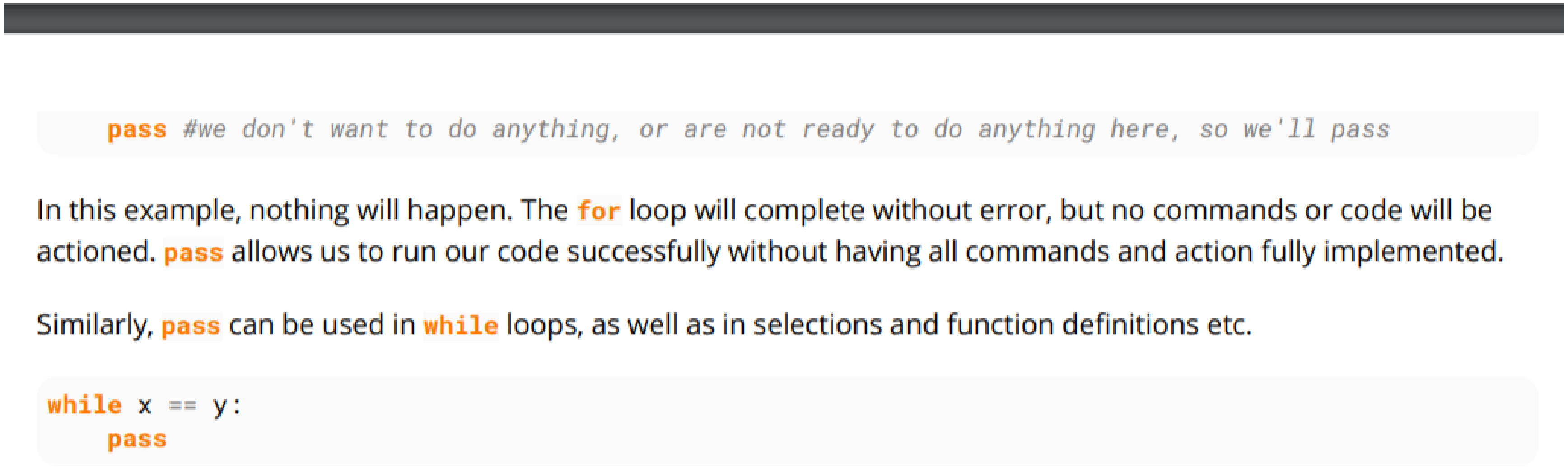
The Pass Statement

pass is a null statement for when a statement is required by Python syntax (such as within the body of a for or while loop), but no action is required or desired by the programmer. This can be **useful as a placeholder** for code that is yet to be written.



```
for x in range(10):
```

GoalKicker.com – Python® Notes for Professionals 96



```
    pass #we don't want to do anything, or are not ready to do anything here, so we'll pass
```

In this example, nothing will happen. The `for` loop will complete without error, but no commands or code will be actioned. `pass` allows us to run our code successfully without having all commands and action fully implemented.

Similarly, `pass` can be used in `while` loops, as well as in selections and function definitions etc.

```
while x == y:
    pass
```

```
while True:
    pass
------

for item in range(5):
    pass
============
```

Cover the below topic once the dict is taught

The "half loop" do-while

Unlike other languages, Python doesn't have a do-until or a do-while construct (this will allow code to be **executed once before the condition is tested**). However, you can combine a while True with a break to achieve the same purpose

```
a = 10
while True:
    a = a-1
    print(a)
    if (a < 7):
        break
    print("done")
```

output

```
9
done
8
done
```

```
7
done
6
==========
```

Teach the below once the collection data type is taught (keep it pending)

Looping and Unpacking

```
collection = [('a', 'b', 'c'), ('x', 'y', 'z'), ('1', '2',
'3')]
for item in collection:
    i1 = (item[0])
    i2 = (item[1])
    i3 = (item[2])

    print(i1)
```

output

```
a
x
1
--------
```

Same code as above..but diff logic ..see below

```
collection = [('a', 'b', 'c'), ('x', 'y', 'z'), ('1',
'2', '3')]
for item in collection:
    i1 = (item[0])
    i2 = (item[1])
    i3 = (item[2])

    print(i1,i2,i3)
```

```
output
a b c
x y z
1 2 3
-------
```

```
collection = [('a', 'b', 'c'), ('x', 'y', 'z'), ('1', '2', '3')]
# print(collection[1])
for item in collection:
    print(item)
    print(item[0])
    print(item[1])
    print(item[2])
```

