school of ai

Python:
Data structures, control flow, OO Programming, Regular Expressions, System Programming

AAA-Python Edition

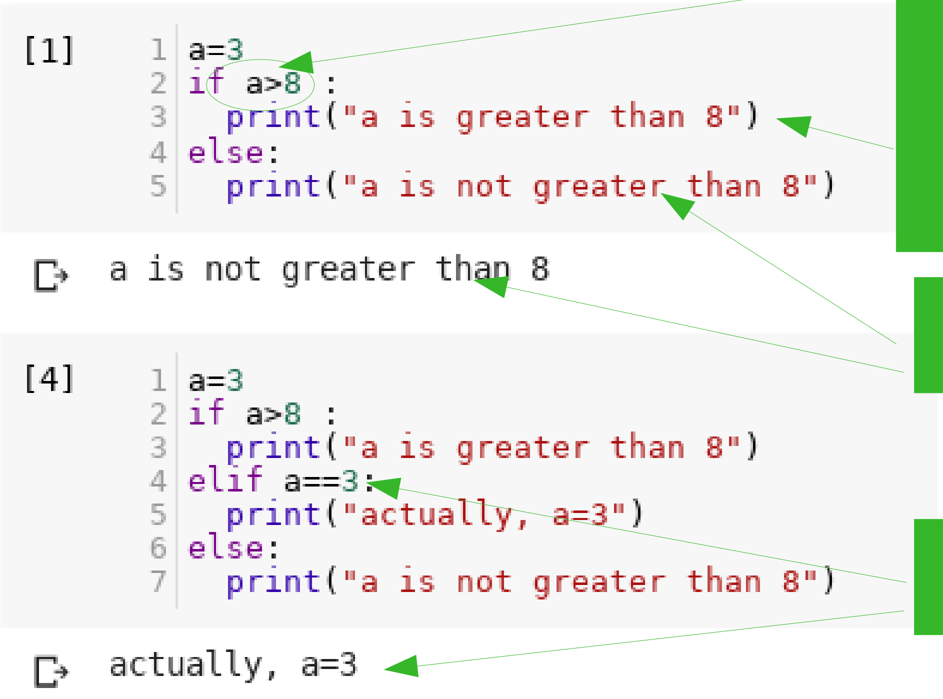
Plan

- 1- if / else , For, While
- 2- Lists, Tuples, List comprehensions
- 3- Dictionaries
- 4- Sets
- 5- Object Oriented Programming
- 6- Regular Expression
- 7- System Programming

1- 1- if / else , For, While

If / else

- These statements are used to **control** **which** block of code **to execute**:



[1]

```
a=3
if a>8 :
  print("a is greater than 8")
else:
  print("a is not greater than 8")
```

```
a is not greater than 8
```

[4]

```
a=3
if a>8 :
  print("a is greater than 8")
elif a==3:
  print("actually, a=3")
else:
  print("a is not greater than 8")
```

```
actually, a=3
```

If the “condition” is true
(the corresponding expression
Is Evaluated to True), then
the if “clause” is executed
(the if block)

The condition was false, so
The “else” clause was executed

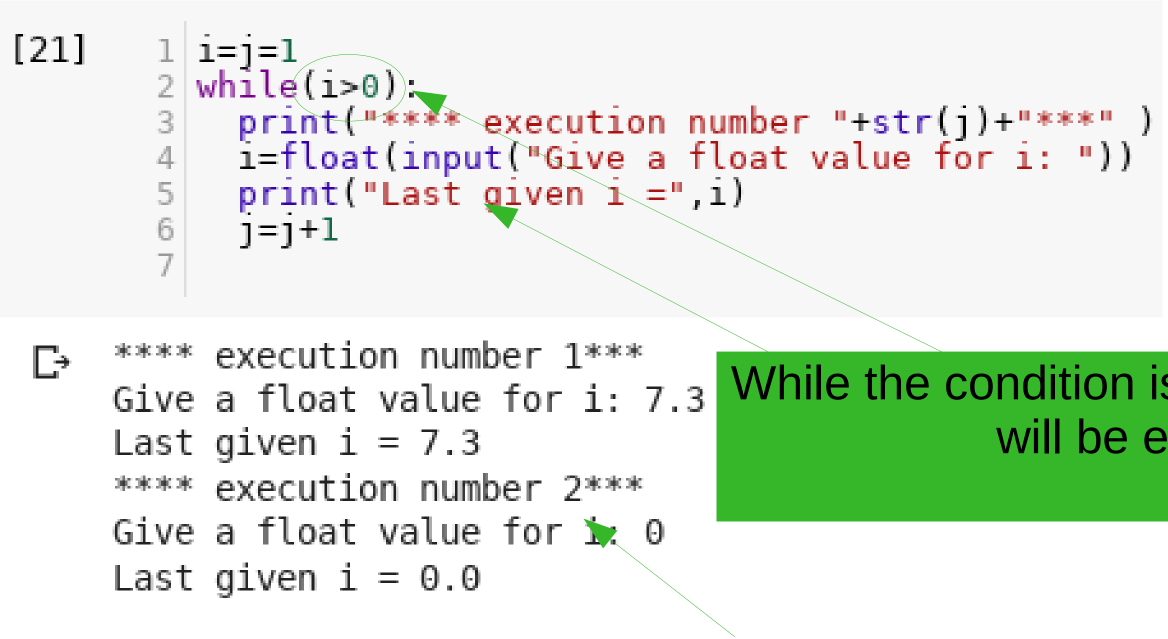
The “elif” clause is executed,
If its condition is true

[By Amina Delali]

1- 1- if / else , For, While

While

- This statement is used to **control how many times** a block of code has to be **executed**:



```
[21]
i=j=1
while(i>0):
  print("**** execution number "+str(j)+"***" )
  i=float(input("Give a float value for i: "))
  print("Last given i =",i)
  j=j+1
```

```
**** execution number 1***
Give a float value for i: 7.3
Last given i = 7.3
**** execution number 2***
Give a float value for i: 0
Last given i = 0.0
```

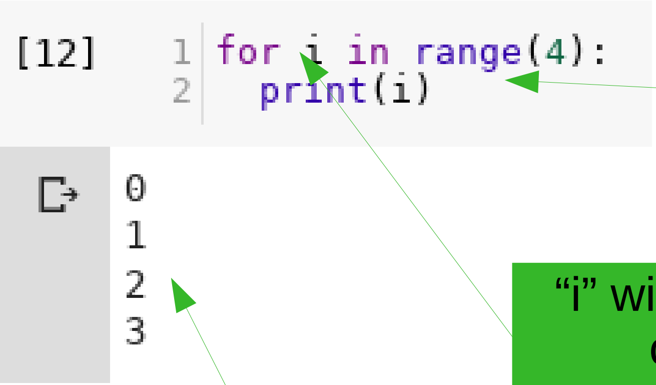
While the condition is true, the block code will be executed.

In this loop, the block has been executed 2 times

1- 1- if / else , For, While

For

- This statement is used to **execute** a block of code **a certain number of times**



```
[12]  for i in range(4):
        print(i)
```

```
0
1
2
3
```

This “range” function: will generate a range of numbers from “0” to “4-1”

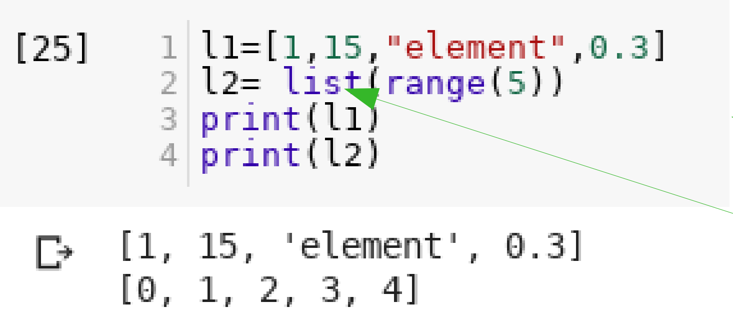
“i” will take its values from the numbers created by the ‘range’ function

This loop will be executed 4 times

2- Lists, Tuples,
List comprehensions

List

- A list is a **value** that contains **multiple values**.



```
[25]  l1=[1,15,"element",0.3]
      l2= list(range(5))
      print(l1)
      print(l2)
```

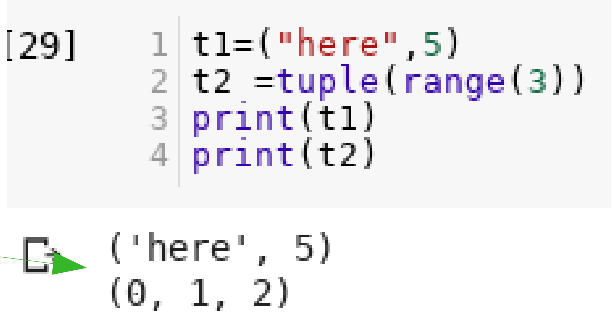
```
[1, 15, 'element', 0.3]
[0, 1, 2, 3, 4]
```

l1 and l2 are lists

Function “list” to create a list

Tuple

A a tuple is a **list** of **immutable values**.



```
[29]  t1=("here",5)
      t2 =tuple(range(3))
      print(t1)
      print(t2)
```

```
('here', 5)
(0, 1, 2)
```

