



# Introduction to the Python programming language

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## Lab #4

- what is evaluated as False; string buffer
- tuple data type
- list comprehension
- control structures
- functions

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# What is evaluated as False?

False

None

0 # and: 0.0

"" # or: ""

[]

()

{}

} empty sequences  
empty set

```
>>> bool(None)
False
>>> bool([])
False
>>> bool([1,2,3])
True
>>> bool("py")
True
```

Anything else is considered to to be True.

HW: XOR.

<http://docs.python.org/3/library/stdtypes.html#truth-value-testing>

# String buffer

**Example:** consider the natural numbers from 1 to 15 (included) and write them down one after the other. Let the result be a string:

„123456789101112131415”.

# String buffer

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„123456789101112131415”.

Naïve approach:

```
5 res = ""
6 for i in range(1, 15+1):
7     res += str(i)
8 #
9 print(res)
```

Using a string buffer:

```
5 parts = []
6 for i in range(1, 15+1):
7     parts.append(str(i))
8 #
9 res = "".join(parts)
10 print(res)
```

# tuple

```
4 >>> a = (1, 2, 3)
5 >>> a[0]
6 1
7 >>> a[0] = 5
8 Traceback (most recent call last):
9   File "<stdin>", line 1, in <module>
10  TypeError: 'tuple' object does not support item assignment
11 >>>
12 >>> m = ('Total Recall', 1990, 7.5)
13 >>> m
14 ('Total Recall', 1990, 7.5)
15 >>> len(m)
16 3
17 >>> m[:2]
18 ('Total Recall', 1990)
19 >>>
20 >>> (x, y) = (1, 2)
21 >>> x
22 1
23 >>> y
24 2
25 >>> single = ('hi',)
26 >>> single
27 ('hi',)
```

immutable  
(read-only)

parallel assignment  
(parentheses are  
often optional)

tuple with one element  
(Notice the special syntax!)

HW: [tuple02.py](#)

```
4 def get_movie_info():
5     # contact database,
6     # fetch info from a website, etc.
7     return ('Total Recall', 1990, 7.5)
8
9
10 def main():
11     (title, year, score) = get_movie_info()
12     print('Title:', title)
13     print('Year:', year)
14     print('Score:', score)
```

using this method, a  
function can return  
**multiple values**

value unpacking

```
1 >>> a = 3
2 >>> b = 9
3 >>> a
4 3
5 >>> b
6 9
7 >>> a, b = b, a
8 >>> a
9 9
10 >>> b
11 3
12 >>>
```

Swap two variables.  
No temp variable is needed :)

## List comprehension: a compact way for building lists

```
1 >>> nums = [1, 2, 3, 4]
2 >>> squares = [n*n for n in nums]
3 >>> squares
4 [1, 4, 9, 16]
```



```
1 >>> nums = [1, 2, 3, 4]
2 >>> squares = []
3 >>> for n in nums:
4 ...     squares.append(n*n)
5 ...
6 >>> squares
7 [1, 4, 9, 16]
```

Generally:

`[expr for var in list]`

Optional „if”:

```
1 >>> nums = [8, 3, 2, 1, 5, 9, 2]
2 >>> small = [n for n in nums if n <= 2]
3 >>> small
4 [2, 1, 2]
5 >>>
```

it keeps only those elements  
that satisfy the condition

# Exercise

Solve the following exercises with list comprehensions.

