VNUHCM - UNIVERSITY OF SCIENCE
FACULTY OF INFORMATION TECHNOLOGY

University of Science - VNU-HCM
Faculty of Information Science
Department of Computer Science

MTH083 - Advanced Programming for Artificial Intelligence

Slot 04-
String – Text File

Advisor:

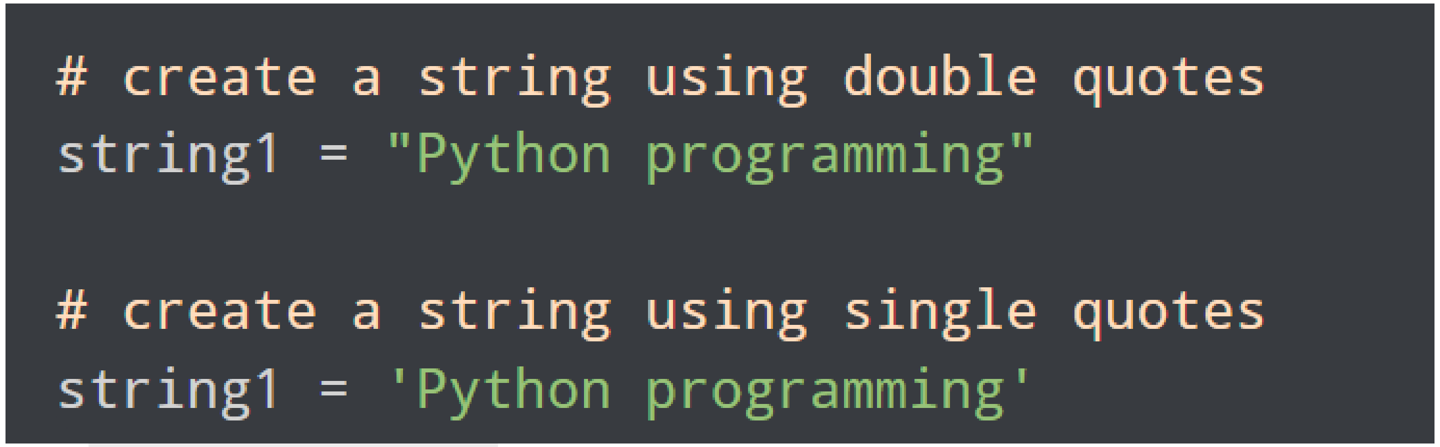
Dr. Nguyễn Tiến Huy

Dr. Lê Thanh Tùng

Part 1: String

String

- A string is a sequence of characters
- Using single quotes or double quotes to represent a string in Python



```python
# create a string using double quotes
string1 = "Python programming"

# create a string using single quotes
string1 = 'Python programming'
```

Access String Characters

- Indexing: positive and negative index (like List)

```python
greet = 'hello'

# access 1st index element
print(greet[1]) # "e"
```

```python
greet = 'hello'

# access 4th last element
print(greet[-4]) # "e"
```

- Slicing

```python
greet = 'Hello'

# access character from 1st index to 3rd index
print(greet[1:4])  # "ell"
```

Strings are immutable

- That means the characters of a string cannot be changed

```python
message = 'Hola Amigos'
message[0] = 'H'
print(message)
```

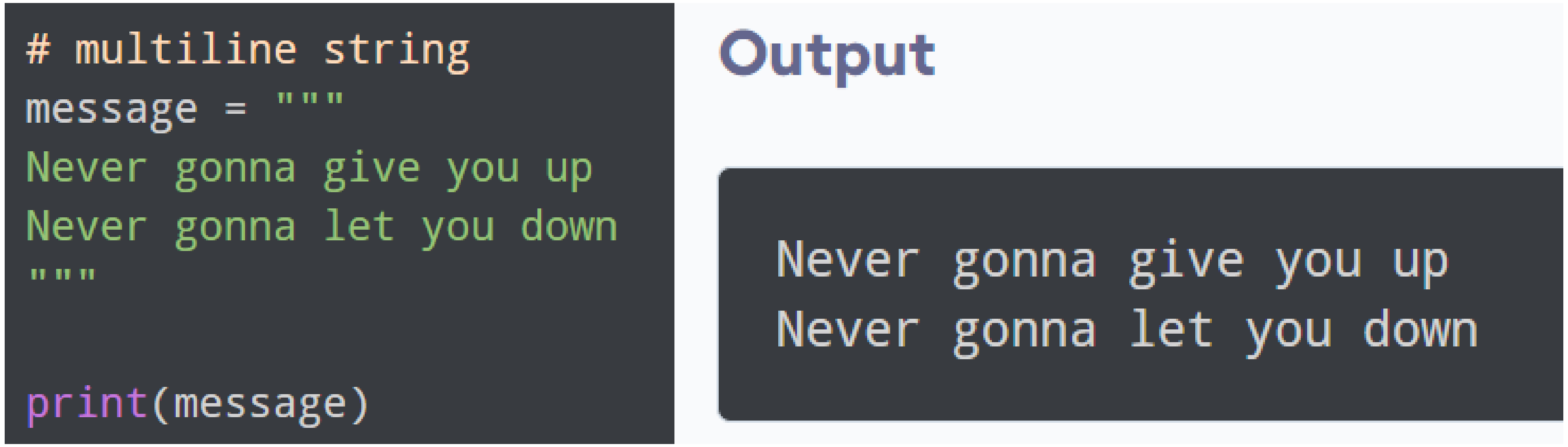
```
Traceback (most recent call last):
  File "<string>", line 2, in <module>
TypeError: 'str' object does not support item assignment
```

- However, we can assign the variable name to a new string

```python
message = 'Hola Amigos'

# assign new string to message variable
message = 'Hello Friends'

prints(message); # prints "Hello Friends"
```

Multiline String

- We can also create a multiline string in Python by using triple quotes



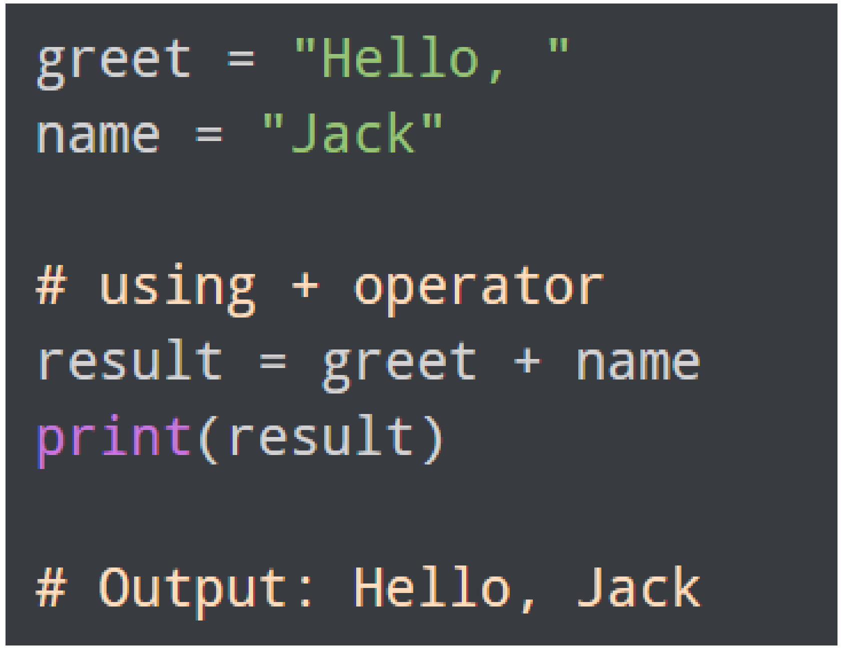
```python
# multiline string
message = """
Never gonna give you up
Never gonna let you down
"""

print(message)
```

Output

```
Never gonna give you up
Never gonna let you down
```

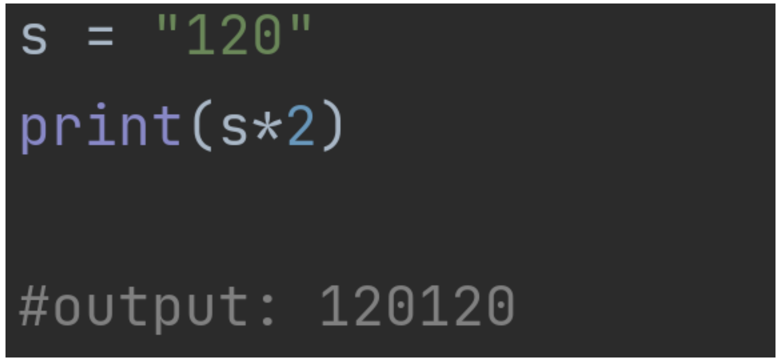
String operations

- "+": concatenate strings



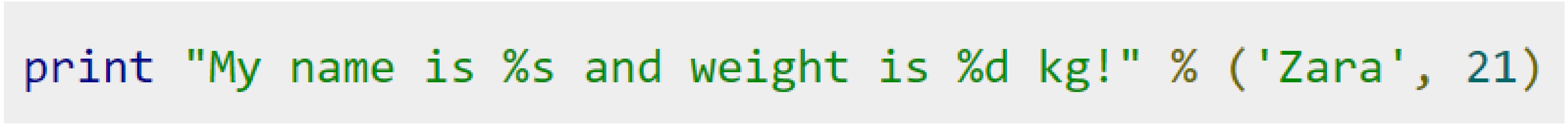
```
greet = "Hello, "
name = "Jack"

# using + operator
result = greet + name
print(result)

# Output: Hello, Jack
```