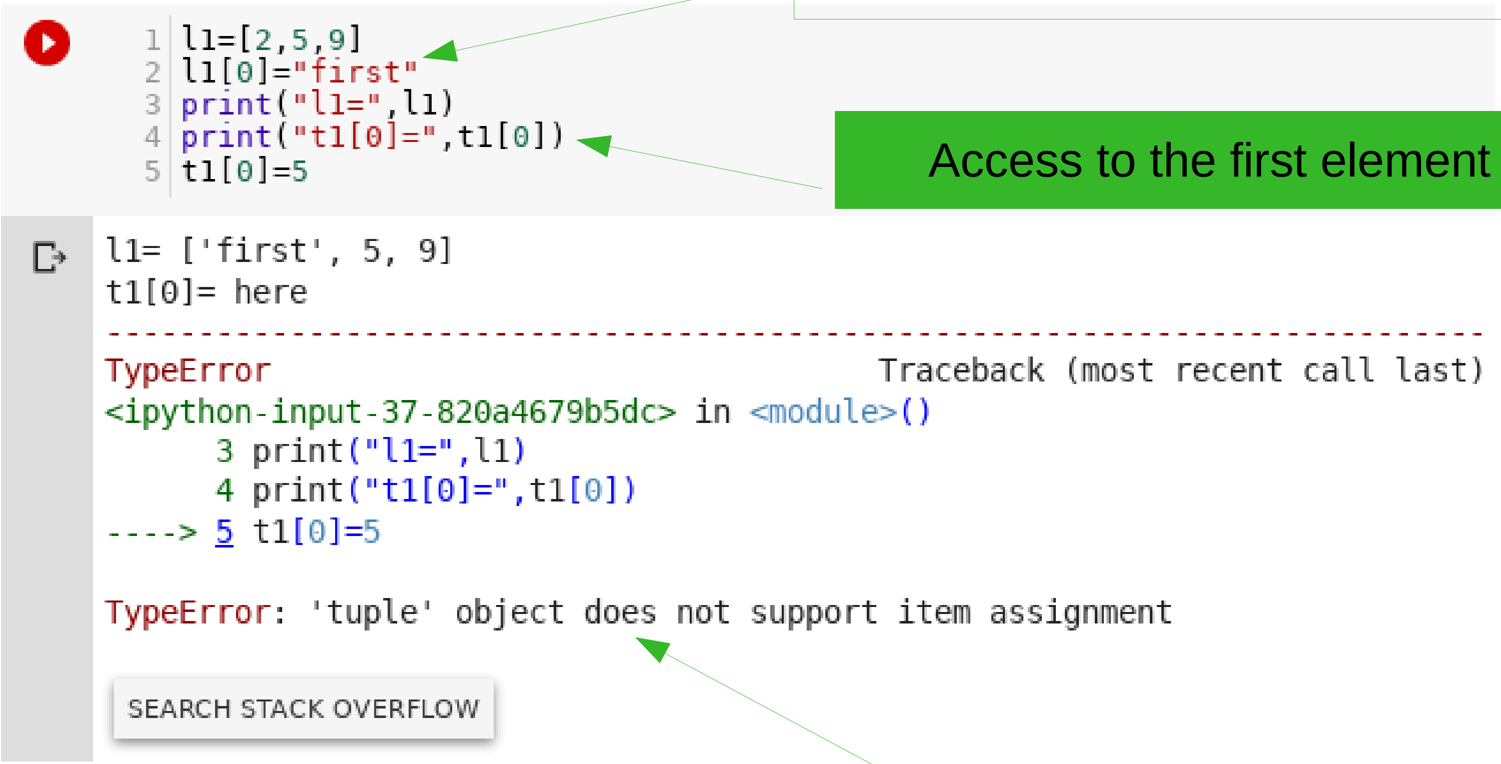
t1 and t2 are tuples

[By Amina Delali]

Lists and tuples (suite)

Modifying the value of the element of index 0 (first element)

Access to the first element



```
l1=[2,5,9]
l1[0]="first"
print("l1=",l1)
print("t1[0]=",t1[0])
t1[0]=5
```

```
l1= ['first', 5, 9]
t1[0]= here
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-37-820a4679b5dc> in <module>()
      3 print("l1=",l1)
      4 print("t1[0]=",t1[0])
----> 5 t1[0]=5

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

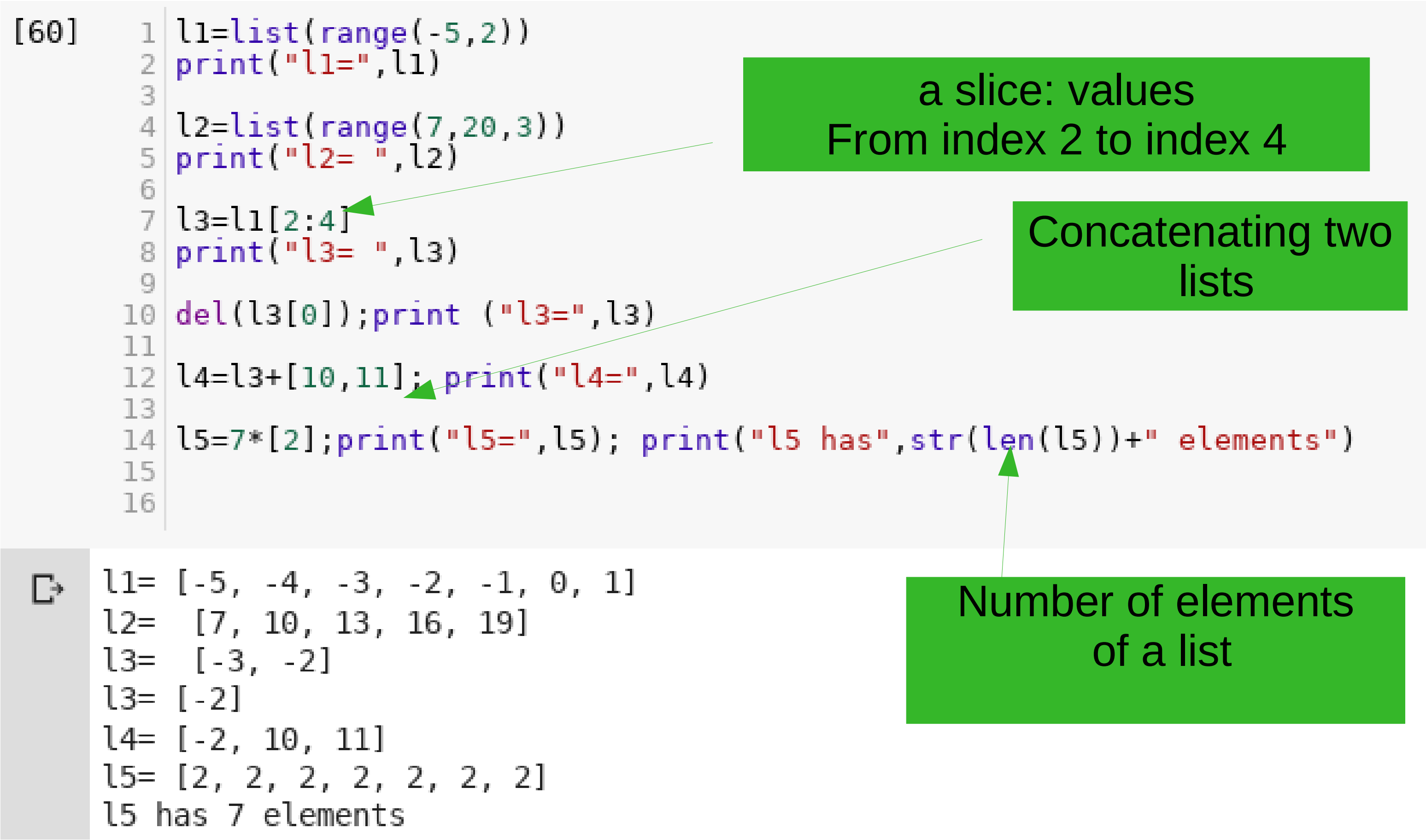
Trying to modify the value of an element of a tuple

[By Amina Delali]

school of a

2- Lists, Tuples,
List comprehensions

Some operations with lists