Link: <https://arato.inf.unideb.hu/szathmary.laszlo/pmwiki/index.php?n=EnPy3.20120818d>



## Common operation: reverse a sequence

```

1  >>> s = 'Python rulz'
2  >>> s[::-1]
3  'zlr nohtyP'
4  >>>
5  >>> li = [23, 76, 84, 12]
6  >>> li[::-1]
7  [12, 84, 76, 23]
8  >>>

```

from the beginning to the end,  
but with a reversed step  
(it returns a new sequence)

## Raising to a power; int and long types



```

1  >>> 2**3
2  8
3  >>> 2**64
4  18446744073709551616L
5  >>> 2**128
6  340282366920938463463374607431768211456L
7  >>>
8  >>> import sys
9  >>> sys.maxint
10 9223372036854775807
11 >>> a = sys.maxint + 1
12 >>> a
13 9223372036854775808L
14 >>> type(sys.maxint)
15 <type 'int'>
16 >>> type(a)
17 <type 'long'>

```

Python can handle arbitrarily  
large integers  
(only depends on the memory)

here: 64 bit int ( $2^{63} - 1$ )

instead of an overflow, its type  
is changed automatically from  
„int” to „long”

**Python 3:** there is only *int* type, but  
in the case of big numbers it behaves  
like *long* .

## if / elif / else

```
4 def main(num):  
5     if num < 0:  
6         print('Negative number.')7     elif num == 0:  
8         print('Zero.')9     elif num < 100:  
10        print('Less than 100.')11    else:  
12        print('More than 100.')
```

# >= 100, actually



Instead of „else if” we write „elif”.

How to memorize that? The word „elif” is just as long as the word „else”...

for

```
4 def main():  
5     li = ['alfa', 'beta', 'gamma']  
6  
7     for e in li:  
8         print(e)  
9  
10    for index, e in enumerate(li):  
11        print(index, e)
```

alfa  
beta  
gamma

0 alfa  
1 beta  
2 gamma

It's a common case that we also need the indexes of the elements.

Use the `enumerate()` function, which is also an iterator in Python 3.

See also `enumerate(my_list, start=1)`.

# break / continue pass

```
4 def main():
5     cnt = 0
6     while True:
7         cnt += 1
8         if cnt == 42:
9             break
10    #
11    print(cnt)    # 42
12
13    li = ['anas', 'banana', 'orange']
14    for e in li:
15        if e == 'banana':
16            continue
17        #
18        print(e)
19
20
21 def palindrome(s):
22     pass    # TODO...
```

42

anas  
orange

empty statement

# docstring

Documentation should be one line:

```
4 def square(num):  
5     """Return the square of a given number."""  
6     return num ** 2
```

Or multiline. In this case the first line should be a short summary in one line. Then leave a line empty, and then you can detail the goal of the function, how it works, what are its side effects, etc.

```
9 def square_v2(num):  
10     """Return the square of a given number.  
11  
12     Calculate the square of the input number."""  
13     return num * num
```

(see also: annex F)

Document your programs! Get used to it!

## optional parameters / default parameter values

```
>>> def greet(name, greetings="Hello"):
...     print("{g}, {n}!".format(g=greetings, n=name))
...
>>> greet("Laszlo")
Hello, Laszlo!
>>>
>>> greet("Laszlo", greetings="Hola")
Hola, Laszlo!
>>>
>>> greet("Laszlo", "Bonjour")
Bonjour, Laszlo!
```

## optional parameters (another example)

```
4  def hello(name, repeat=1, postfix=''):
5      for i in range(repeat):
6          print(name + postfix)
7
8
9  def main():
10     hello('Laci')
11     print('#' * 10)
12     hello('Laci', repeat=3)
13     print('#' * 10)
14     hello('Laci', postfix='!')
15     print('#' * 10)
16     hello('Laci', repeat=3, postfix='!')
17     print('#' * 10)
18     print('#' * 10)
19     hello('Laci', 3)
20     print('#' * 10)
21     hello('Laci', 3, '')
22     print('#' * 10)
23     hello('Laci', '') # error
```



# Exercises

1. [[20120818a](#)] distance between two points (tuple)
2. [[20120818d](#)] list comprehensions (to complete)
3. [[20120818e](#)] multiples of 3 or 5 (PE #1)  
(this time with list comprehensions)
4. [[20120920e](#)] line break
5. [[20130211b](#)] diamond
6. [[20120818f](#)] sum square difference (PE #6)
7. [[20130305a](#)] XOR (Warning! Requires thinking!)