- "*": Repetition

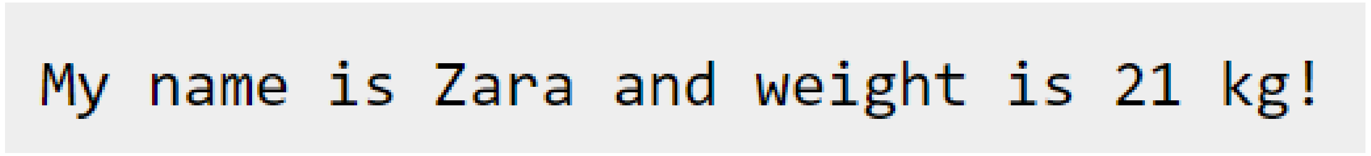


```
s = "120"
print(s*2)


#output: 120120
```

- %: formatting



```
print "My name is %s and weight is %d kg!" % ('Zara', 21)
```



```
My name is Zara and weight is 21 kg!
```

String comparison

Declare the string variable:

```
fruit1 = 'Apple'
```

String is

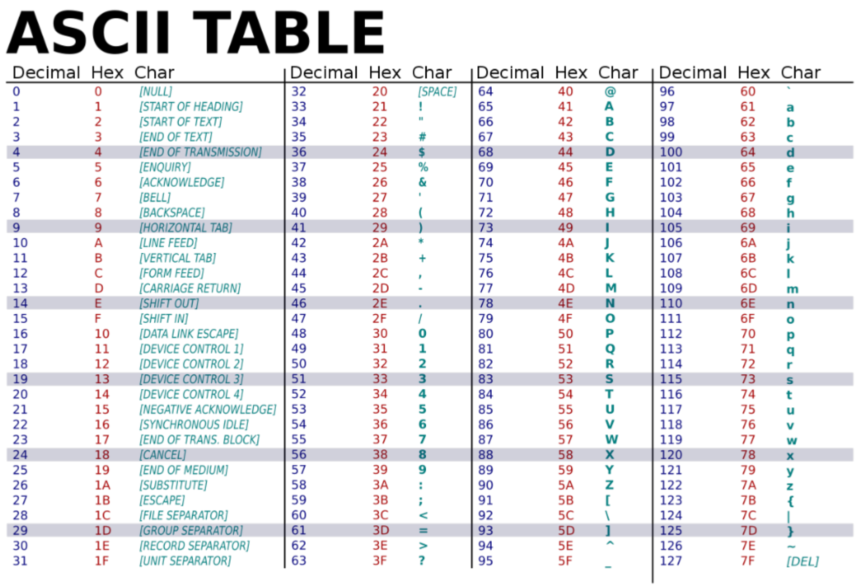
- Case-sensitive
- A (65) < a (97)

Operator	Code	Output
Equality	`print(fruit1 == 'Apple')`	`True`
Not equal to	`print(fruit1 != 'Apple')`	`False`
Less than	`print(fruit1 < 'Apple')`	`False`
Greater than	`print(fruit1 > 'Apple')`	`False`
Less than or equal to	`print(fruit1 <= 'Apple')`	`True`
Greater than or equal to	`print(fruit1 >= 'Apple')`	`True`

String comparison

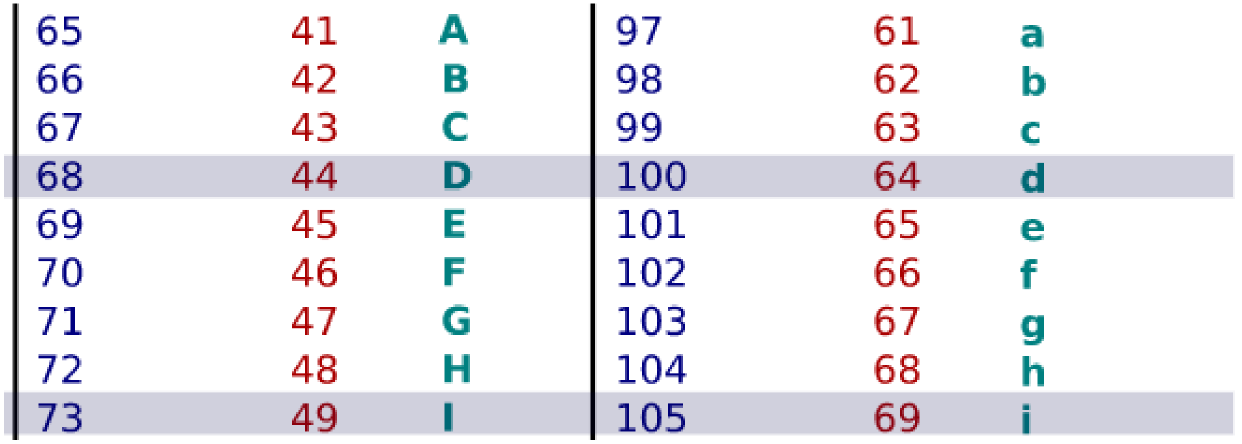
String comparison is based on character comparison which depends on **ASCII code**

```python
string1 = "Abrar"
string2 = "Ahmed"
string3 = "ABCD"
string4 = "ABCD"
if string1 <= string2:
    print(string1," is smaller ",string2," is greater")
if string2 >= string4:
    print(string4," is smaller ", string2," is greater")
if string3 == string4:
    print(string3," is equal to ",string4)
if string1 != string3:
    print(string1," is not equal to ", string3)
```



ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[END OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]



65	41	A	97	61	a
66	42	B	98	62	b
67	43	C	99	63	c
68	44	D	100	64	d
69	45	E	101	65	e
70	46	F	102	66	f
71	47	G	103	67	g
72	48	H	104	68	h
73	49	I	105	69	i

Basic Operations

isalnum()	Returns True if all characters in the string are alphanumeric
isalpha()	Returns True if all characters in the string are in the alphabet
isascii()	Returns True if all characters in the string are ascii characters
isdecimal()	Returns True if all characters in the string are decimals
isdigit()	Returns True if all characters in the string are digits
isidentifier()	Returns True if the string is an identifier
islower()	Returns True if all characters in the string are lower case
isnumeric()	Returns True if all characters in the string are numeric
isprintable()	Returns True if all characters in the string are printable
isspace()	Returns True if all characters in the string are whitespaces
isupper()	Returns True if all characters in the string are upper case

Basic Operations

Convert string into lower, upper:

lower()	Converts a string into lower case
capitalize()	Converts the first character to upper case
upper()	Converts a string into upper case

```
message = 'PYTHON IS FUN'

# convert message to lowercase
print(message.lower())

# Output: python is fun
```

```
message = 'python is fun'

# convert message to uppercase
print(message.upper())

# Output: PYTHON IS FUN
```

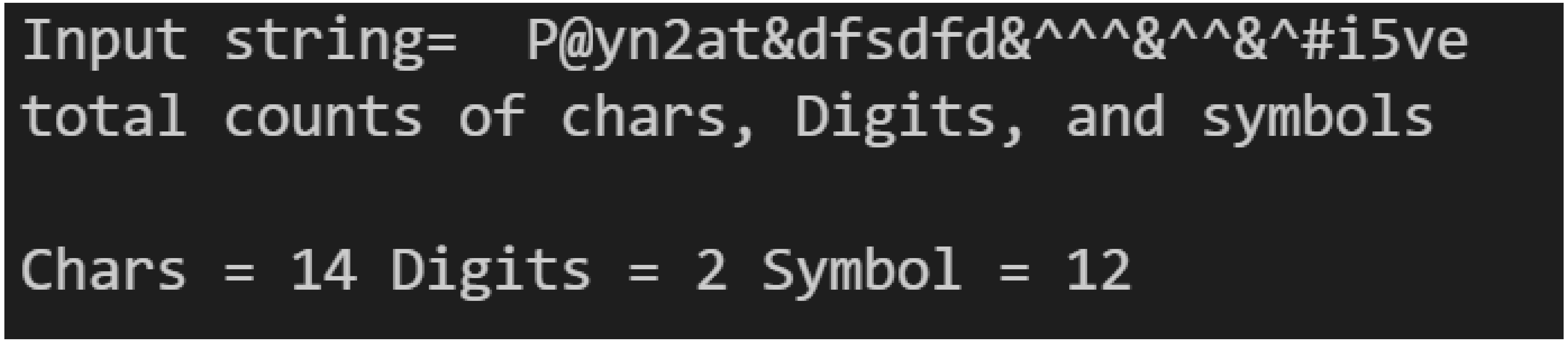
```
sentence = "i love PYTHON"

# converts first character to uppercase and others to lowercase
capitalized_string = sentence.capitalize()

print(capitalized_string)

# Output: I love python
```

Some important functions

- split(): https://www.w3schools.com/python/ref_string_split.asp
- join(): https://www.w3schools.com/python/ref_string_join.asp
- strip(): https://www.w3schools.com/python/ref_string_strip.asp
- find(): https://www.w3schools.com/python/ref_string_find.asp
- startswith(): https://www.w3schools.com/python/ref_string_startswith.asp
- rstrip(): https://www.w3schools.com/python/ref_string_rstrip.asp
- zfill(): https://www.w3schools.com/python/ref_string_zfill.asp
- index(): https://www.w3schools.com/python/ref_string_index.asp
- count(): https://www.w3schools.com/python/ref_string_count.asp
- endswith(): https://www.w3schools.com/python/ref_string_endswith.asp