```
l1=list(range(-5,2))
print("l1=",l1)

l2=list(range(7,20,3))
print("l2= ",l2)

l3=l1[2:4]
print("l3= ",l3)

del(l3[0]);print ("l3=",l3)

l4=l3+[10,11]; print("l4=",l4)

l5=7*[2];print("l5=",l5); print("l5 has",str(len(l5))+" elements")
```

```
l1= [-5, -4, -3, -2, -1, 0, 1]
l2=  [7, 10, 13, 16, 19]
l3=  [-3, -2]
l3= [-2]
l4= [-2, 10, 11]
l5= [2, 2, 2, 2, 2, 2, 2]
l5 has 7 elements
```

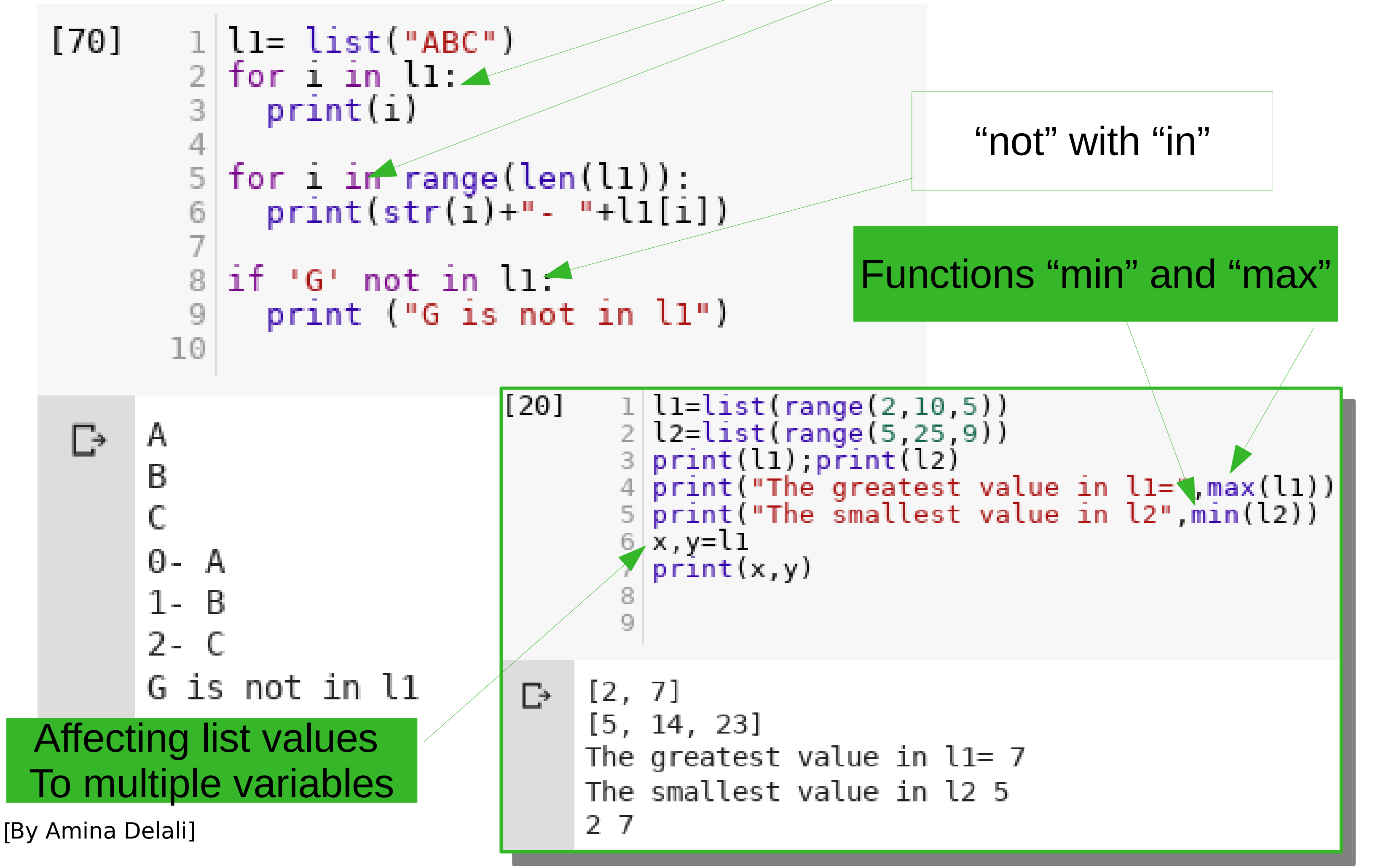
a slice: values
From index 2 to index 4

Concatenating two lists

Number of elements of a list

[By Amina Delali]

Some operations with lists (suite)



```
[70]
l1= list("ABC")
for i in l1:
  print(i)

for i in range(len(l1)):
  print(str(i)+"-  "+l1[i])

if 'G' not in l1:
  print ("G is not in l1")
```

```
A
B
C
0-  A
1-  B
2-  C
G is not in l1
```

Iterate through list

“not” with “in”

Functions “min” and “max”

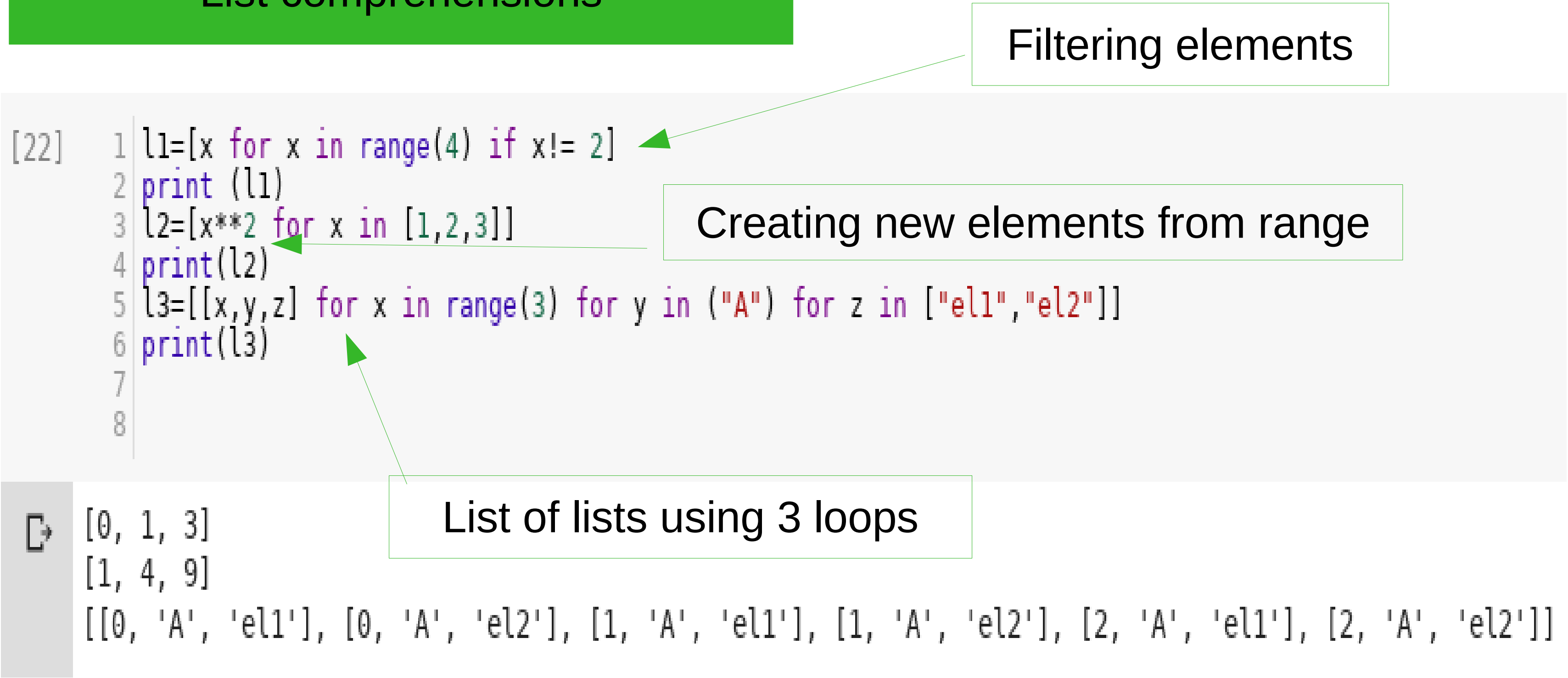
```
[20]
l1=list(range(2,10,5))
l2=list(range(5,25,9))
print(l1);print(l2)
print("The greatest value in l1=",max(l1))
print("The smallest value in l2",min(l2))
x,y=l1
print(x,y)
```

```
[2, 7]
[5, 14, 23]
The greatest value in l1= 7
The smallest value in l2 5
2 7
```

Affecting list values
To multiple variables

[By Amina Delali]

List comprehensions



[22]

```
l1=[x for x in range(4) if x!= 2]
print (l1)
l2=[x**2 for x in [1,2,3]]
print(l2)
l3=[[x,y,z] for x in range(3) for y in ("A") for z in ["el1","el2"]]
print(l3)
```

```
[0, 1, 3]
[1, 4, 9]
[[0, 'A', 'el1'], [0, 'A', 'el2'], [1, 'A', 'el1'], [1, 'A', 'el2'], [2, 'A', 'el1'], [2, 'A', 'el2']]
```

Filtering elements

Creating new elements from range

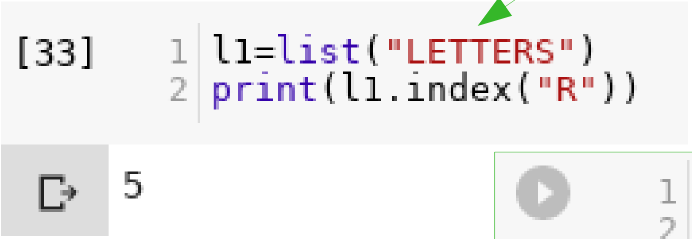
List of lists using 3 loops

2- Lists, Tuples,
List comprehensions

List methods

- A list has some methods. We will talk about methods later.

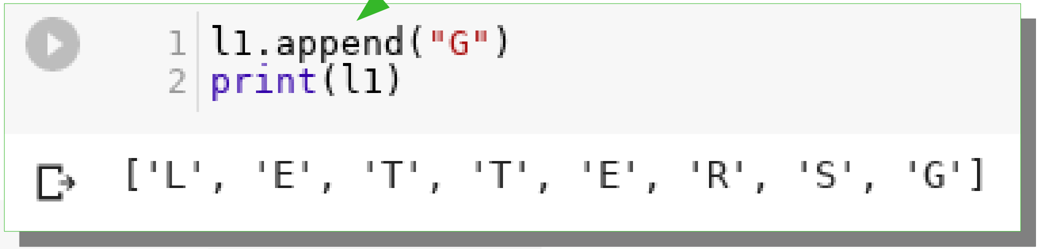
Finding an element in a list