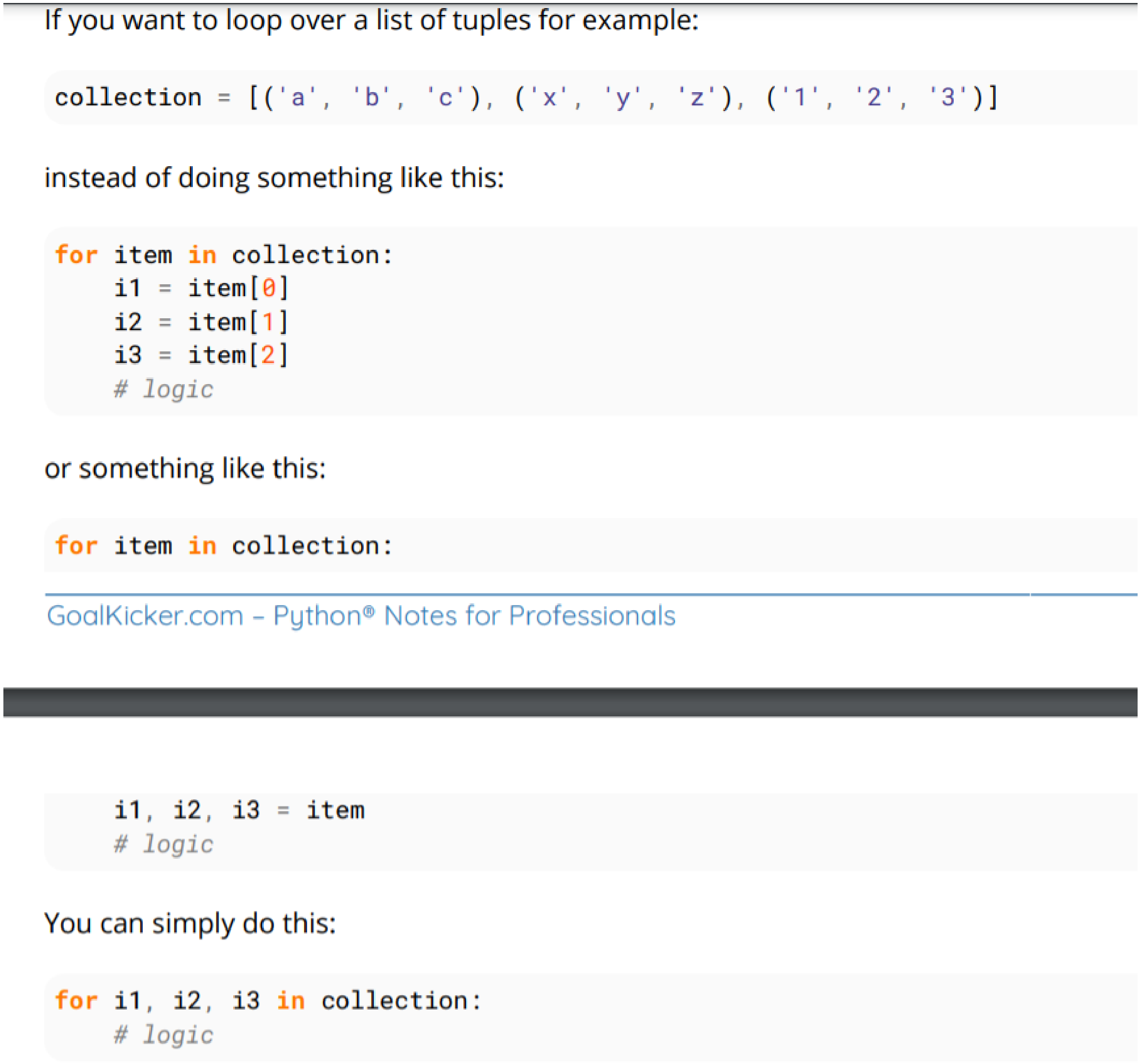
```
output
('a', 'b', 'c')
```

```
a
b
c
('x', 'y', 'z')
x
y
z
('1', '2', '3')
1
2
3
---------
```

```python
collection = [('Lara', 'TPP', '10'), ('Jon', 'Chennai', '2'), ('Murugan', 'Kerala', '30')]
for item in collection:
    i1 = (item[0])
    # i2 = (item[1])
    # i3 = (item[2])

    print(i1)
```