Exercise

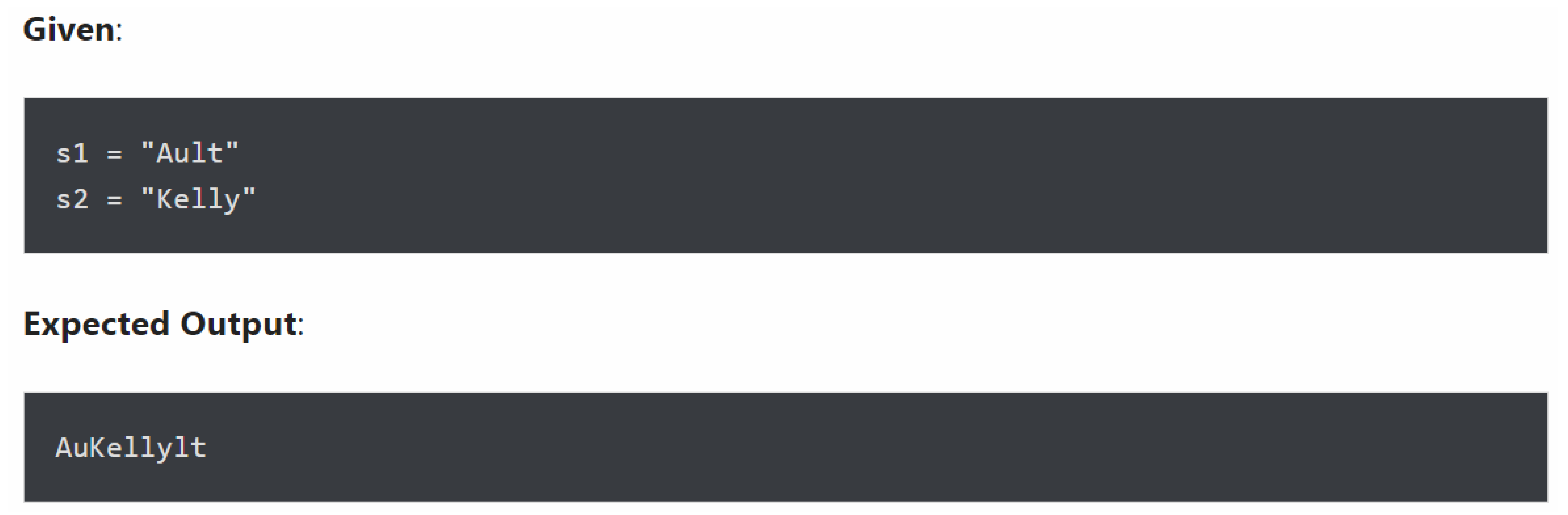
- Count all letters, digits, and special symbols from a given string



```
Input string=  P@yn2at&dfsdfd&^^^&^^&^#i5ve
total counts of chars, Digits, and symbols

Chars = 14 Digits = 2 Symbol = 12
```

Exercise

- Given two strings, s1 and s2. Write a program to create a new string s3 by appending s2 in the middle of s1



Given:

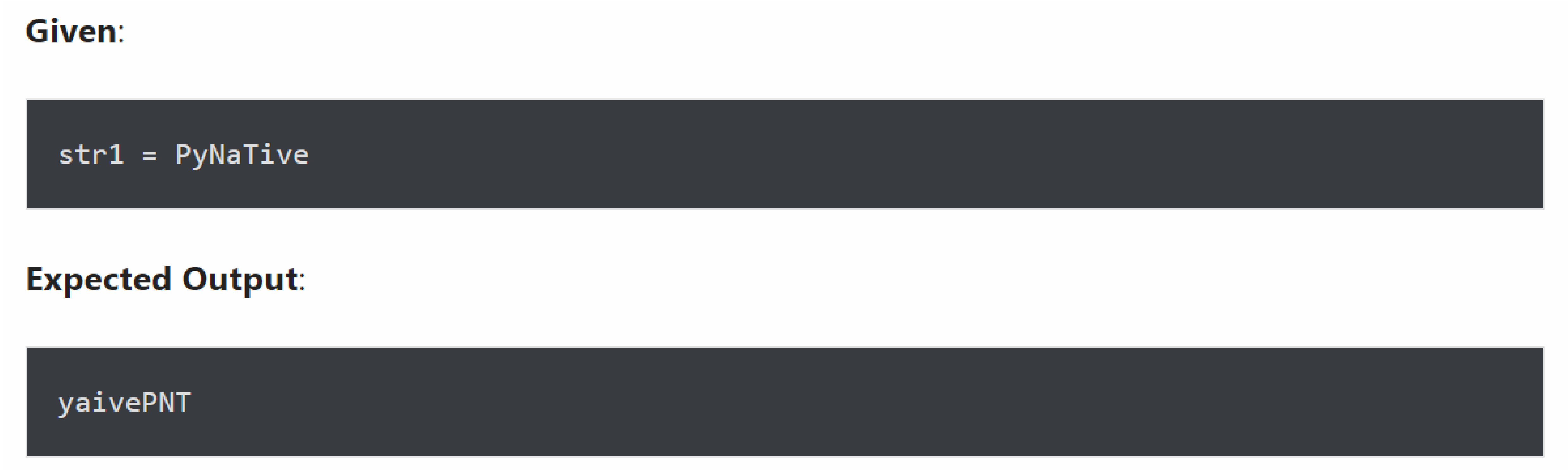
```
s1 = "Ault"
s2 = "Kelly"
```

Expected Output:

```
AuKellylt
```

Exercise

- Arrange string characters such that lowercase letters should come first



Given:

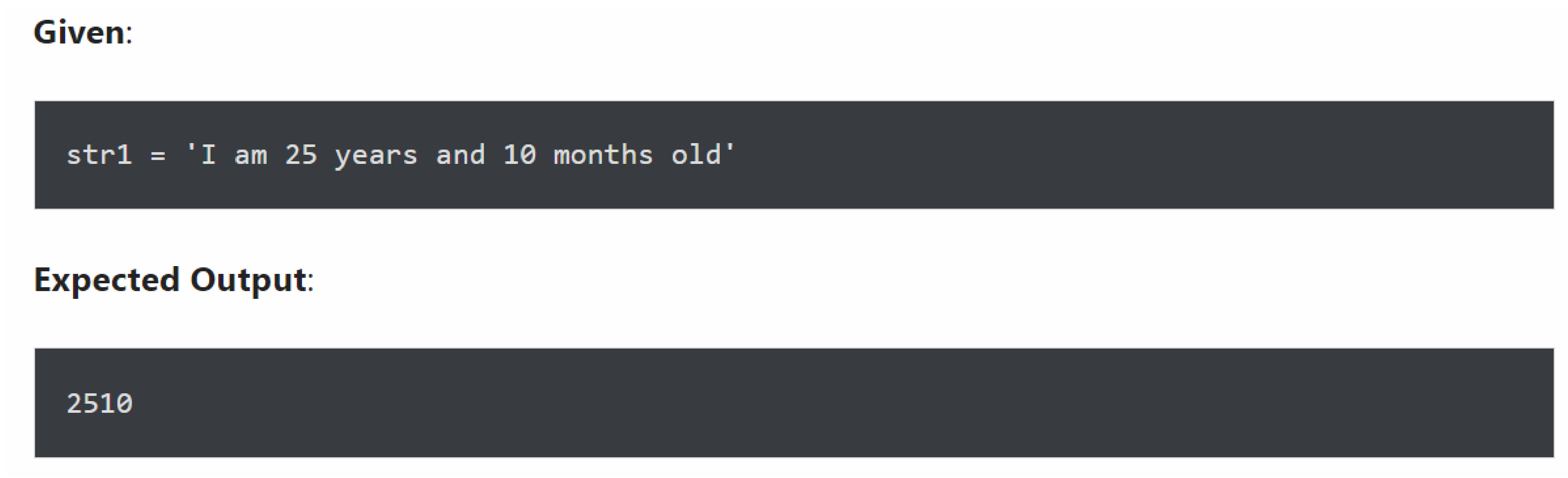
```
str1 = PyNaTive
```

Expected Output:

```
yaivePNT
```

Exercise

- Removal all characters from a string except integers



Given:

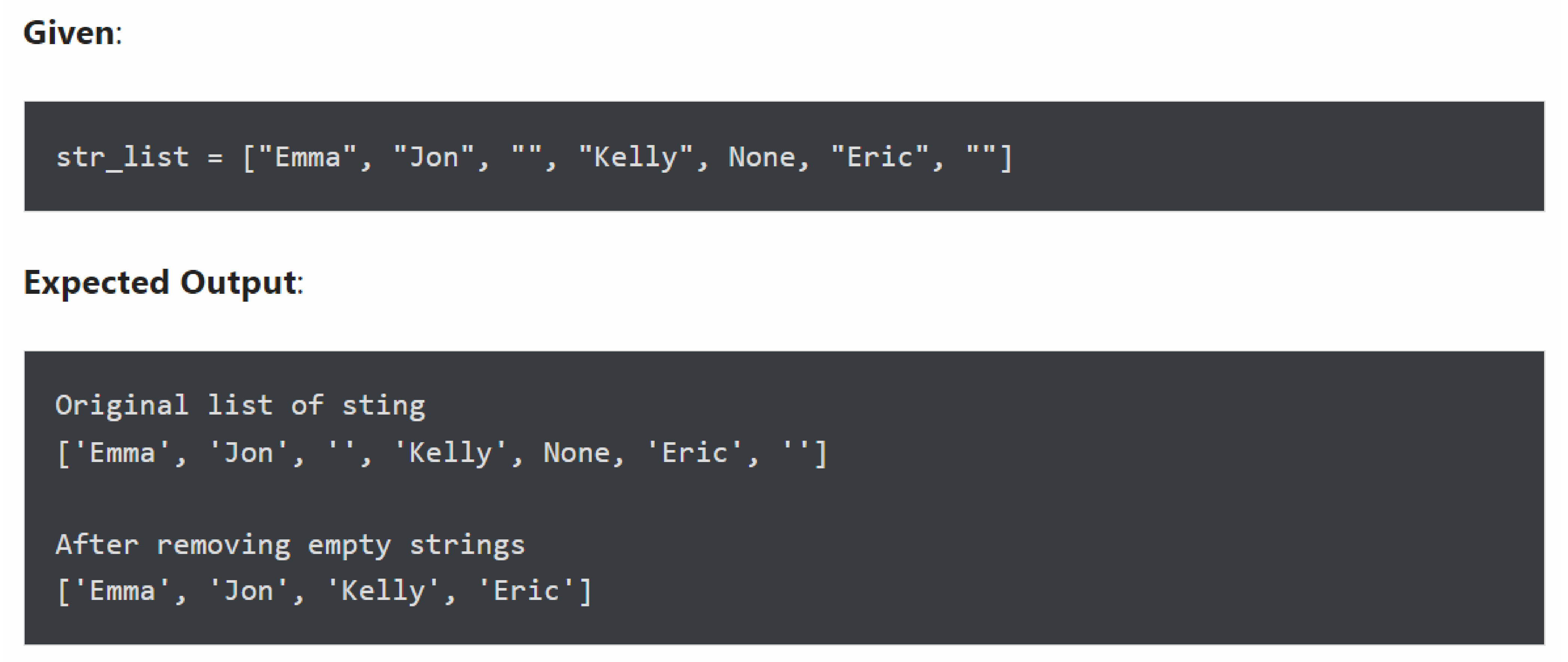
```
str1 = 'I am 25 years and 10 months old'
```

Expected Output:

```
2510
```

Exercise

- Remove empty strings from a list of strings



Given:

```
str_list = ["Emma", "Jon", "", "Kelly", None, "Eric", ""]
```

Expected Output:

```
Original list of sting
['Emma', 'Jon', '', 'Kelly', None, 'Eric', '']

After removing empty strings
['Emma', 'Jon', 'Kelly', 'Eric']
```

Exercise

- Split a string on hyphens

Given:

```
str1 = Emma-is-a-data-scientist
```

Expected Output:

```
Displaying each substring

Emma
is
a
data
scientist
```

Exercise

- Write a program that reads a string from the user. If all the characters in the string are hexadecimal digits, print out the corresponding decimal value. If not, print out an error message

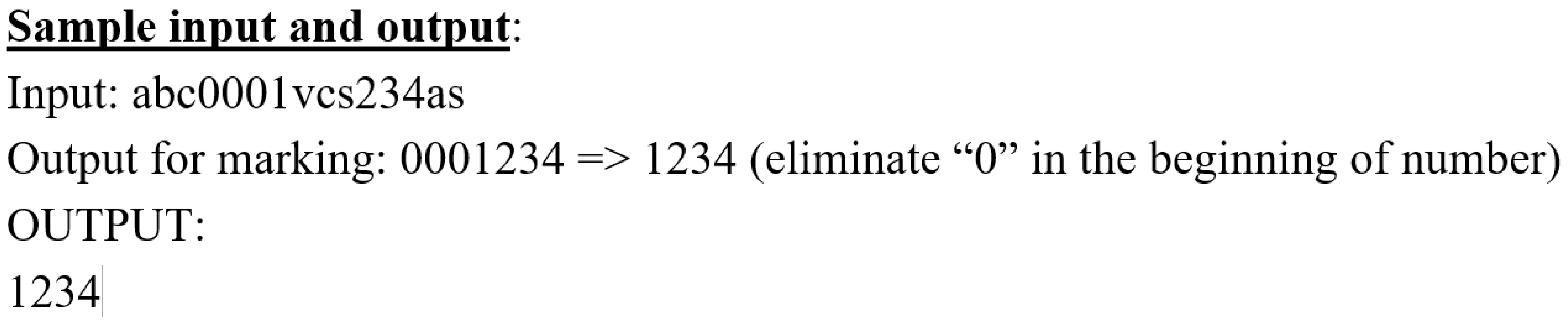
- 1F => 31
- 1G => "Error"
- 1f => 31

Exercise

- Write a function to count the occurrence of all words (non-case sensitive) in the string. Known that each word is separated by a space

Exercise

- You should write functions so that print out the meaningful integer number in s. Known that this number is separated by the other characters and maybe starts with many “0”. Return -1 if there is not a number in s.



Sample input and output:

Input: abc0001vcs234as

Output for marking: 0001234 => 1234 (eliminate “0” in the beginning of number)

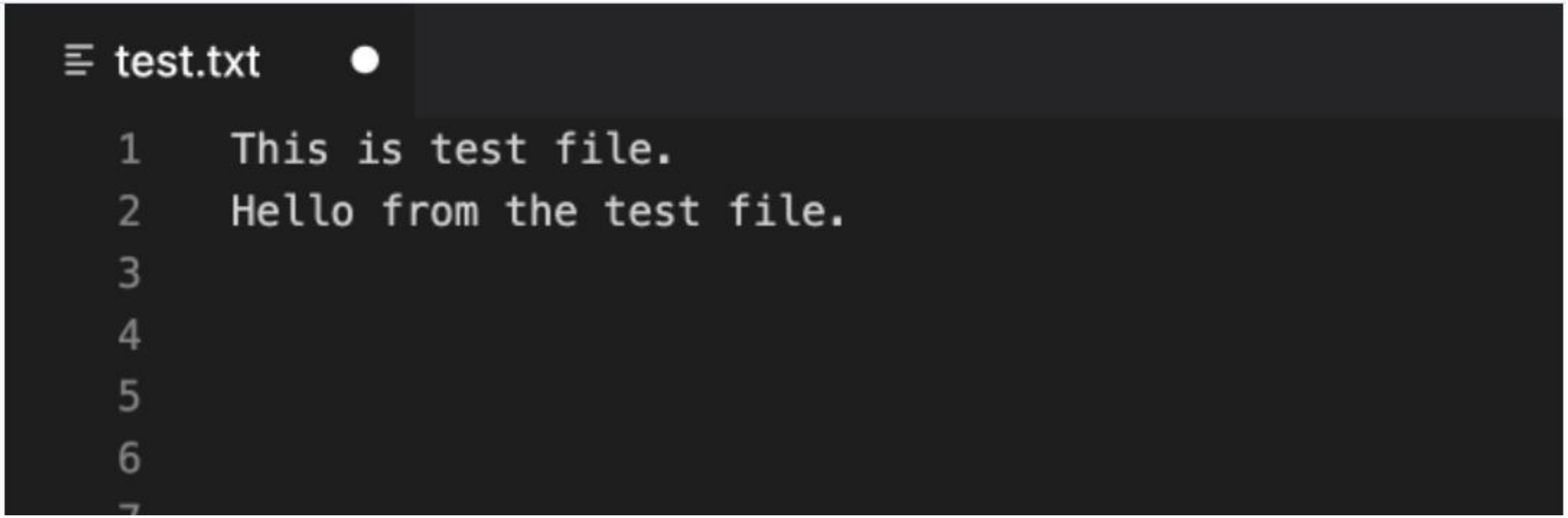
OUTPUT:

```
1234
```

Part 2: Text Files

Text File

- Python provides basic functions and methods necessary to manipulate files by default.
- You can do most of the file manipulation using a **file** object.



```
This is test file.
Hello from the test file.
```