```
[33]  l1=list("LETTERS")
      print(l1.index("R"))
```

```
5
```

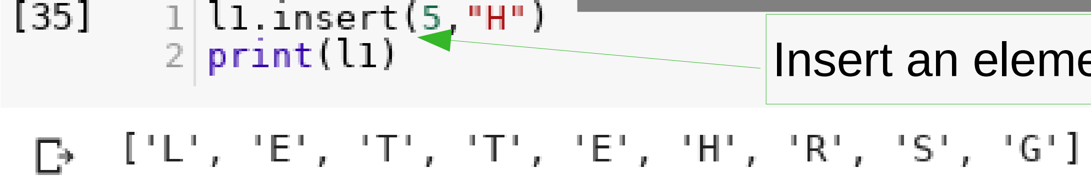
Add an element to the end of a list



```
l1.append("G")
print(l1)
```

```
['L', 'E', 'T', 'T', 'E', 'R', 'S', 'G']
```

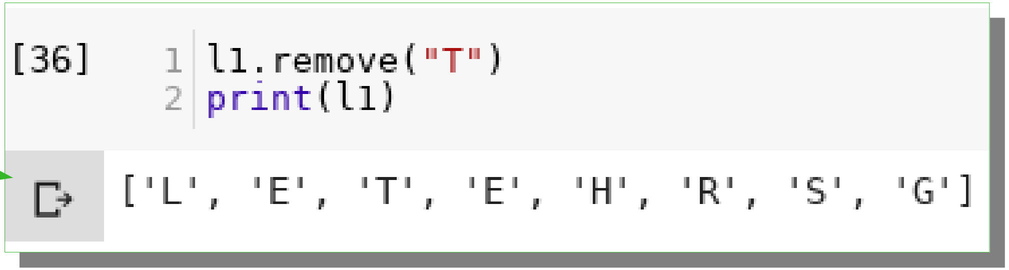
Insert an element at a certain position



```
[35]  l1.insert(5,"H")
      print(l1)
```

```
['L', 'E', 'T', 'T', 'E', 'H', 'R', 'S', 'G']
```

Remove an element from a list



```
[36]  l1.remove("T")
      print(l1)
```

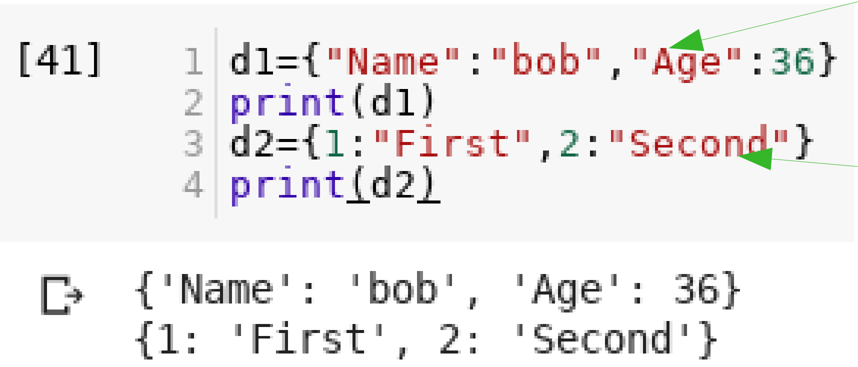
```
['L', 'E', 'T', 'E', 'H', 'R', 'S', 'G']
```

[By Amina Delali]

3- Dictionaries

Dictionaries

- A **dictionary** is a list of values with corresponding **keys**

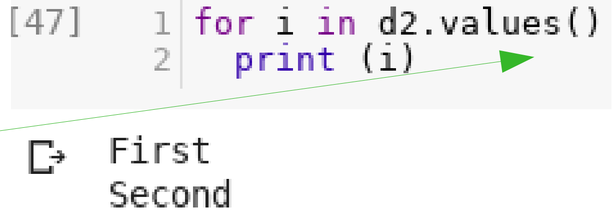


```
[41]  d1={"Name":"bob","Age":36}
      print(d1)
      d2={1:"First",2:"Second"}
      print(d2)
```

```
{'Name': 'bob', 'Age': 36}
{1: 'First', 2: 'Second'}
```

key

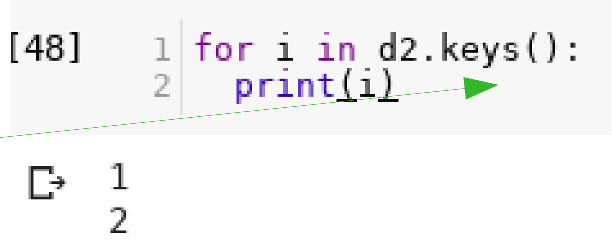
Value



```
[47]  for i in d2.values()
        print (i)
```

```
First
Second
```

Method that returns the dictionary values



```
[48]  for i in d2.keys():
        print(i)
```

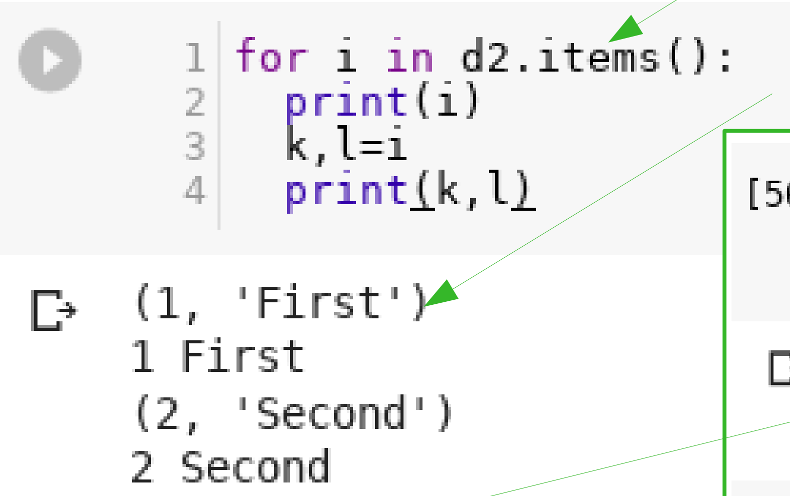
```
1
2
```

Method that returns the dictionary keys

[By Amina Delali]

3- Dictionaries

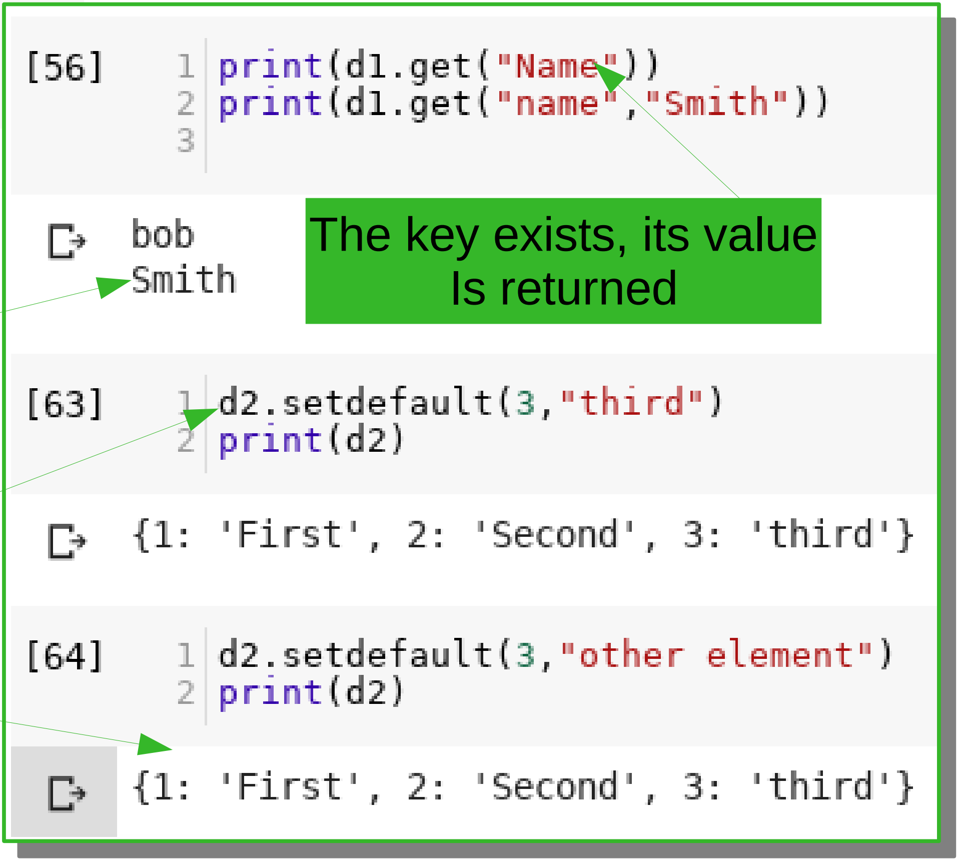
Dictionaries (suite)