output

```
Lara
Jon
Murugan
==========
```



If you want to loop over a list of tuples for example:

```
collection = [('a', 'b', 'c'), ('x', 'y', 'z'), ('1', '2', '3')]
```

instead of doing something like this:

```
for item in collection:
    i1 = item[0]
    i2 = item[1]
    i3 = item[2]
    # logic
```

or something like this:

```
for item in collection:
```

```
    i1, i2, i3 = item
    # logic
```

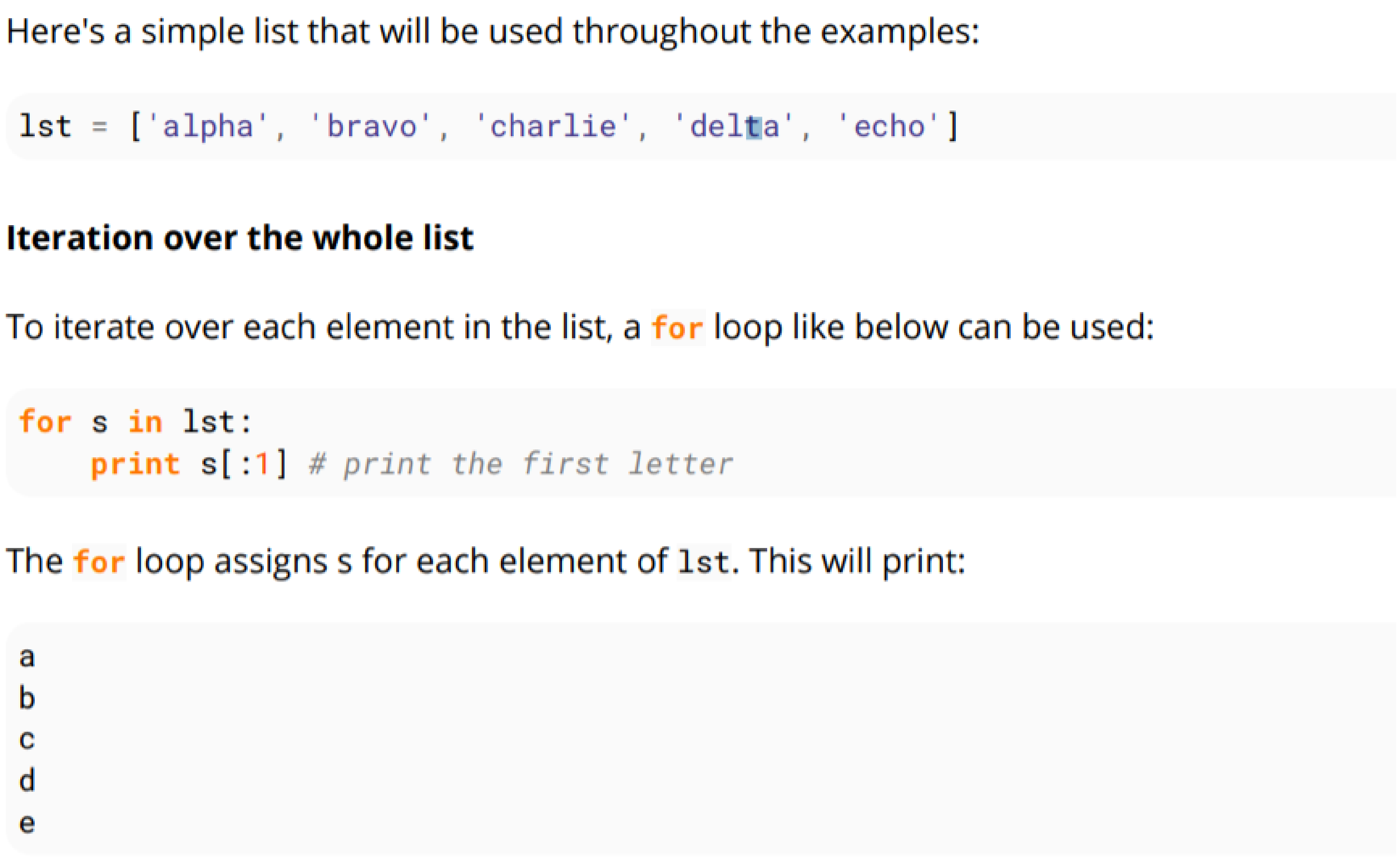
You can simply do this:

```
for i1, i2, i3 in collection:
    # logic
```