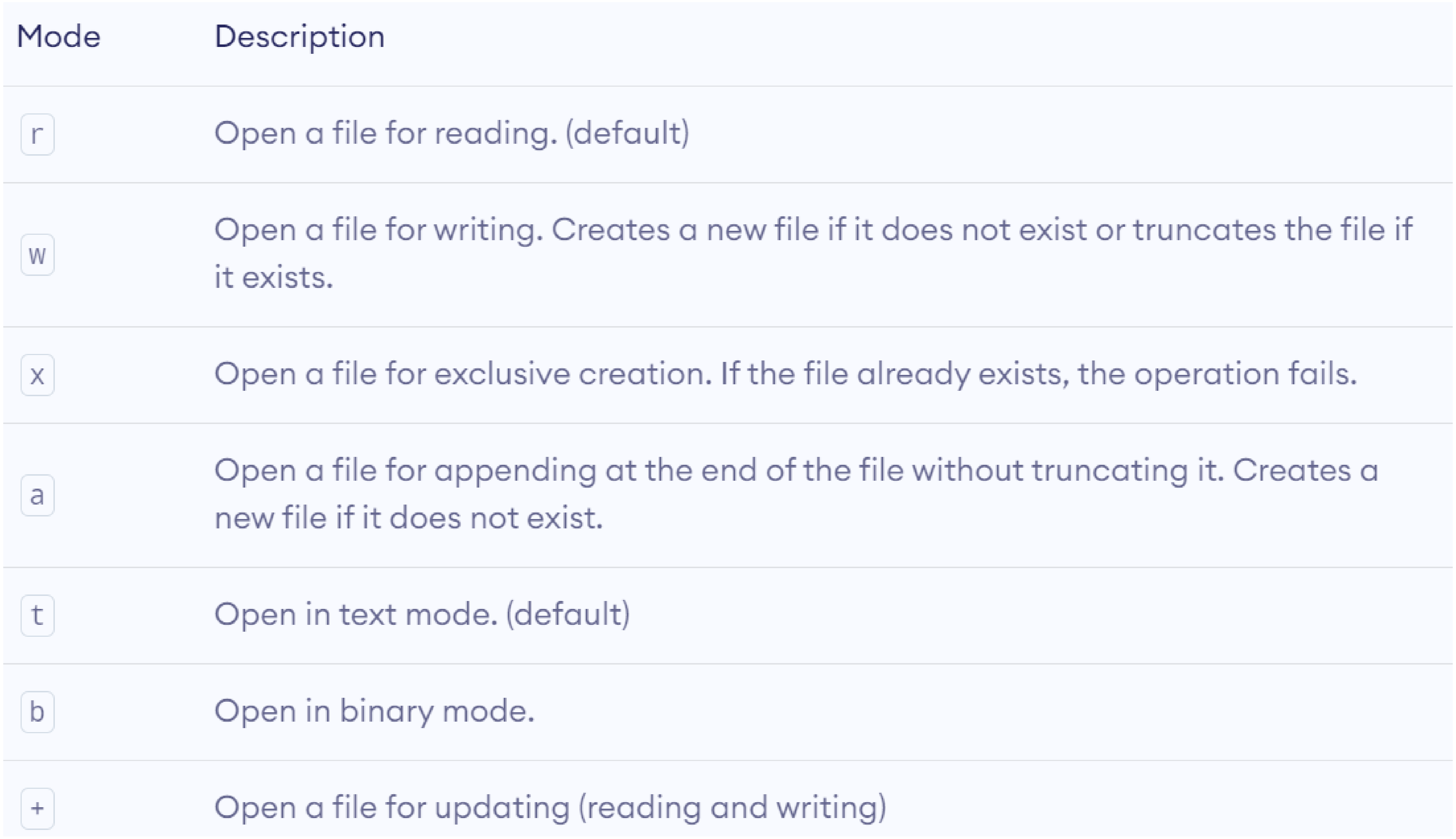
Open a file

- Before you can read or write a file, you have to open it using the *open()* function.

file = open(file_name [, access_mode][, buffering])

- **access_mode** – read, write, append etc (r,w,a,…)
- **buffering** –
    - buffering = 0, no buffering takes place
    - buffering = 1, line buffering is performed while accessing a file.
    - buffering > 1, buffering action is performed with the indicated buffer size.
    - buffering < 0, the buffer size is the system default (default behavior).

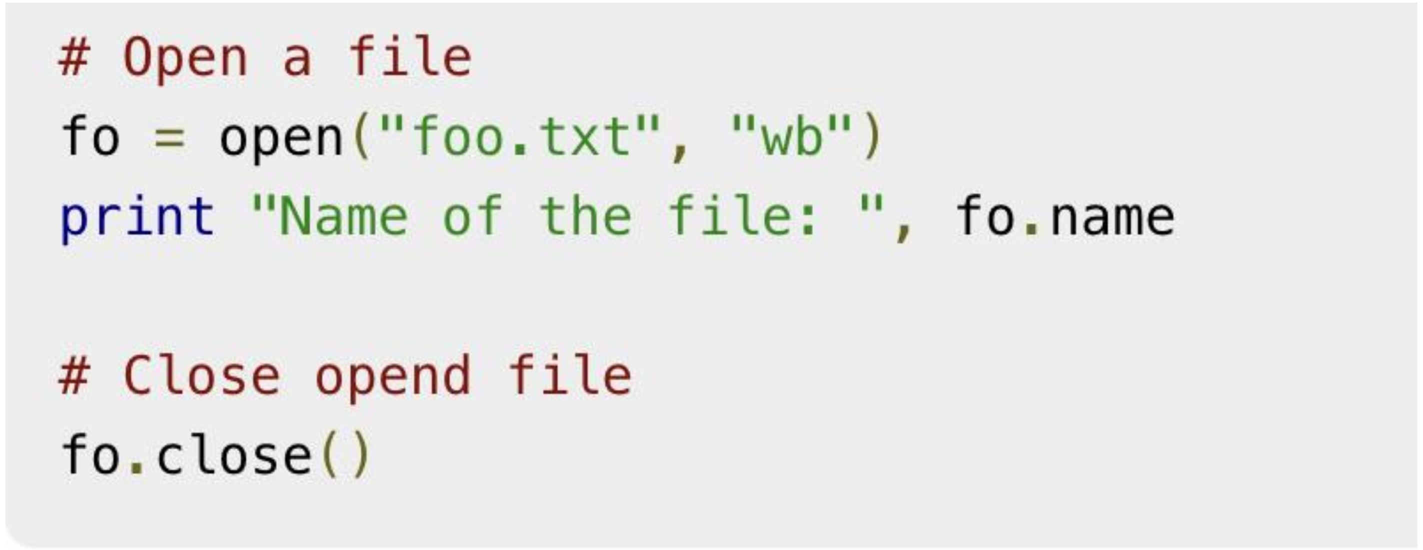
Access Mode



Mode	Description
`r`	Open a file for reading. (default)
`w`	Open a file for writing. Creates a new file if it does not exist or truncates the file if it exists.
`x`	Open a file for exclusive creation. If the file already exists, the operation fails.
`a`	Open a file for appending at the end of the file without truncating it. Creates a new file if it does not exist.
`t`	Open in text mode. (default)
`b`	Open in binary mode.
`+`	Open a file for updating (reading and writing)

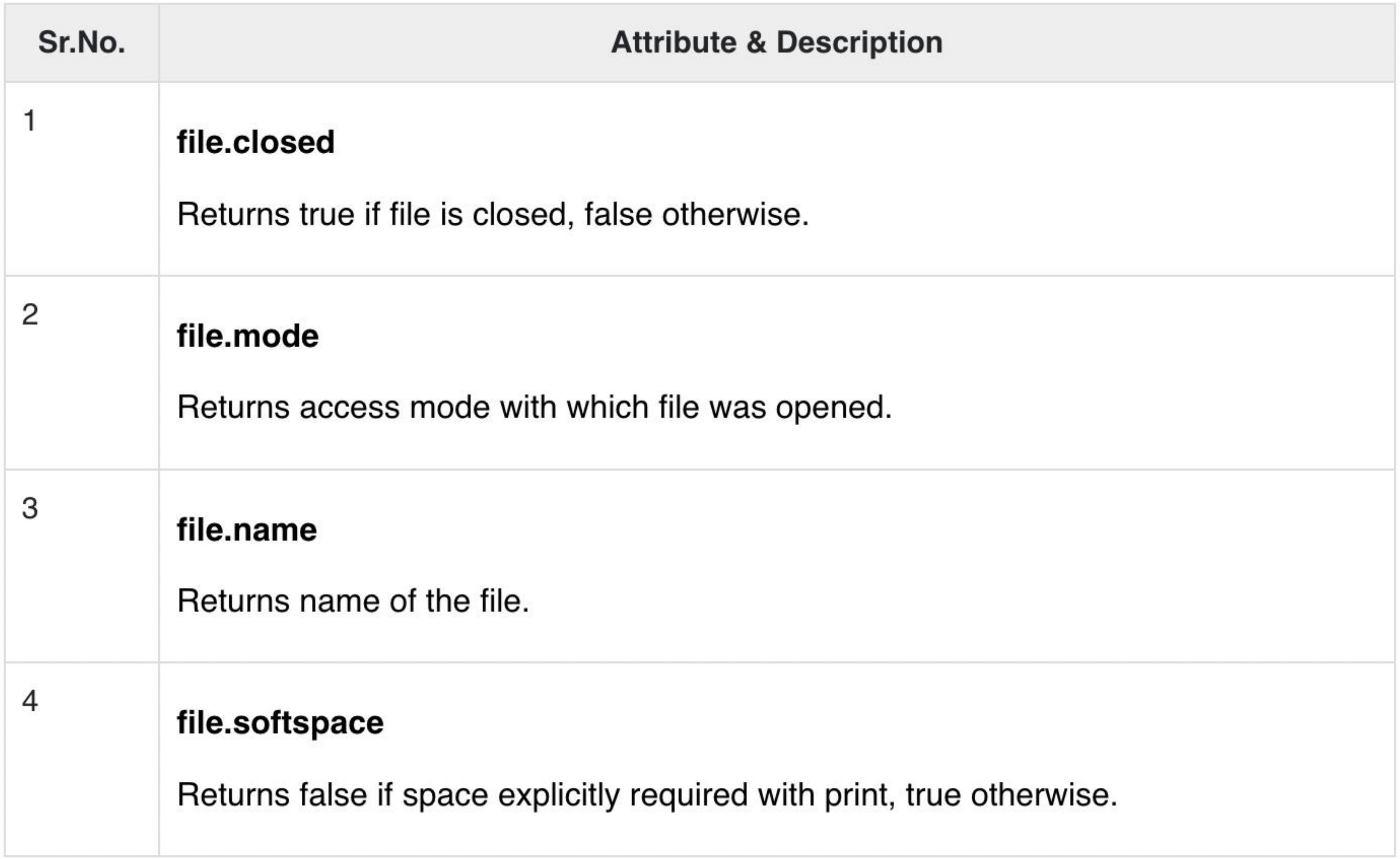
Closing Files

- The close() method of a *file* object flushes any unwritten information and closes the file object, after which no more writing can be done.
- Python automatically closes a file when the reference object of a file is reassigned to another file. It is a good practice to use the close() method to close a file.



```
# Open a file
fo = open("foo.txt", "wb")
print "Name of the file: ", fo.name

# Close opend file
fo.close()
```

Attributes related to file object



Sr.No.	Attribute & Description
1	**file.closed** Returns true if file is closed, false otherwise.
2	**file.mode** Returns access mode with which file was opened.
3	**file.name** Returns name of the file.
4	**file.softspace** Returns false if space explicitly required with print, true otherwise.