```
for i in d2.items():
  print(i)
  k,l=i
  print(k,l)
```

```
(1, 'First')
1 First
(2, 'Second')
2 Second
```

Method that returns the dictionary items: pairs of key,value



```
[56]
print(d1.get("Name"))
print(d1.get("name","Smith"))
```

```
bob
Smith
```

```
[63]
d2.setdefault(3,"third")
print(d2)
```

```
{1: 'First', 2: 'Second', 3: 'third'}
```

```
[64]
d2.setdefault(3,"other element")
print(d2)
```

```
{1: 'First', 2: 'Second', 3: 'third'}
```

The key exists, its value Is returned

The key doesn't exist so a default value is given

A key is created with a default value

The key already exists, So no other key is created

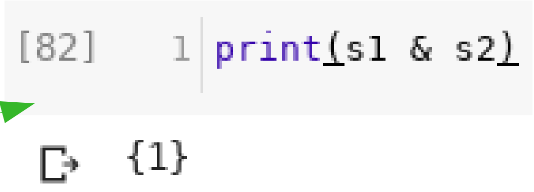
[By]

4- Sets

Sets

- A **set** is a list of **distinct** values

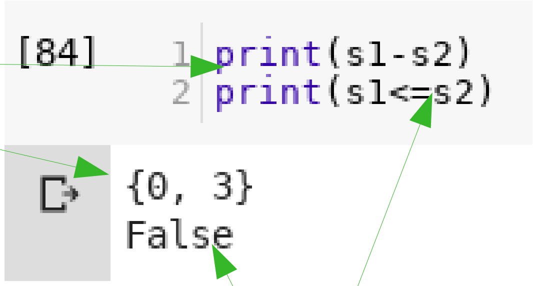
Intersection between s1 and s2



```
[82]  print(s1 & s2)
```

```
{1}
```

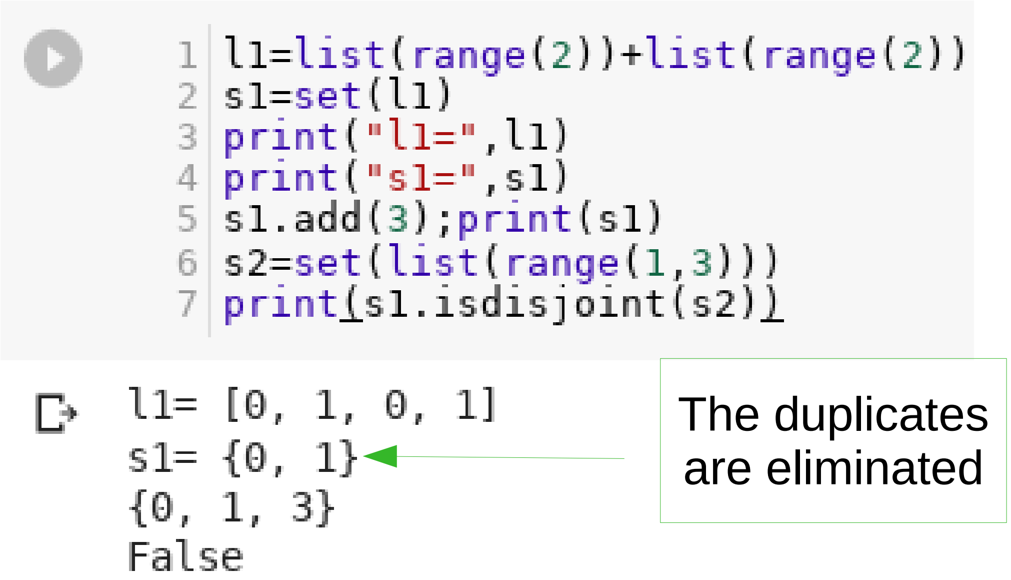
Elements in S1 and not in s2



```
[84]  print(s1-s2)
      print(s1<=s2)
```

```
{0, 3}
False
```

Is s1 a subset of s2



```
l1=list(range(2))+list(range(2))
s1=set(l1)
print("l1=",l1)
print("s1=",s1)
s1.add(3);print(s1)
s2=set(list(range(1,3)))
print(s1.isdisjoint(s2))
```

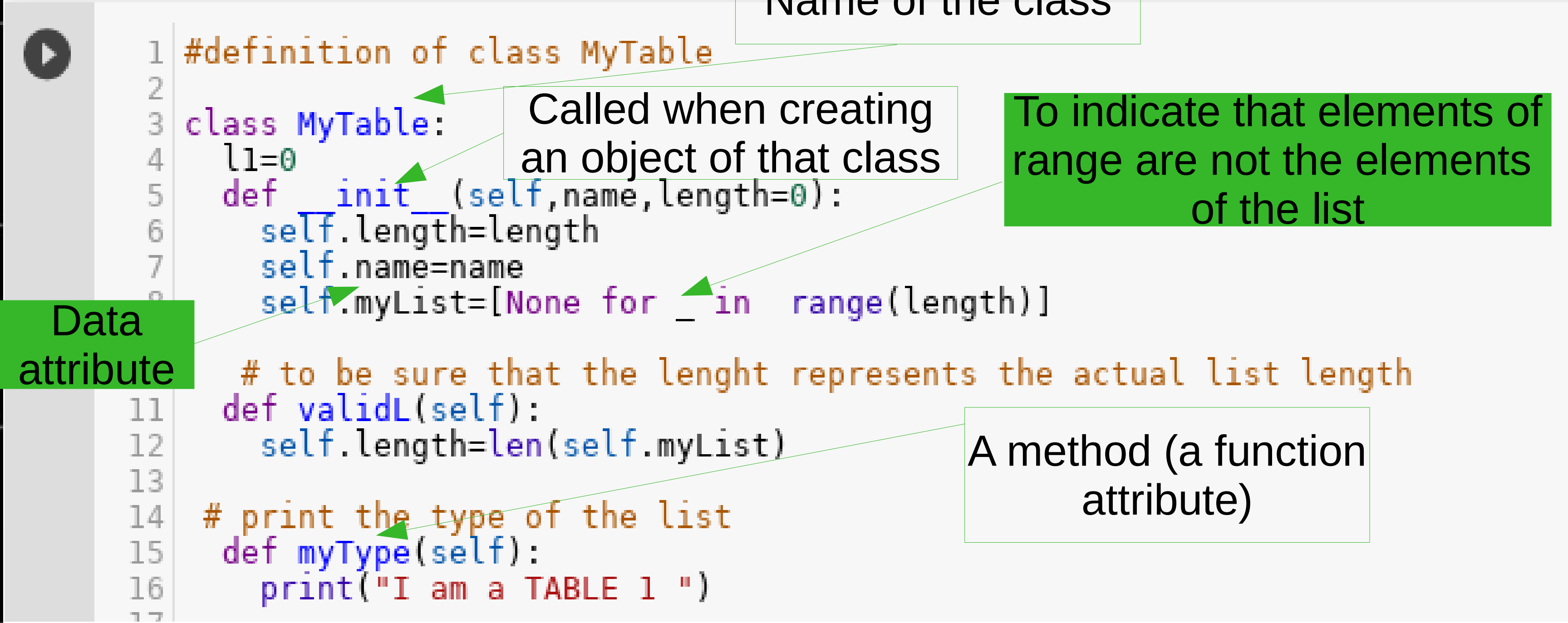
```
l1= [0, 1, 0, 1]
s1= {0, 1}
{0, 1, 3}
False
```

The duplicates are eliminated

[By]

Classes

- In Python, we can define “**classes**”: a defined prototype that **encapsulates data** and the **functions** to operate on them.
- An instance of a **class** is called an “**object”.** We **already** used **objects** when we **used lists**, **sets** and **dictionaries.**



```
#definition of class MyTable

class MyTable:
  l1=0
  def __init__(self,name,length=0):
    self.length=length
    self.name=name
    self.myList=[None for _ in  range(length)]