This will also work for most types of iterables, not just tuples.
==========

Iterating different portion of a list with different step size

Suppose you have a long list of elements and you are only interested in **every other element of the list.** Perhaps you only want to examine the **first or last elements**, or a specific range of entries in your list. Python has strong indexing built-in capabilities. Here are some examples of how to achieve these scenarios.



Here's a simple list that will be used throughout the examples:

```
lst = ['alpha', 'bravo', 'charlie', 'delta', 'echo']
```

Iteration over the whole list

To iterate over each element in the list, a `for` loop like below can be used:

```
for s in lst:
    print s[:1] # print the first letter
```

The `for` loop assigns s for each element of `lst`. This will print:

```
a
b
c
d
e
```

```
lst = ['alpha', 'bravo', 'charlie', 'delta', 'echo']
for item in lst:
    print(item[0])
    print(item[0:3])
```

output

```
a
alp
b
bra
c
cha
d
del
e
ech
```

=========

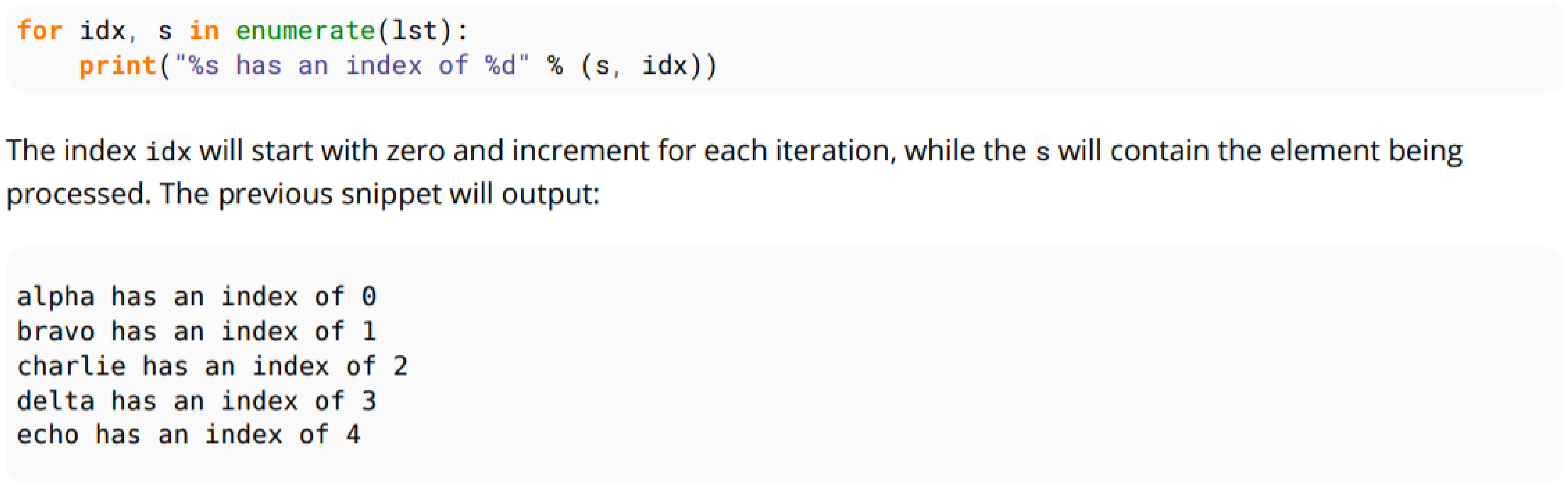
enumerate

Often you need both the element and the index of that element. The enumerate keyword performs that task.

```
lst = ['alpha', 'bravo', 'charlie', 'delta',
'echo']
for item in enumerate(lst):
    print(item)
```

output

```
(0, 'alpha')
(1, 'bravo')
(2, 'charlie')
(3, 'delta')
(4, 'echo')
=========
```



```
for idx, s in enumerate(lst):
    print("%s has an index of %d" % (s, idx))
```