Example

```
# Open a file
fo = open("foo.txt", "wb")
print "Name of the file: ", fo.name
print "Closed or not : ", fo.closed
print "Opening mode : ", fo.mode
print "Softspace flag : ", fo.softspace
```

This produces the following result –

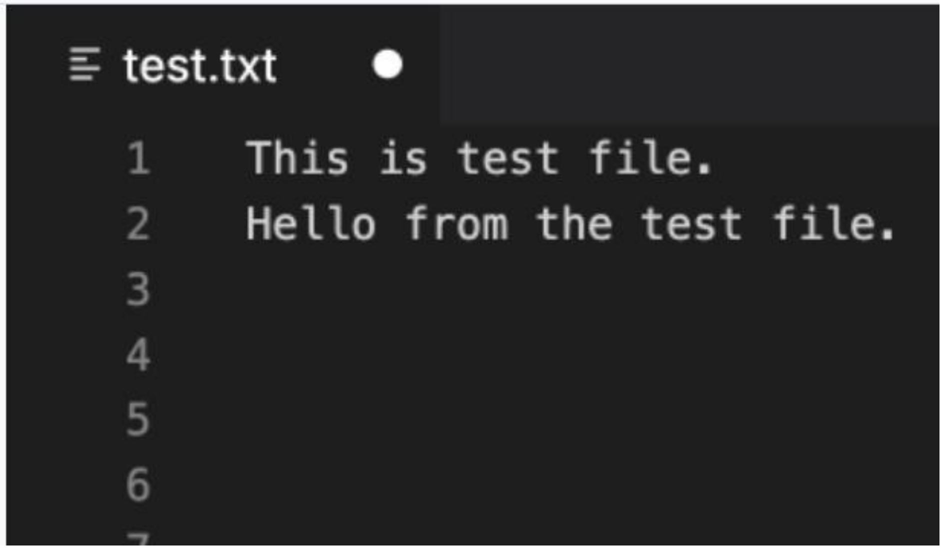
```
Name of the file:  foo.txt
Closed or not :  False
Opening mode :  wb
Softspace flag :  0
```

Example

```python
# open a file
file1 = open("test.txt", "r")

# read the file
read_content = file1.read()
print(read_content)
```

Output

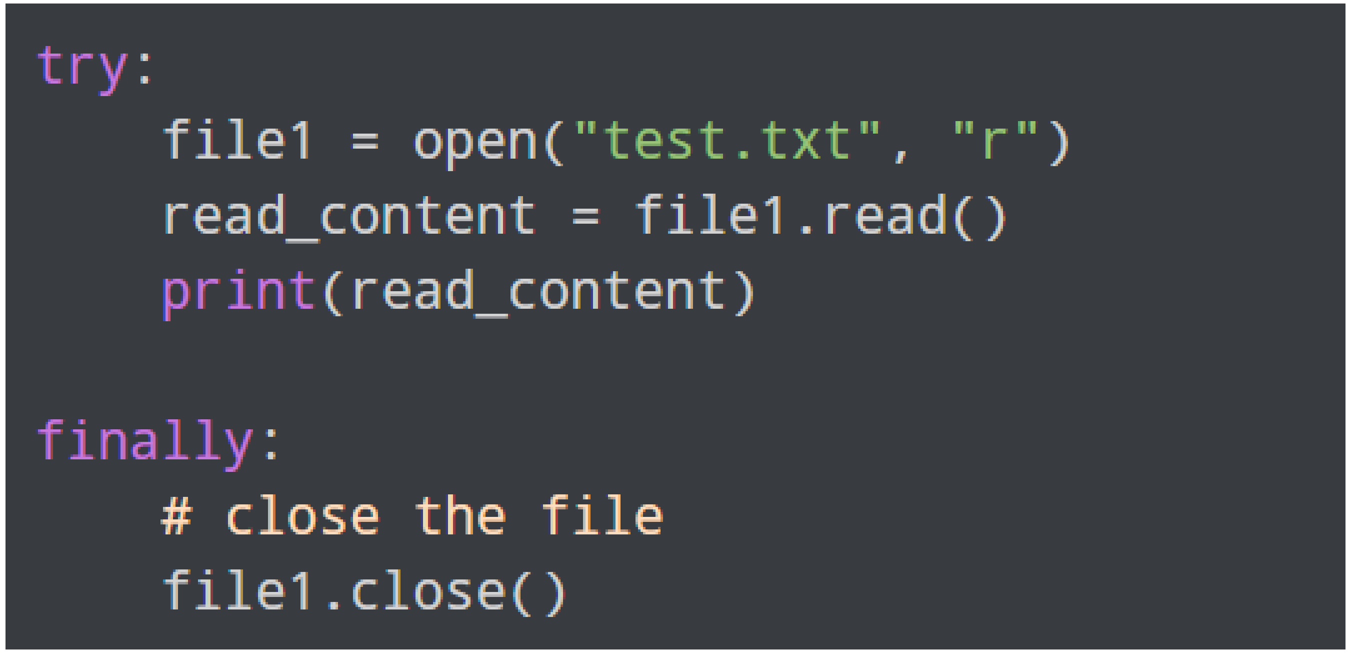
```
This is a test file.
Hello from the test file.
```


test.txt

```
This is test file.
Hello from the test file.
```

Exception Handling in Files

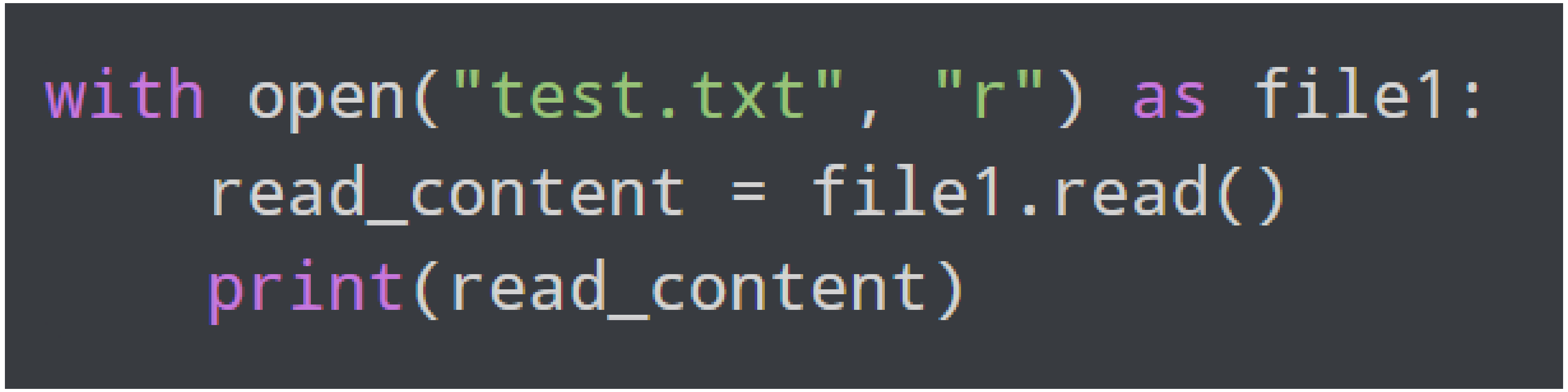
- If an exception occurs when we are performing some operation with the file, the code exits without closing the file
- Using try/except/...



```python
try:
    file1 = open("test.txt", "r")
    read_content = file1.read()
    print(read_content)

finally:
    # close the file
    file1.close()
```

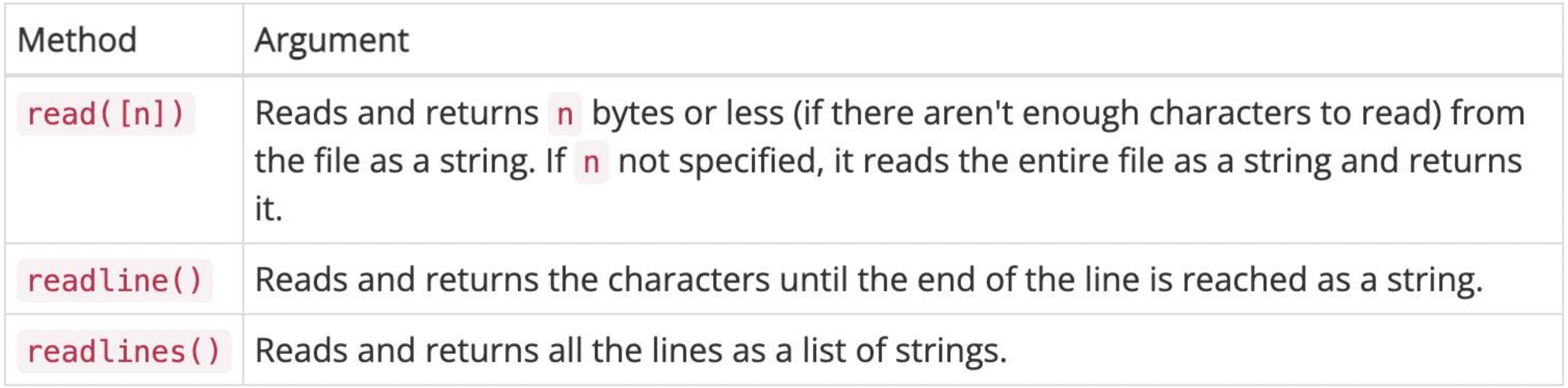
with ... open Syntax

- In Python, we can use the **with...open** syntax to automatically close the file



```python
with open("test.txt", "r") as file1:
    read_content = file1.read()
    print(read_content)
```