   # to be sure that the lenght represents the actual list length
  def validL(self):
    self.length=len(self.myList)

 # print the type of the list
  def myType(self):
    print("I am a TABLE 1 ")
```

Name of the class

Called when creating an object of that class

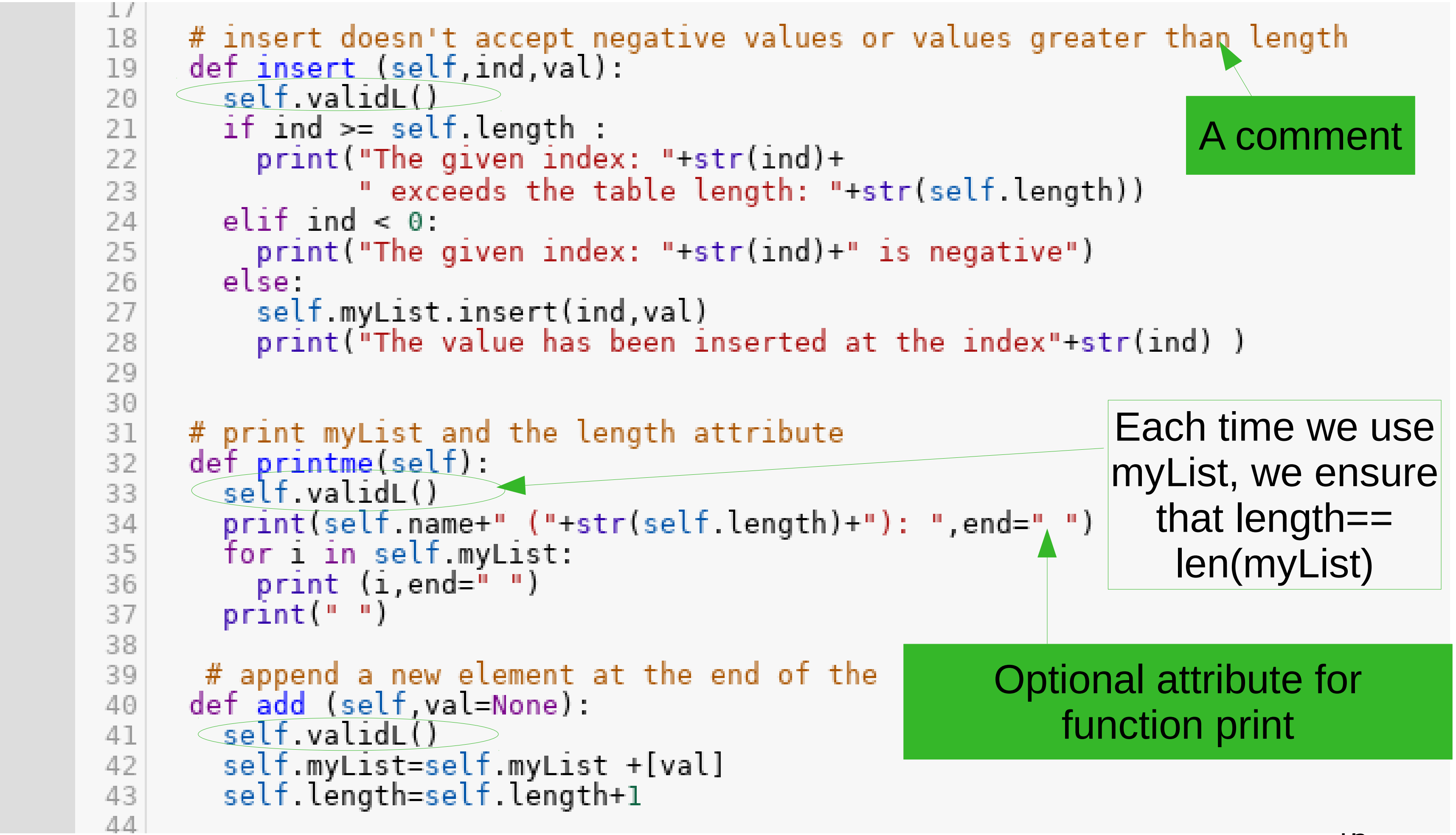
To indicate that elements of range are not the elements of the list

Data attribute

A method (a function attribute)

[By]

Classes



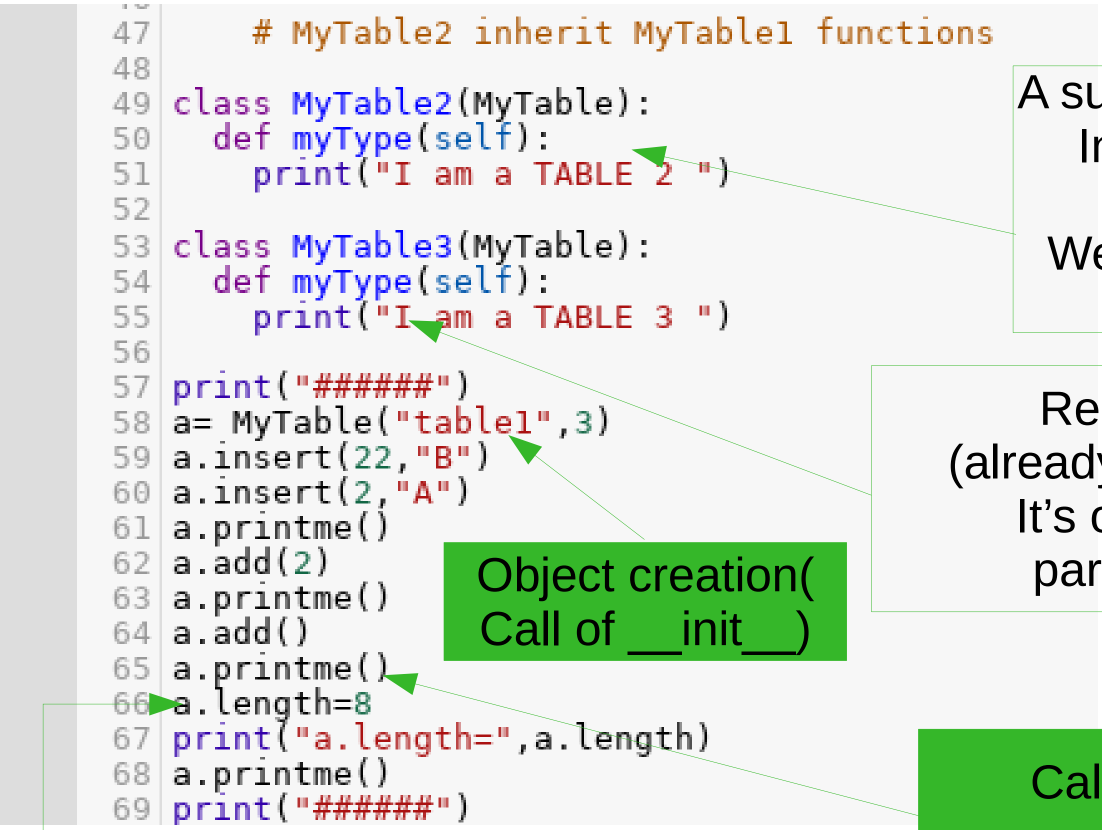
```
 # insert doesn't accept negative values or values greater than length
 def insert (self,ind,val):
   self.validL()
   if ind >= self.length :
     print("The given index: "+str(ind)+
           " exceeds the table length: "+str(self.length))
   elif ind < 0:
     print("The given index: "+str(ind)+" is negative")
   else:
     self.myList.insert(ind,val)
     print("The value has been inserted at the index"+str(ind) )


 # print myList and the length attribute
 def printme(self):
   self.validL()
   print(self.name+" ("+str(self.length)+"): ",end=" ")
   for i in self.myList:
     print (i,end=" ")
   print(" ")

  # append a new element at the end of the
 def add (self,val=None):
   self.validL()
   self.myList=self.myList +[val]
   self.length=self.length+1
```

A comment

Each time we use myList, we ensure that length== len(myList)

Optional attribute for function print

Classes



```
    # MyTable2 inherit MyTable1 functions

class MyTable2(MyTable):
  def myType(self):
    print("I am a TABLE 2 ")

class MyTable3(MyTable):
  def myType(self):
    print("I am a TABLE 3 ")