The index `idx` will start with zero and increment for each iteration, while the `s` will contain the element being processed. The previous snippet will output:

```
alpha has an index of 0
bravo has an index of 1
charlie has an index of 2
delta has an index of 3
echo has an index of 4
```

========

Iterate over sub-list (Teach this once list is taught)

If we want to iterate over a range (remembering that Python uses zero-based indexing), use the range keyword.

```
lst = ['alpha', 'bravo', 'charlie', 'delta', 'echo']
for i in range(len(lst)):
    pass
print(lst[2:4])
```

output

```
['charlie', 'delta']
```

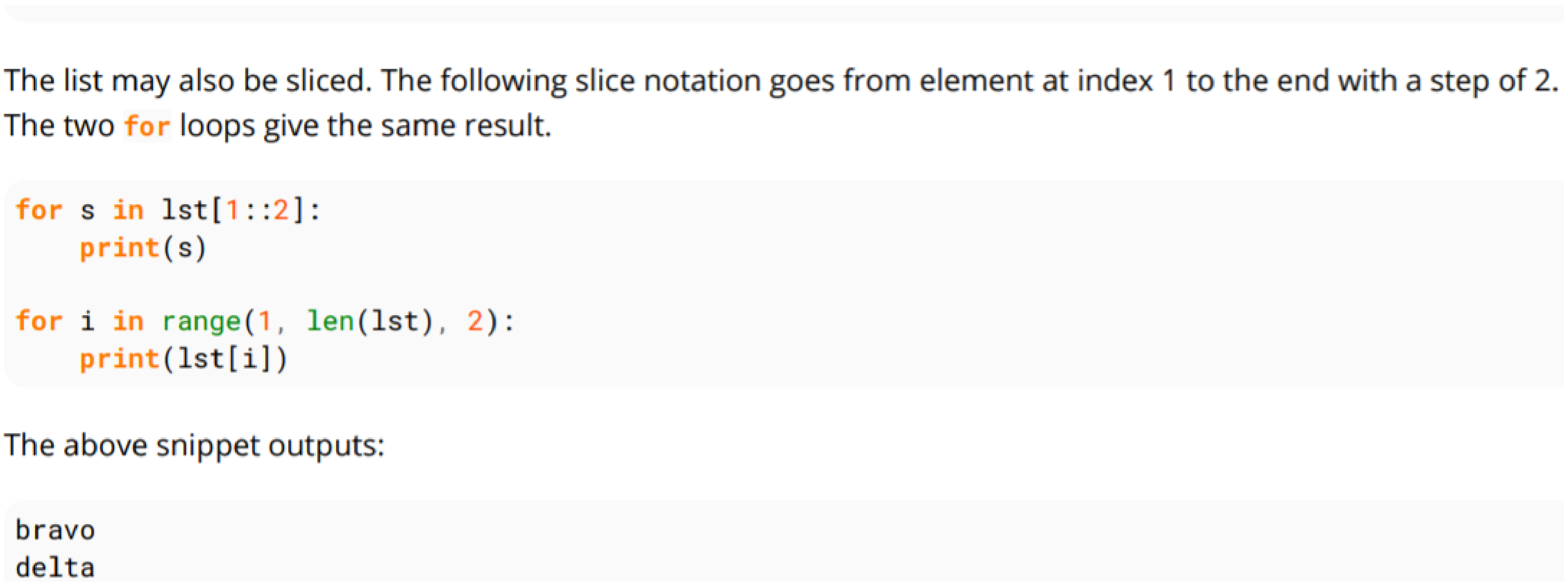
```
=======
Another logic to iterate over sublist
lst = ['alpha', 'bravo', 'charlie', 'delta', 'echo']
for i in range(len(lst)):
    print(i,lst[i])

print(lst.index('delta'))
output
0 alpha
1 bravo
2 charlie
3 delta
4 echo
3
=========
```