Reading Content from Files

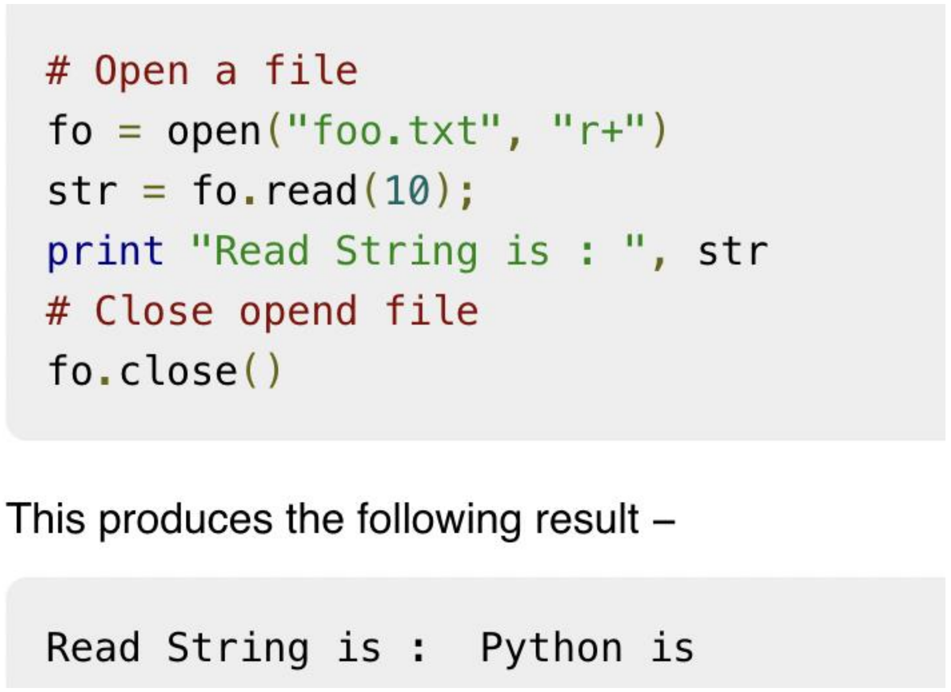


Method	Argument
`read([n])`	Reads and returns `n` bytes or less (if there aren't enough characters to read) from the file as a string. If `n` not specified, it reads the entire file as a string and returns it.
`readline()`	Reads and returns the characters until the end of the line is reached as a string.
`readlines()`	Reads and returns all the lines as a list of strings.

read()

- The **read()** method returns the specified number of bytes from the file.

  Default is -1 which means the whole file



```
# Open a file
fo = open("foo.txt", "r+")
str = fo.read(10);
print "Read String is : ", str
# Close opend file
fo.close()
```

This produces the following result –

```
Read String is :  Python is
```

- Passed parameter is the number of bytes to be read from the opened file.
- Starts reading from the beginning of the file
- Default - read as much as possible, maybe until the end of file.

readlines()

- Return all lines in the file, as a list where each line is an item in the list object

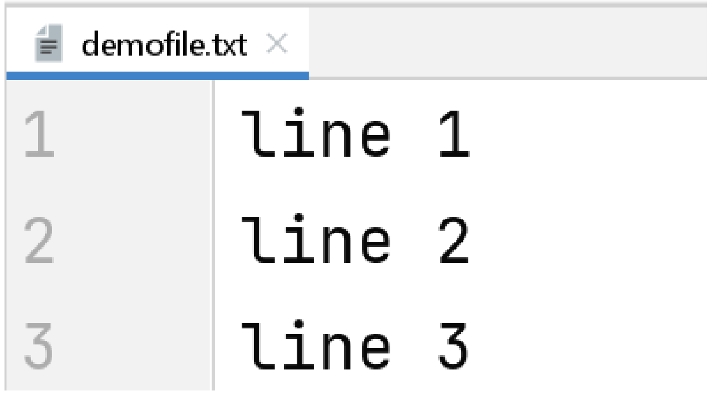
Syntax

```
file.readlines(hint)
```

Parameter Values

Parameter	Description
hint	Optional. If the number of bytes returned exceed the hint number, no more lines will be returned. Default value is -1, which means all lines will be returned.

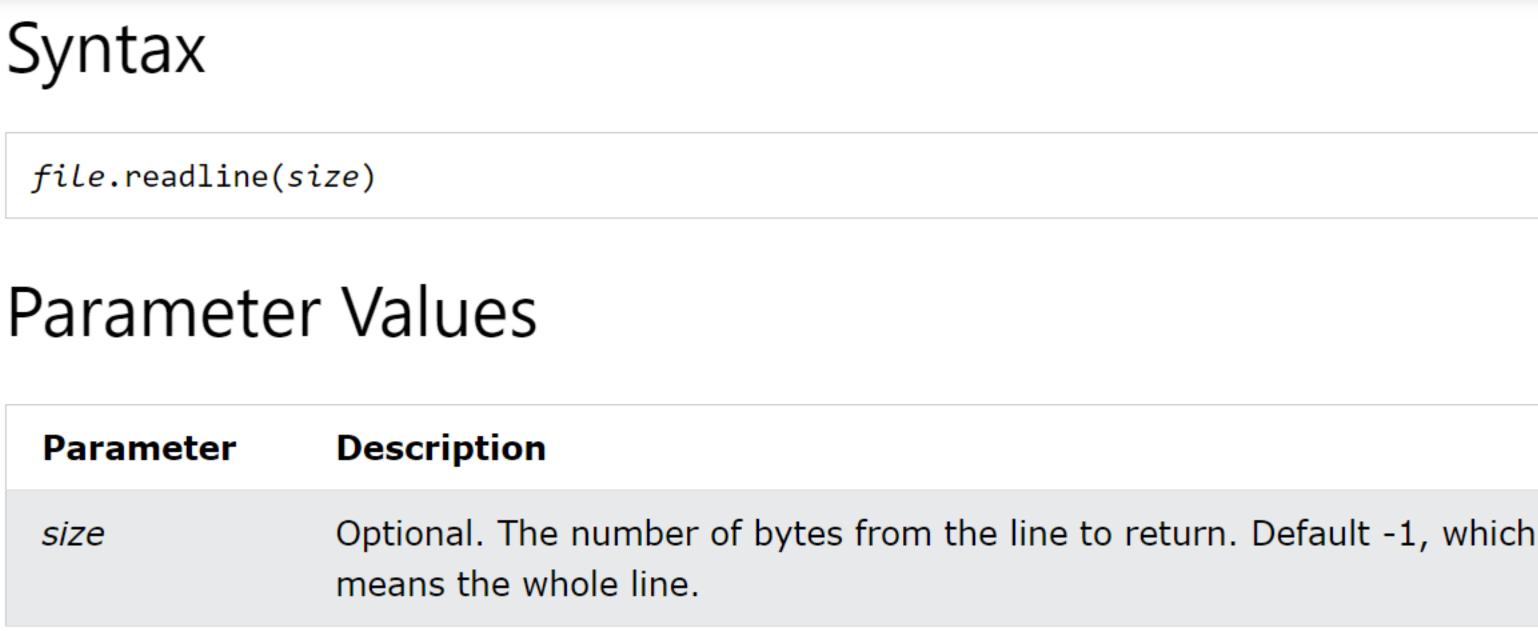
```
f = open("demofile.txt", "r")
lines = f.readlines()
print(type(lines)) # <class 'list'>
print(lines) # ['line 1\n', 'line 2\n', 'line 3\n']
```


demofile.txt

```
line 1
line 2
line 3
```

readline()

- Returns one line from the file from the current cursor

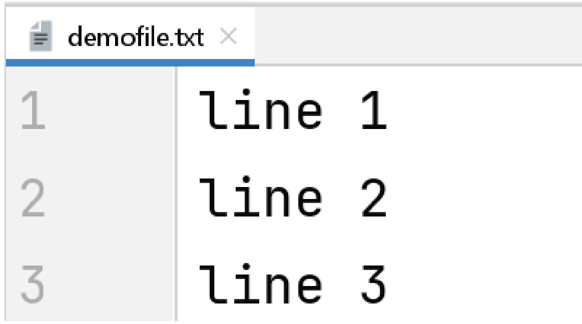


Syntax

```
file.readline(size)
```

Parameter Values

Parameter	Description
size	Optional. The number of bytes from the line to return. Default -1, which means the whole line.



demofile.txt

```
line 1
line 2
line 3
```

```
f = open("demofile.txt", "r")
line = f.readline()
print(type(line)) # <class 'str'>
print(line) # line 1
```