print("######")
a= MyTable("table1",3)
a.insert(22,"B")
a.insert(2,"A")
a.printme()
a.add(2)
a.printme()
a.add()
a.printme()
a.length=8
print("a.length=",a.length)
a.printme()
print("######")
```

A subclass of class MyTable
Inherits all its methods
and data attributes:
We can use them without
redefining them.

Redefine “myType”
(already defined in MyTable)
It’s overriding myType
parent class method

Object creation(
Call of __init__)

Call of a method

Access of a data attribute

[By Amina Delali]

Classes

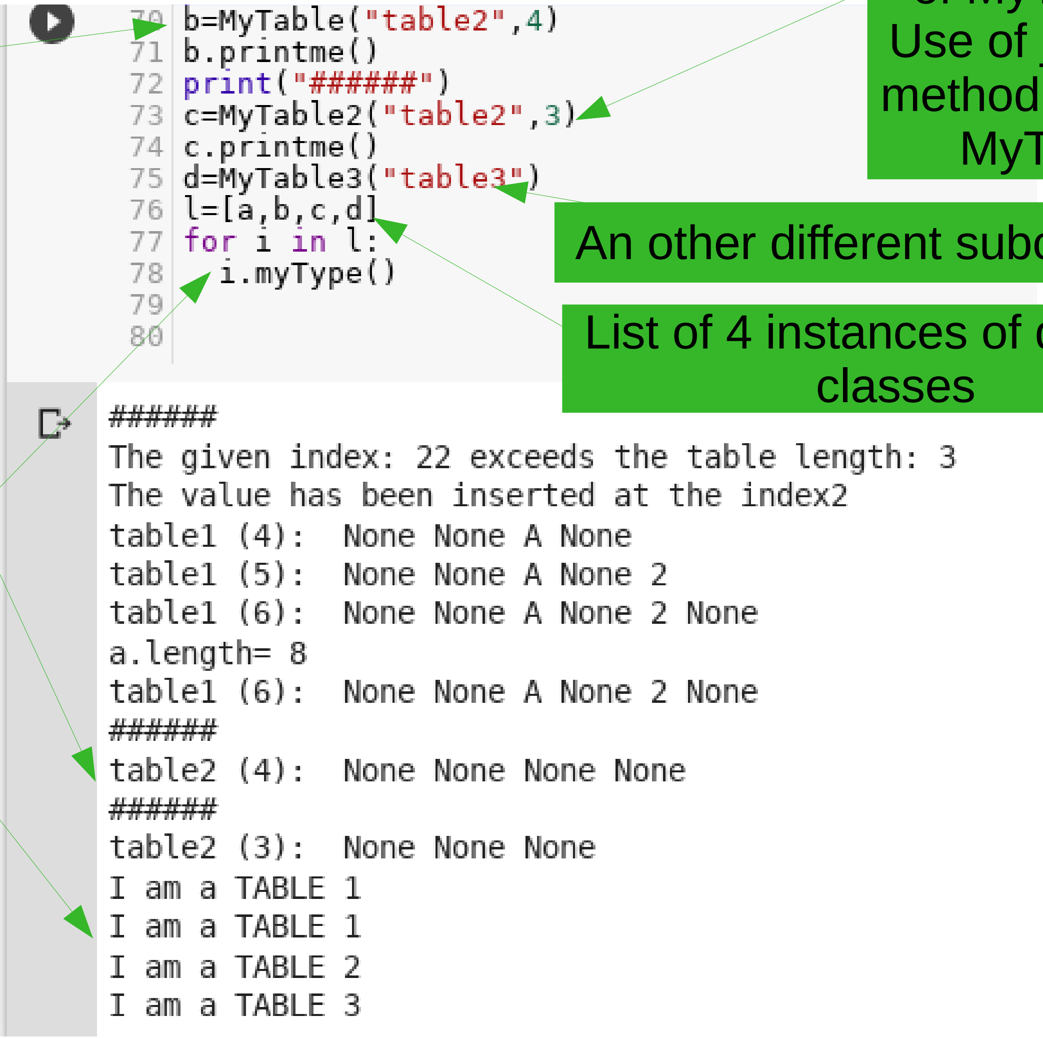
Same class, different values

c an instance of MyTable2: Use of __init__ method of class MyTable

An other different subclass

List of 4 instances of different classes

Call of the same Method had different results == Polymorphism



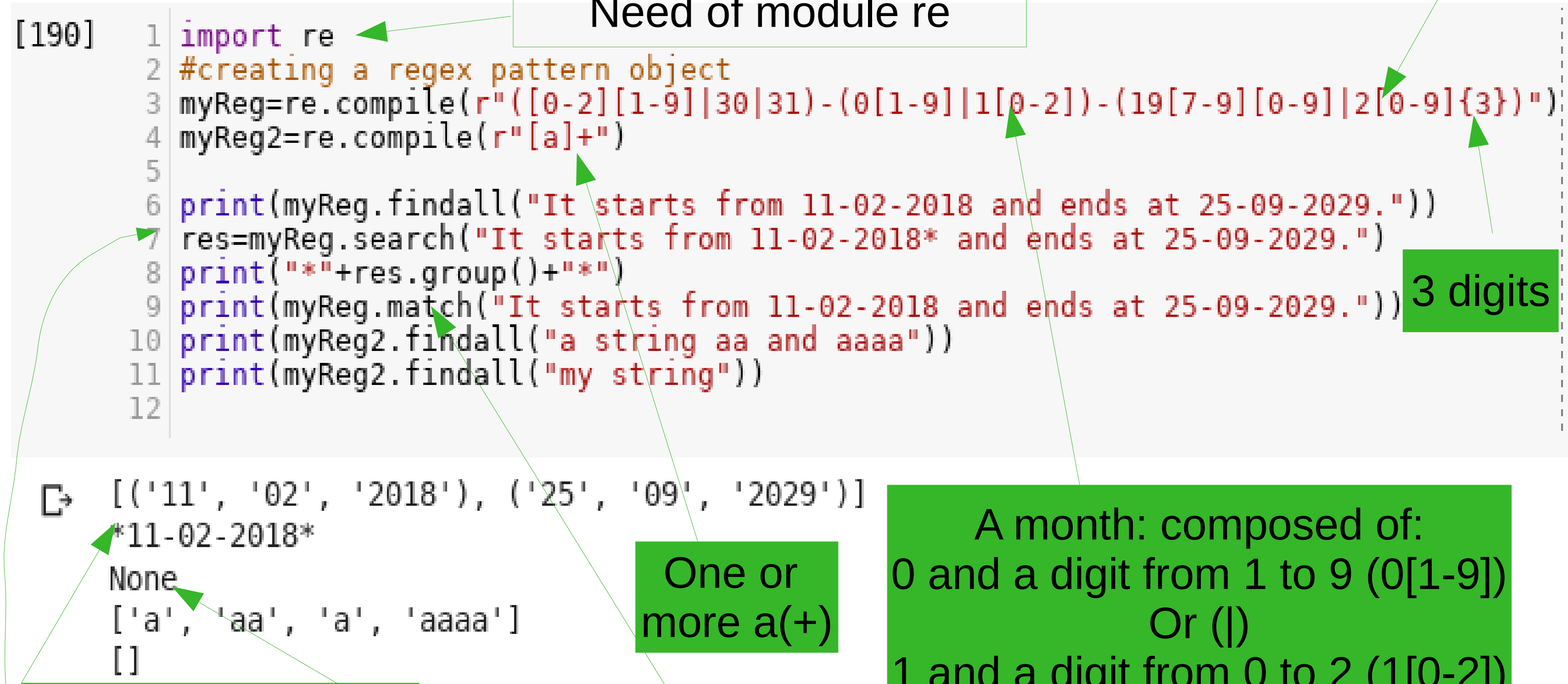
```
b=MyTable("table2",4)
b.printme()
print("######")
c=MyTable2("table2",3)
c.printme()
d=MyTable3("table3")
l=[a,b,c,d]
for i in l:
    i.myType()
```

```
######
The given index: 22 exceeds the table length: 3
The value has been inserted at the index2
table1 (4):  None None A None
table1 (5):  None None A None 2
table1 (6):  None None A None 2 None
a.length= 8
table1 (6):  None None A None 2 None
######
table2 (4):  None None None None
######
table2 (3):  None None None
I am a TABLE 1
I am a TABLE 1
I am a TABLE 2
I am a TABLE 3
```

[By Amina Delali]

Regular expressions

- A regular expression is a **description** of **pattern** of **text**



```
[190]
import re
#creating a regex pattern object
myReg=re.compile(r"([0-2][1-9]|30|31)-(0[1-9]|1[0-2])-(19[7-9][0-9]|2[0-9]{3})")
myReg2=re.compile(r"[a]+")

print(myReg.findall("It starts from 11-02-2018 and ends at 25-09-2029."))
res=myReg.search("It starts from 11-02-2018* and ends at 25-09-2029.")
print("*"+res.group()+"*")
print(myReg.match("It starts from 11-02-2018 and ends at 25-09-2029."))
print(myReg2.findall("a string aa and aaaa"))
print(myReg2.findall("my string"))
```

```
[('11', '02', '2018'), ('25', '09', '2029')]
*11-02-2018*
None
['a', 'aa', 'a', 'aaaa']
[]
```

Need of module re

A year from 1970 to 2999

3 digits

One or more a(+)

A month: composed of:
0 and a digit from 1 to 9 (0[1-9])
Or (|)
1 and a digit from 0 to 2 (1[0-2])

Search for the first date

Search a pattern at the start

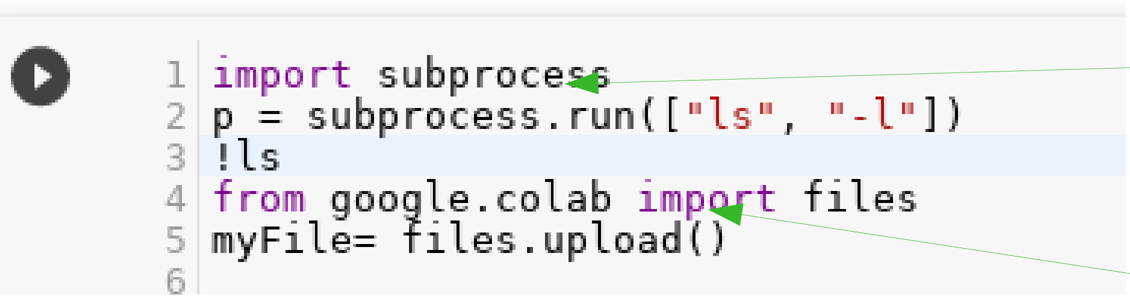
[By Amina Delali]

7- System programming

System Programming

- We will **focus** on system programming in **Colab.**
- Some Python functions can be **simply** done on **Colab.**

- For example the **bash commands**: they can be used as they are by **prefixing** them by **“!”** or **“%”**: !ls, !mkdir, !git, !pip, %cd … etc

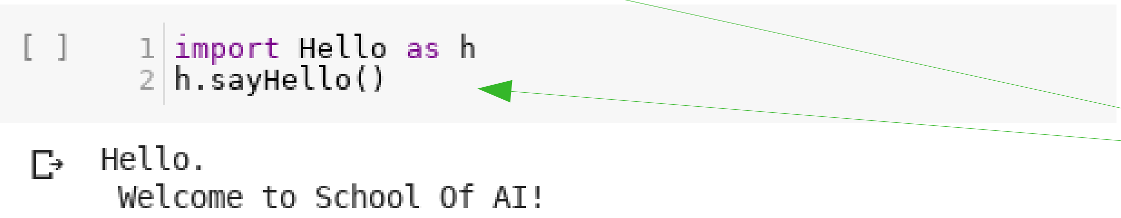