If we want to iterate over a range (remembering that Python uses zero-based indexing), use the `range` keyword.

```
for i in range(2,4):
    print("lst at %d contains %s" % (i, lst[i]))
```

This would output:

```
lst at 2 contains charlie
lst at 3 contains delta
```



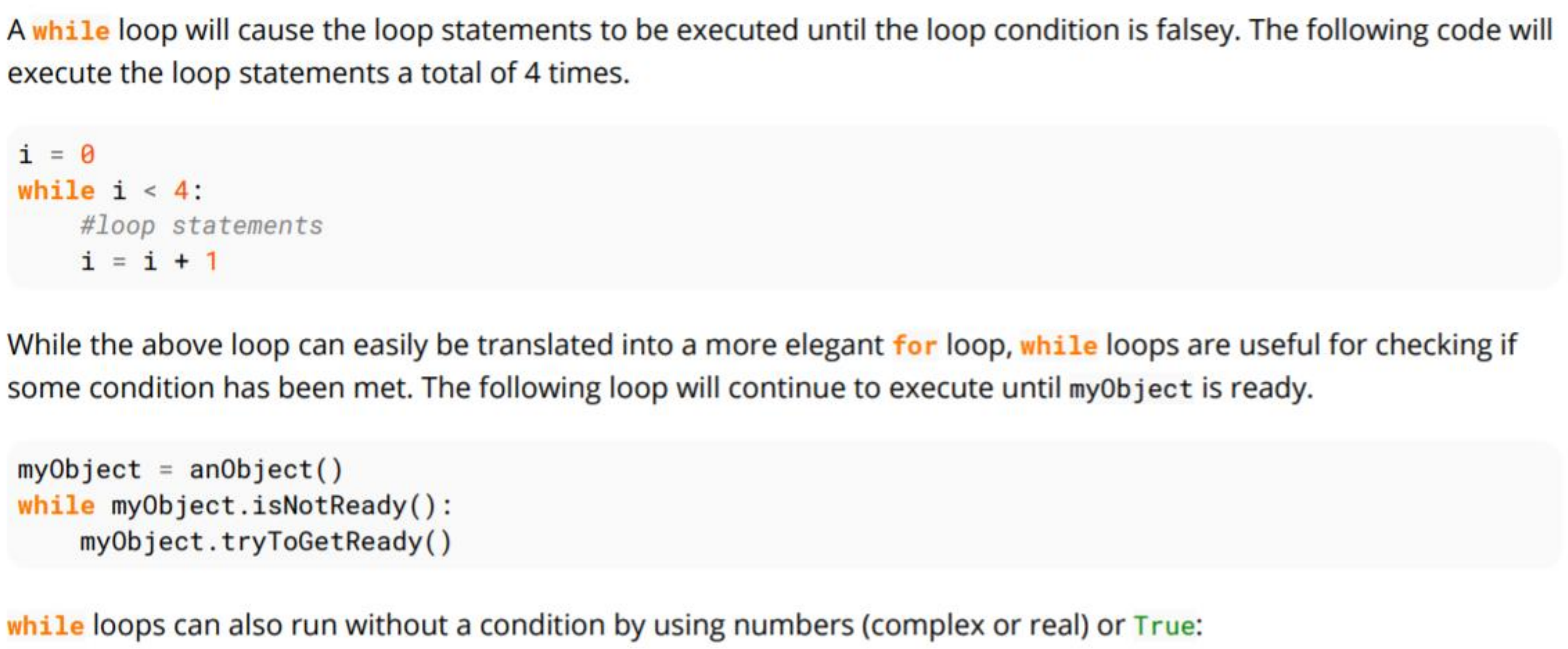
The list may also be sliced. The following slice notation goes from element at index 1 to the end with a step of 2. The two `for` loops give the same result.

```
for s in lst[1::2]:
    print(s)

for i in range(1, len(lst), 2):
    print(lst[i])
```

The above snippet outputs:

```
bravo
delta
```

While Loop



A while loop will cause the loop statements to be executed until the loop condition is falsey. The following code will execute the loop statements a total of 4 times.

```
i = 0
while i < 4:
    #loop statements
    i = i + 1
```