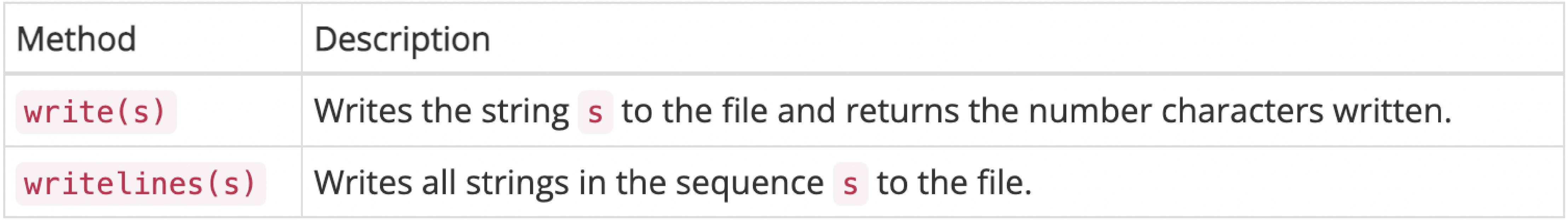
The readline() method

Example: Reading file line by line

```
>>>
>>> f = open("poem.txt", "r")
>>>
>>> while True:
...     line = f.readline()
...     if not line:
...         break
...     print(line)
...
The caged bird sings
with a fearful trill
of things unknown
but longed for still
>>>
```

Writing to Files in Python

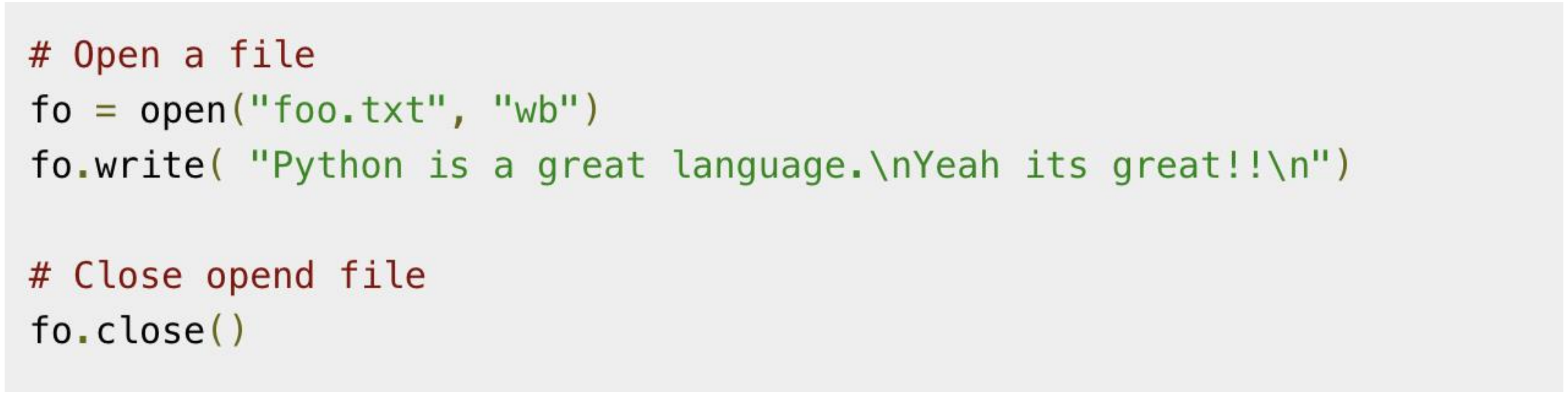
- There are two things we need to remember while writing to a file
  - If we try to open a file that doesn't exist, a new file is created
  - If a file already exists, its content is erased, and new content is added to the file (without append mode) with mode "w"



Method	Description
`write(s)`	Writes the string `s` to the file and returns the number characters written.
`writelines(s)`	Writes all strings in the sequence `s` to the file.

write()

- The *write()* method writes any string to an open file. It is important to note that Python strings can have binary data and not just text.
- The write() method does not add a newline character ('\n') to the end of the string

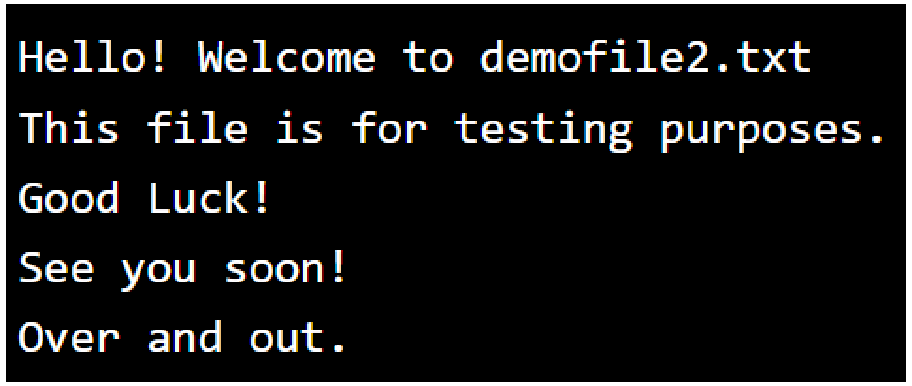


```
# Open a file
fo = open("foo.txt", "wb")
fo.write( "Python is a great language.\nYeah its great!!\n")

# Close opend file
fo.close()
```

writelines()

- Writes the items of a list to the file

```
f = open("demofile3.txt", "a")
f.writelines(["\nSee you soon!", "\nOver and out."])
f.close()

#open and read the file after the appending:
f = open("demofile3.txt", "r")
print(f.read())
```



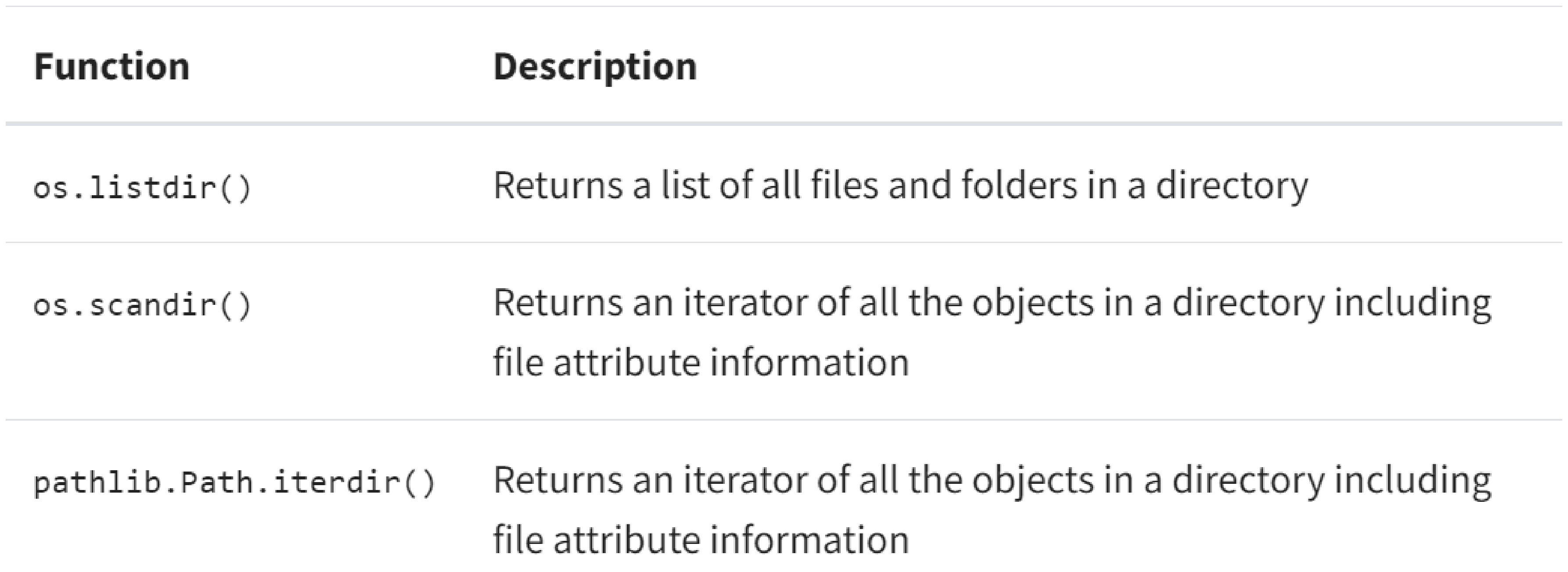
```
Hello! Welcome to demofile2.txt
This file is for testing purposes.
Good Luck!
See you soon!
Over and out.
```

Exercise

- Retrieve a list of employees from the input.txt file and generate an employee list accordingly. If two employees share the same email abbreviation, assign them numbers in ascending order after the abbreviation.
- For instance, if there are two employees named Le Thanh Tung and Le Thu Tung with the email abbreviation "lttung," Le Thanh Tung is listed first, so no number is required. Le Thu Tung, who appears later, will be assigned a number beginning from 2, resulting in the email lttung2@fit.hcmus.edu.vn.
- The input and output examples for this task are given in the input.txt and out1a.txt files, respectively

Exercise

- Write a Python program to merge multiple text files into a single output file, sorting the contents in alphabetical order and removing duplicates. Assume that each input file contains one word per line, and the output file should also contain one word per line.



Function	Description
`os.listdir()`	Returns a list of all files and folders in a directory
`os.scandir()`	Returns an iterator of all the objects in a directory including file attribute information
`pathlib.Path.iterdir()`	Returns an iterator of all the objects in a directory including file attribute information

THANK YOU

for YOUR ATTENTION