```
import subprocess
p = subprocess.run(["ls", "-l"])
!ls
from google.colab import files
myFile= files.upload()

```

Running ‘ls’ using subprocess

Import a local file

Browse...
Hello.py
Cancel upload



```
[ ]  import Hello as h
     h.sayHello()
```

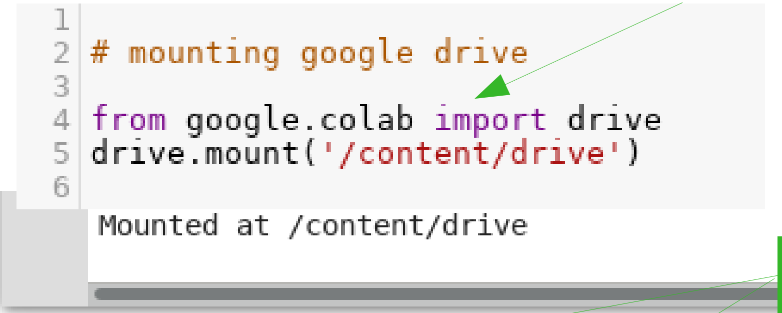
```
Hello.
 Welcome to School Of AI!
```

After selecting the Script file, import it school of a

7- System programming

System Programming

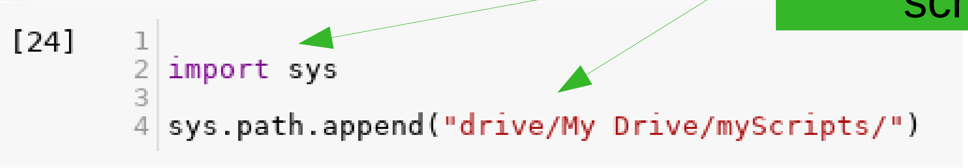
- Second way of using a **user** defined **script**:
- We have to **mount Google Drive**



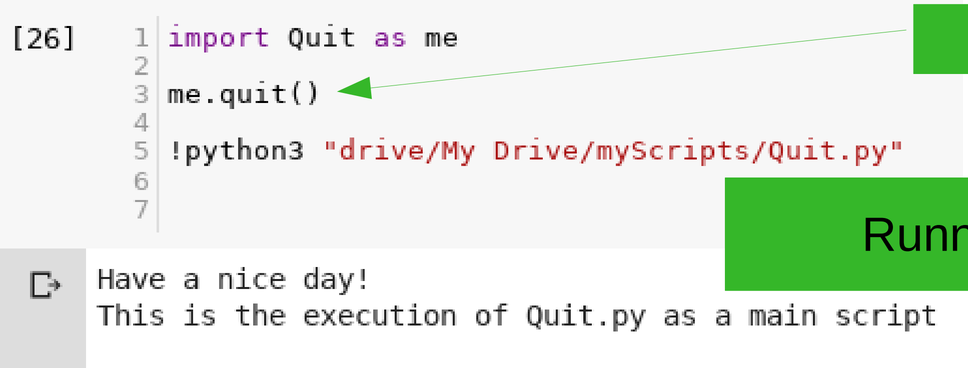
```
# mounting google drive

from google.colab import drive
drive.mount('/content/drive')

```

```
Mounted at /content/drive
```

To avoid using the full path of the script, use sys.path.append



```
[24]
import sys

sys.path.append("drive/My Drive/myScripts/")
```



```
[26]
import Quit as me

me.quit()

!python3 "drive/My Drive/myScripts/Quit.py"

```

```
Have a nice day!
This is the execution of Quit.py as a main script
```

Using a defined function

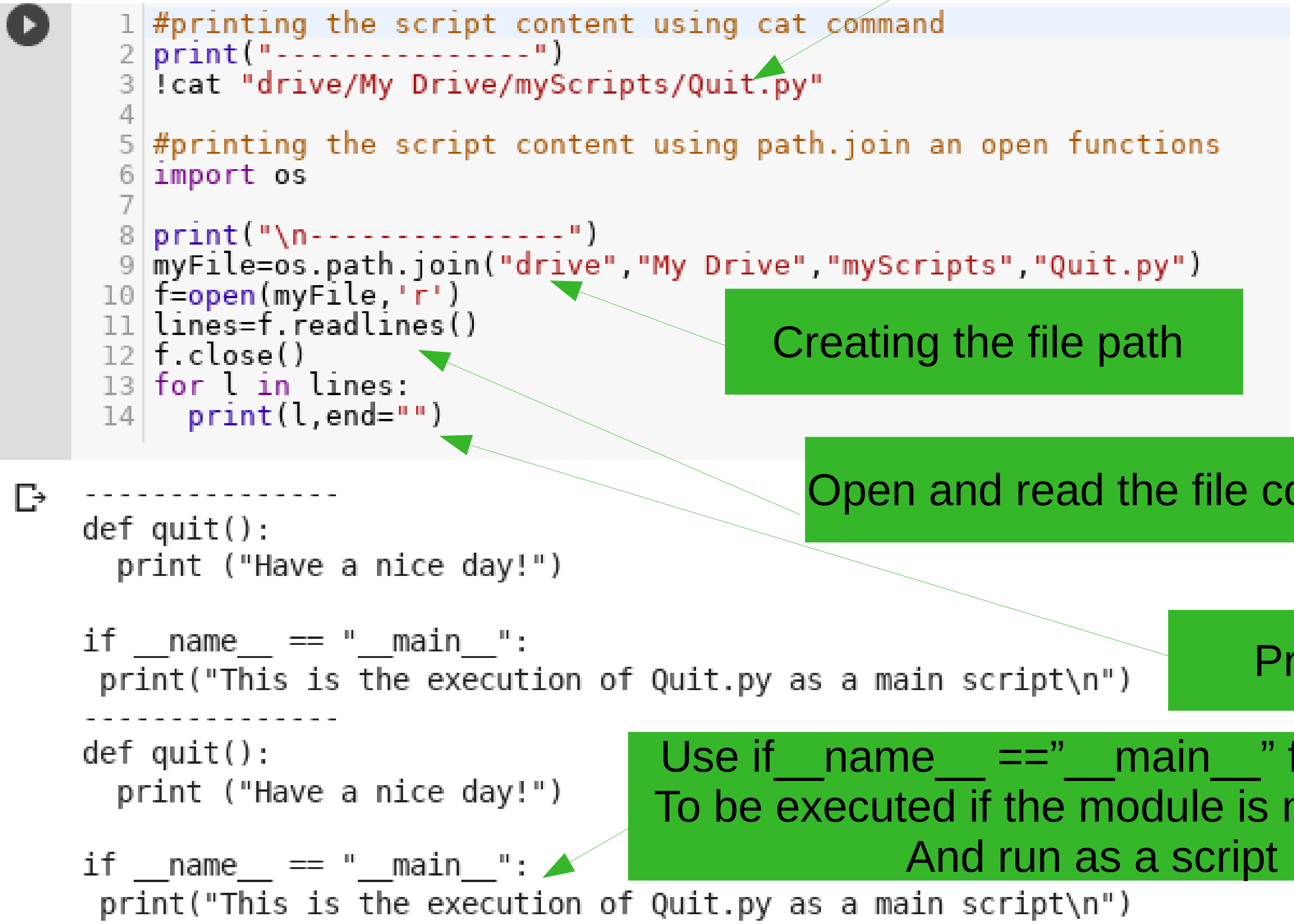
Running the file as a script

[By Amina Delali]

7- System programming

System Programming

Using ‘!cat’ to print the content of the file



```
#printing the script content using cat command
print("---------------")
!cat "drive/My Drive/myScripts/Quit.py"

#printing the script content using path.join an open functions
import os

print("\n---------------")
myFile=os.path.join("drive","My Drive","myScripts","Quit.py")
f=open(myFile,'r')
lines=f.readlines()
f.close()
for l in lines:
  print(l,end="")
```

```
---------------
def quit():
  print ("Have a nice day!")

if __name__ == "__main__":
 print("This is the execution of Quit.py as a main script\n")
---------------
def quit():
  print ("Have a nice day!")

if __name__ == "__main__":
 print("This is the execution of Quit.py as a main script\n")
```

Creating the file path

Open and read the file content into a list

Print the list

Use if__name__ ==”__main__” for the code
To be executed if the module is not imported
And run as a script

[By Amina Delali]

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Thank you!

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