While the above loop can easily be translated into a more elegant for loop, while loops are useful for checking if some condition has been met. The following loop will continue to execute until myObject is ready.

```
myObject = anObject()
while myObject.isNotReady():
    myObject.tryToGetReady()
```

while loops can also run without a condition by using numbers (complex or real) or True:

========

```
count =5
while count:
   count = count-1
   print(count)
```

output

```
4

3

2

1

0
```

----

while loops can also run without a condition by using numbers (complex or real) or True:

```
while 5.8j:
    print(" ll")
```

output: run infinite

==========

```
while 5:
    print(" ll")
```

output: run infinite

If the condition is always true the while loop will run forever (infinite loop) **if it is not terminated by a break or return** statement or an exception

```
while True:
    print("infinite")
    break
```

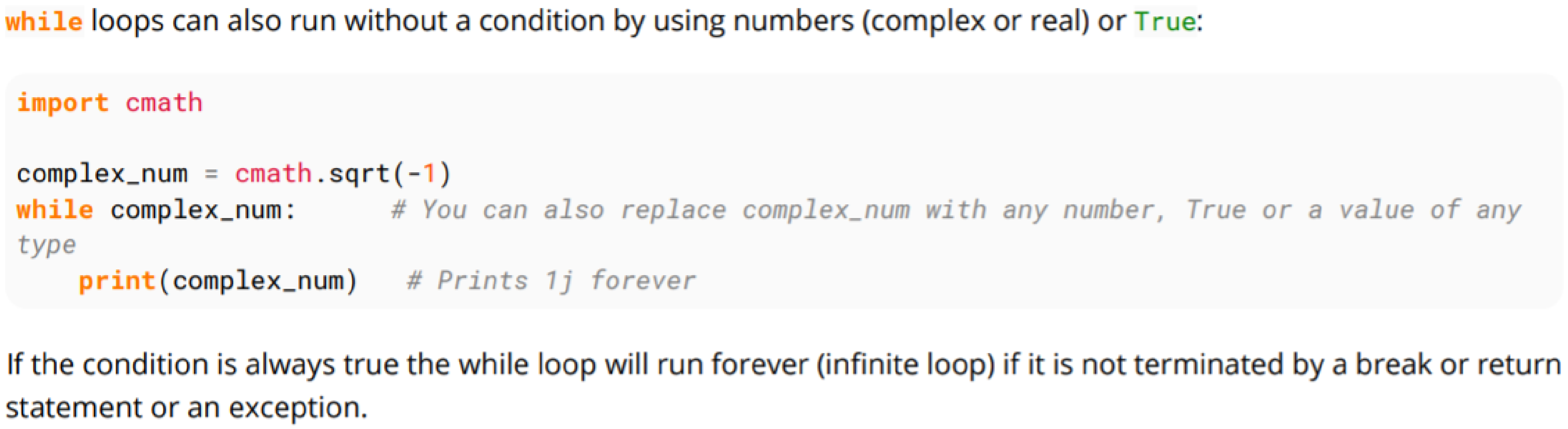
output

infinite # executed only once and then encounter with ‘break’ statement

----

Use ‘return’ to break the infintite loop in the fn

```
def fn():
    while True:
        print("infinite")
        return
fn()
output
infinite
```



`while` loops can also run without a condition by using numbers (complex or real) or `True`:

```
import cmath

complex_num = cmath.sqrt(-1)
while complex_num:      # You can also replace complex_num with any number, True or a value of any
type
    print(complex_num)   # Prints 1j forever
```

If the condition is always true the while loop will run forever (infinite loop) if it is not terminated by a break or return statement or an exception.

If the condition is always true , while loop will run forever (infinite loop)- if it is not terminated by a break or return (statement) or an exception

For example:

```
while loop_condition():
    ...
    if break_condition():
        break
    ...
```

is equivalent to:

```
# pseudocode

<<start>>:
if loop_condition():
    ...
    if break_condition():
        goto <<end>>
    ...
    goto <<start>>
```

```
<<end>>:
```

These remain equivalent if we attach an `else` clause to each of them.

For example: